Effect of some growth regulators and fertilization on growth and yield of maize (zea maize, l)

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The objectives of this investigation were to:I) evaluate the effects of GA3 and CCC as seed-soaking treatments atdifferent rates and their interactions with N rate on growth, yield, andgrain N uptake of cv. Giza-2 com.2) compare the effects of ethephon vs. Primo on vegetative growth, cropquality, and distribution of total yield among organs of com plant shoot atharvest.3) determine optimum time and rate of application of ethephon and Primo tominimize stalk lodging and to maximize yields of hybrid com.4) study the agronomic and economic responses of com to different levels ofN, P, and K as a balanced fertilizing management.5) evaluate the yield and economic responses of hybrid com to eight N ratesunder unmanured and manured com conditions.To accomplish the first objective, a 2-year (1988, 1989) field studywas conducted at the Agric. Res. Center. of Faculty of Agric., Moshtohor,Zagazig University (Benha Branch). The soil of the experimental field wasclay textured with a pH of 7.97, had an organic matter of 2.3 %, and a totalN of 0.14 %. The experiment was laid out in a strip plot design with fourreplications. The treatments were a factorial combination of five PGRtreatments and three N rates for a total of 15 treatments. Treatments ofPGRs were applied as seed-soaking solutions which were in 1988 and 1989as follows: 1988 19891) Check (no-POR added) 1) Check (no-POR added)2) GA3 at 150 ppm 2) GA3 at 75 ppm893) GA3 at 300 ppm4) CCC at 600 ppm5) CCC at 1200 ppm3) GA3 at 150 ppm4) CCC at 300 ppm5) CCC at 600 ppmResults of this experiment can be summarized as follows:1) Treatments of GA3 and CCC did not significantly affect plant height, earheight, stem diameter, active leaves number, leaf area, days to mid-silk,percentage of barren, and lodged plants in 1988 season. However, in1989, the treatments significantly modified ear height, active leavesnumber, and barren plants percentage.2) In 1988, the highest level of 1200 ppm CCC significantly reduced thenumber of harvested plants/fa by 6000 plants compared to the control.However, the number of harvested plants/fa was not significantly affectedby PGR treatments in 1989.3) Number of ears/plant significantly increased by increasing CCCconcentration from 600 to 1200 ppm in 1988, while the treatment of 150ppm GA3 significantly had more ears/plant as compared to either CCC at300 ppm or the control in the second season.4) The treatment of 600 ppm-CCC significantly reduced number ofkernels/ear in comparison with all other treatments, and also reducedweight of kernels/ear as comp.ared to 300 ppm of GA3 or 1200 ppm ofCCC in 1988. However, both parameters in 1989, and 100-kernel weightin both seasons were not significantly changed by all PGR treatments.5) The PGR treatments had no significant effects on grain yield, grain Npercent, and grain N uptake in both seasons, and stover yield estimatedonly in 1989. Yet, there were slight increases in grain yield with 150ppm-GA3 in 1988, and with GA3 and CCC applied at both rates of eachin 1989.6) Changing levels of either GA3 or CCC did not significantly affect allparameters measured in both seasons except for harvested plants/fa,number of kernels/ear, and weight of kernels/ear with both CCC levels in19887) Increasing N rate from 70 to 130 kg/fa significantly increased both stemdiameter and active leaves number, but reduced percentage of barrenplants in same direction in 1989. Meanwhile, all other vegetativeparameters checked in both seasons were not changed by N ratetreatments.8) Harvested plants/fa, number of ears/plant, number and weight ofkernels/ear, 100-kernel weight, and stover yield were not significantlyaffected by N rate treatments in both seasons. However, ear and kernelcharacteristics were slightly improved, and stover yield was increasedwith the increase in N

rate.9) Grain yield, grain N percentage, and grain N uptake were significantlyincreased as N rate increased from 70 to 100 kg Nzfa, but not from 100 to.130 kg N/fa in 1989 only.10) Except for plant height, and leaf area of prime ear measured in 1988, thePGR by N rate interaction effects were not significant for all otherparameters studied in both seasons.To achieve the second and the third objectives, a field experimentwas performed in 1992 at the Penn State University's Farm, USA. Findingsof this experiment can be summarized as follows:I. The PGR treatments meaningfully altered vegetative growth charactersof com plants.a) Both plant height and stalk lodging were reduced.b) The ethephon at 450 and 750 g/ha rates increased ear shank length atVI0 stage. On the other hand, it was decreased with the Primotreatments at 800 and 1200 g/ha at the same stage.c) A 29 and 13% delay occurred in silking with using Primo at 800 and1200 g/ha, respectively.d) The Primo 400 g/ha applied at either V6 or VlO increased leaf area,and leaf area index.2. The Primo 400 g/ha at V6 increased grain yield by 7% as compared to thatof the control. However, at VIO; there was a 17% reduction in grainyield by using 1200 g/ha of Primo.3. Delaying the application time of ethephon and Primo from V6 stage toVlO stage improved com quality.4. Total shoot dry weight reflected the mode of action of both ethephon andPrimo as growth retardants. Moreover, the PGRs affected grain yield viatheir impact on dry matter distribution among plant shoot organs.5. Concentrations of total Nand N03-N were inversely proportional to drymatter accumulation.To fulfill the fourth objective, a 2-year field trial was carried out inthe same time and at the same field, previously mentioned, for GA3 andCCC Experiment. The most important results are:1. Effect of N ratesa) Plant height, stem diameter, number of leaves, and leaf area wereincreased by increasing N rate from zero to 60 kg/fa.b) Barren plants percentage as well as number of days to mid-silkingdecreased with the 0 - 60 kg/fa N increment.c) The 60 kg N/fa gave the greatest leaf area.d) Lodged plants percentage was not affected by N rates.e) Increasing N rate up to 60 kg N/fa increased grain yield, however;it was not affected much as N rate increased from 60 to 120 kg N/fa.f) Increasing N rate up to 120 kg N/fa increased grain N percentage.g) Grain N uptake was increased with increasing N rate up to 60 kg N/fa,and up to 90 kg N/fa in 1988 and 1989, respectively.T2. Effect of P20S ratesa) Forty kg of P20S/fa increased both leaf area and ear height than thoseof the control.b) There were no significant responses in yield, yield components, orgrain N uptake in 1988. In 1989, grain yield, grain N uptake, andweight of kernels per ear were significantly higher at 40 kg P20S/farate as compared to the control.3. Effect of K20 ratesAll measured parameters for vegetative growth, yield, yield components,or grain N uptake did not significantly respond to the application of 40 kgK20 vs. zero K20 in both seasons of study.4. NPK interactionsExcept for P x K interaction effect on kernel number per ear in 1989, andN x P x K interaction effect on grain N content in 1988, there were nosignificant effects observed in both years for other possible interactionson all other estimated parameters.Two field experiments were conducted during 1992 in Penn State,USA to study the yield and economic response of com to eight N rates underunmanured and manured soil conditions (the fifth objective). Fourrandomized complete blocks were used for both experiments. The used Nrates were 0, 40,80, 120, 160,200,240, and 280 kg/ha for each experiment.The most important results can be summarized as follows:1. The application of 200 kg N/ha to unmanured com resulted III 66%increase in com grain yield compared with that of the control. On theother hand, grain yield of manured com was negatively affected byapplied N rates.2. The quality of unmanured com was improved by applying inorganic N.While; stover N03-N was, the only parameter among those measured forcrop quality, significantly increased by increasing N rate for manuredcom.3. Manuring com without inorganic N addition produced as much grains as120 kg N/ha applied to unmanured com. This suggests that manuringcom can efficiently replace inorganic fertilizer N.Economic analysis'1. Economic optimum N fertilizer rates were 77,91, and 60 kg/fa for 1988,1989, and 1992, respectively, and all were lower than that needed toreach the yield plateau in each trial.2. The difference between the economic optimum N rates and the maximumused N rates were 43, 29, and 58 kg/fa in the same three years,respectively. This result reflects the importance of supplying theoptimum N rate to minimize N loss and to maximize com profitability.3. Every one kg N applied at the economic level contributed an average of27.5 kg for 1988 and 1989, and 65 kg for 1992 of the total grain yieldproduction.Conclusions1. The effects of GA3, and CCC as seed-soaking treatments were

almostslight on vegetative growth and yield of com under conditions of thisstudy.2. Ethephon, or Primo can be used as folliar applications for controlling stalklodging, improving ear characters, enhancing harvest index, or forbreeding targets. However, such PGRs must be applied at the optimumtime and proper rate to fully achieve these objectives.3. The commonly used N rates for com (by farmers in Egypt) are consideredhigh not only from the agronomic standpoint but also from the economicviewpoint. Therefore, economic studies for fertilizing com should beestablished with using different genotypes, and variety of managementsystems at other locations of' com production in Egypt. Thesesuggestions would help in producing more grains, maximizing comprofitability, and limiting the harmful impact ofN03 on environment.