

## SUMMARY

The objectives of this investigation were to:

- 1) evaluate the effects of GA3 and CCC as seed-soaking treatments at different rates and their interactions with N rate on growth, yield, and grain N uptake of cv. Giza-2 corn.
- 2) compare the effects of ethephon vs. Primo on vegetative growth, crop quality, and distribution of total yield among organs of corn plant shoot at harvest.
- 3) determine optimum time and rate of application of ethephon and Primo to minimize stalk lodging and to maximize yields of hybrid corn.
- 4) study the agronomic and economic responses of corn to different levels of N, P, and K as a balanced fertilizing management.
- 5) evaluate the yield and economic responses of hybrid corn to eight N rates under unmanured and manured corn conditions.

To accomplish the first objective, a 2-year (1988, 1989) field study was conducted at the Agric. Res. Center. of Faculty of Agric., Moshtohor, Zagazig University (Benha Branch). The soil of the experimental field was clay textured with a pH of 7.97, had an organic matter of 2.3 %, and a total N of 0.14 %. The experiment was laid out in a strip plot design with four replications. The treatments were a factorial combination of five PGR treatments and three N rates for a total of 15 treatments. Treatments of PGRs were applied as seed-soaking solutions which were in 1988 and 1989 as follows:

as follows:	1988	1989
	1) Check (no-PGR added)	1) Check (no-PGR added)
	2) GA3 at 150 ppm	2) GA3 at 75 ppm

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|--------------------|-------------------|
| 3) GA3 at 300 ppm  | 3) GA3 at 150 ppm |
| 4) CCC at 600 ppm  | 4) CCC at 300 ppm |
| 5) CCC at 1200 ppm | 5) CCC at 600 ppm |

Results of this experiment can be summarized as follows:

- 1) Treatments of GA3 and CCC did not significantly affect plant height, ear height, stem diameter, active leaves number, leaf area, days to mid-silk, percentage of barren, and lodged plants in 1988 season. However, in 1989, the treatments significantly modified ear height, active leaves number, and barren plants percentage.
  - 2) In 1988, the highest level of 1200 ppm CCC significantly reduced the number of harvested plants/fa by 6000 plants compared to the control. However, the number of harvested plants/fa was not significantly affected by PGR treatments in 1989.
  - 3) Number of ears/plant significantly increased by increasing CCC concentration from 600 to 1200 ppm in 1988, while the treatment of 150 ppm GA3 significantly had more ears/plant as compared to either CCC at 300 ppm or the control in the second season.
  - 4) The treatment of 600 ppm-CCC significantly reduced number of kernels/ear in comparison with all other treatments, and also reduced weight of kernels/ear as compared to 300 ppm of GA3 or 1200 ppm of CCC in 1988. However, both parameters in 1989, and 100-kernel weight in both seasons were not significantly changed by all PGR treatments.
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- 5) The PGR treatments had no significant effects on grain yield, grain N percent, and grain N uptake in both seasons, and stover yield estimated only in 1989. Yet, there were slight increases in grain yield with 150 ppm-GA3 in 1988, and with GA3 and CCC applied at both rates of each in 1989.
  - 6) Changing levels of either GA3 or CCC did not significantly affect all parameters measured in both seasons except for harvested plants/fa, number of kernels/ear, and weight of kernels/ear with both CCC levels in 1988.
  - 7) Increasing N rate from 70 to 130 kg/fa significantly increased both stem diameter and active leaves number, but reduced percentage of barren plants in same direction in 1989. Meanwhile, all other vegetative parameters checked in both seasons were not changed by N rate treatments.
  - 8) Harvested plants/fa, number of ears/plant, number and weight of kernels/ear, 100-kernel weight, and stover yield were not significantly affected by N rate treatments in both seasons. However, ear and kernel characteristics were slightly improved, and stover yield was increased with the increase in N rate.
  - 9) Grain yield, grain N percentage, and grain N uptake were significantly increased as N rate increased from 70 to 100 kg N/fa, but not from 100 to 130 kg N/fa in 1989 only.
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- 10) Except for plant height, and leaf area of prime ear measured in 1988, the PGR by N rate interaction effects were not significant for all other parameters studied in both seasons.

To achieve **the second and the third objectives**, a field experiment was performed in 1992 at the Penn State University's Farm, USA. Findings of this experiment can be summarized as follows:

1. The PGR treatments meaningfully altered vegetative growth characters of corn plants.
  - a) Both plant height and stalk lodging were reduced.
  - b) The ethephon at 450 and 750 g/ha rates increased ear shank length at V10 stage. On the other hand, it was decreased with the Primo treatments at 800 and 1200 g/ha at the same stage.
  - c) A 29 and 13% delay occurred in silking with using Primo at 800 and 1200 g/ha, respectively.
  - d) The Primo 400 g/ha applied at either V6 or V10 increased leaf area, and leaf area index.
2. The Primo 400 g/ha at V6 increased grain yield by 7% as compared to that of the control. However, at V10, there was a 17% reduction in grain yield by using 1200 g/ha of Primo.
3. Delaying the application time of ethephon and Primo from V6 stage to V10 stage improved corn quality.

4. Total shoot dry weight reflected the mode of action of both ethephon and Primo as growth retardants. Moreover, the PGRs affected grain yield via their impact on dry matter distribution among plant shoot organs.
5. Concentrations of total N and NO<sub>3</sub>-N were inversely proportional to dry matter accumulation.

To fulfill **the fourth objective**, a 2-year field trial was carried out in the same time and at the same field, previously mentioned, for GA3 and CCC Experiment. The most important results are:

#### **1. Effect of N rates**

- a) Plant height, stem diameter, number of leaves, and leaf area were increased by increasing N rate from zero to 60 kg/fa.
  - b) Barren plants percentage as well as number of days to mid-silking decreased 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.
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## 2. Effect of $P_2O_5$ rates

- a) Forty kg of  $P_2O_5$ /fa increased both leaf area and ear height than those of the control.
- b) There were no significant responses in yield, yield components, or grain N uptake in 1988. In 1989, grain yield, grain N uptake, and weight of kernels per ear were significantly higher at 40 kg  $P_2O_5$ /fa rate as compared to the control.

## 3. Effect of $K_2O$ rates

All measured parameters for vegetative growth, yield, yield components, or grain N uptake did not significantly respond to the application of 40 kg  $K_2O$  vs. zero  $K_2O$  in both seasons of study.

## 4. NPK interactions

Except for P x K interaction effect on kernel number per ear in 1989, and N x P x K interaction effect on grain N content in 1988, there were no significant effects observed in both years for other possible interactions on all other estimated parameters.

Two field experiments were conducted during 1992 in Penn State, USA to study the yield and economic response of corn to eight N rates under unmanured and manured soil conditions (**the fifth objective**). Four randomized complete blocks were used for both experiments. The used N rates 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 corn resulted in 66% increase in corn grain yield compared with that of the control. On the other hand, grain yield of manured corn was negatively affected by applied N rates.
2. The quality of unmanured corn was improved by applying inorganic N. While; stover  $\text{NO}_3\text{-N}$  was, the only parameter among those measured for crop quality, significantly increased by increasing N rate for manured corn.
3. Manuring corn without inorganic N addition produced as much grains as 120 kg N/ha applied to unmanured corn. This suggests that manuring corn can efficiently replace inorganic fertilizer N.

#### **Economic analysis**

1. Economic optimum N fertilizer rates were 77, 91, and 60 kg/ha for 1988, 1989, and 1992, respectively, and all were lower than that needed to reach the yield plateau in each trial.
  2. The difference between the economic optimum N rates and the maximum used N rates were 43, 29, and 58 kg/ha in the same three years, respectively. This result reflects the importance of supplying the optimum N rate to minimize N loss and to maximize corn profitability.
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3. Every one kg N applied at the economic level contributed an average of 27.5 kg for 1988 and 1989, and 65 kg for 1992 of the total grain yield production.

### **Conclusions**

1. The effects of GA3, and CCC as seed-soaking treatments were almost slight on vegetative growth and yield of corn under conditions of this study.
2. Ethephon, or Primo can be used as foliar applications for controlling stalk lodging, improving ear characters, enhancing harvest index, or for breeding targets. However, such PGRs must be applied at the optimum time and proper rate to fully achieve these objectives.
3. The commonly used N rates for corn (by farmers in Egypt) are considered high not only from the agronomic standpoint but also from the economic viewpoint. Therefore, economic studies for fertilizing corn should be established with using different genotypes, and variety of management systems at other locations of corn production in Egypt. These suggestions would help in producing more grains, maximizing corn profitability, and limiting the harmful impact of NO<sub>3</sub> on environment.