

## SUMMARY

Two field experiments were carried out at Mallawi Agricultural Research Station, El- Minia, Egypt during the two successive seasons (1993 and 1994 seasons) to study the effect of nitrogen and phosphorus levels as well as sweet sorghum cultivars on growth characters, yield, yield components and technological properties of juice and syrup of sweet sorghum.

Each experiment included 24 treatments which were the combination between four levels of nitrogen (0, 40, 80, and 120 kg N/ feddan), three levels of phosphorus (0, 16 and 32 kg P<sub>2</sub>O<sub>5</sub>/ feddan) and two sweet sorghum cultivars (Hybrid 405 and Honey cultivars). The treatments in the two seasons were arranged in split- split plot experimental design in four replications. The area of the experimental unit was 14.7 m<sup>2</sup> (3 x 4.9 m) with 7 ridges which were 70 cm apart and 3 m length as well as 25 cm between hills with two plants in each hill. The sowing dates were on 25 th May and 1 st June in 1993 and 1994 seasons, respectively.

### **Characters studied:**

#### **A- Growth measurements:**

Four samples of ten plants were labeled at random from the second and sixth ridges of each sub- sub plot during the growth period at 45, 60, 75 and 90 days from planting to study the following characters:

- 1- plant height (cm).
- 2- Stalk diameter (cm).

- 3- Leaf area (cm<sup>2</sup>).
- 4- Flowering date (number of days to 50% flowering).

### **B- Yield and yield components.**

- 1- Panicle length (cm).
- 2- Grain yield (g)/ plant.
- 3- 1000- grain weight (g).
- 4- Grain yield (kg)/ feddan.
- 5- Whole yield (ton)/ feddan.
- 6- Clean yield of stalks (ton )/ feddan.

### **C- Technological properties:**

- 1- Juice extraction percent.
- 2- Total soluble solids percent (T.S.S).
- 3- Sucrose content.
- 4- Reducing sugars content.
- 5- Purity percent.
- 6- Syrup yield (ton)/ feddan

The following are the most important results:

### **I- Growth measurements:**

#### **A- Effect of nitrogen levels:**

- 1- The average values of plant height at 45, 60, and 75 days from planting increased significantly by increasing N level up to 120 kg N/ feddan. On the other hand, there were no significant differences between 40, 80, and 120 kg N/ feddan in plant height at 90 days from planting.
- 2- Increasing N levels tended to increase stalk diameter with prolonging the growing period. The thicker stalks were obtained from 120 kg N/ feddan at the four samples. On the contrary, no significant difference

between 80 and 120 kg N/ feddan on stalk diameter was obtained at 60 and 90 days from sowing date.

- 3- There was progressive and consistent increase in leaf area by increasing N levels from zero to 120 kg N/ feddan at the four samples. However, no significant differences between 80 and 120 kg N/feddan in leaf area at 45, 60 and 75 days from planting.
- 4- The mean number of days to 50% flower opening significantly decreased by increasing N level up to 120 kg N/ feddan.

#### **B- Effect of phosphorus levels:**

- 1- Plant height increased by increasing rates of phosphorus fertilizer from zero to 32 kg P<sub>2</sub>O<sub>5</sub>/ feddan at 45, 60, 75 and 90 days from planting.
- 2- The effect of phosphorus fertilizer rates was not significant on the mean values of stalk diameter at all samples and leaf area at 75, and 90 days from planting.
- 3- The average values of leaves area/plant significantly increased by increasing phosphorus level up to 16 kg P<sub>2</sub>O<sub>5</sub>/ feddan at 45 and 60 days from planting.
- 4- Increasing phosphorus fertilizer levels tended to decrease the number of days to 50% flowering. The shortest period from planting till 50% flowering was resulted from addition of 32 kg P<sub>2</sub>O<sub>5</sub>/ feddan.

#### **C- Effect of varieties:**

- 1- Hybrid 405 significantly surpassed Honey cultivar i plant height, stalk diameter and leaf area at different sampling period.
- 2- Hybrid 405 gave the earliest flowering and shortest period to 50% flowering than honey cultivar.

### **Interaction Effect:**

- 1- Significant interaction effect was detected for N x P levels on plant height leaf area at the four samples in addition to flowering date.
- 2- Hybrid 405 which received 120 kg N/ feddan gave the tallest plant and greatest leaf area at different samples.
- 3- There were significant differences between the averages of plant height at 45, 60 and 75 days from planting; stem diameter and leaf area at 45 and 60 days from planting as affected by the interaction between phosphorus levels and cultivars.
- 4- The higher values of plant height, stem diameter, and leaf area were obtained from Hybrid 405 with applying 120 kg N/ feddan and different levels of phosphorus fertilizer.

### **II- Yield and yield components:**

#### **A- Effect of nitrogen levels:**

- 1- The differences between the mean values of panicle length was not significant as affected by the levels of nitrogen.
- 2- Grain yield per plant and per feddan significantly increased by increasing N levels up to 80 kg N/ feddan.
- 3- The mean values of 1000- grain weight significantly increased by increasing the levels of nitrogen up to 120 kg N/ feddan.
- 4- The application of nitrogen fertilizer at 120 kg N/ feddan increased the whole yield/ feddan over the control treatment by 46.12%, 37.79% and 77.79% at milk, dough and ripe stages, respectively. However, no

significant differences between 80 and 120 kg N/ feddan at milk and ripe stages were obtained.

- 5- The mean values of clean yield/ feddan was significantly affected by the application of nitrogen fertilizer at different maturity stages. However, there was no significant differences between 40, 80 and 120 kg N/ feddan at milk and dough stages. The application of 120 kg N/ feddan gave the maximum clean yield of stalks/ plant at milk, dough and ripe stages when compared with the other levels.

#### **B- Effect of phosphorus levels:**

- 1- Phosphorus application had no significant effect on panicle length, 1000- grain weight, whole yield/ feddan at different maturity stages as well as clean yield of stalks/ feddan at milk and ripe stages.
- 2- The average values of grain yield per plant and per feddan as well as clean yield of stalks/ feddan at dough stage significantly increased by increasing phosphorus levels up to 16 kg P<sub>2</sub>O<sub>5</sub>/ feddan.

#### **C- Effect of varieties:**

- 1- Honey cultivar produced the highest mean values of panicle length, whole yield and clean yield of stalks per feddan at the three maturity stages when compared with Hybrid 405.
- 2- Hybrid 405 gave the highest 1000- grain weight, grain yield per plant and per feddan than Honey cultivar.

#### **Interaction Effect:**

- 1- The interaction between N and P fertilizer levels had a significant effect on the average values of clean yield of stalks/ feddan at dough stage.

The maximum values was obtained from applying 120 kg N + 32 kg P<sub>2</sub>O<sub>5</sub>/ feddan.

- 2- The mean values of clean yield of stalks/ feddan of Honey Cultivar was significantly affected by the interaction between N levels (120 kg N/ fed,) and cultivars.
- 3- The panicle length and clean yield of stalks/ fed. were significantly affected due to the interaction between phosphorus levels and cultivars at milk stage.
- 4- The differences between the mean values of whole yield/ feddan at milk stage and clean yield of stalks/ feddan at milk and ripe stage were highly influenced by the interaction between NP levels and cultivars. Honey cultivar with applying 120 kg N + 32 kg P<sub>2</sub>O<sub>5</sub>/ fed. gave the maximum mean values of clean yield of stalks/ feddan.

### **III- Technological properties:**

#### **A- Effect of nitrogen levels:**

- 1- Juice extraction at dough stage, total soluble solids and sucrose percent in juice at different maturity stages were significantly affected by the application of nitrogen levels. However, no significant differences between 80 and 120 kg N/ feddan on the above characters were obtained.
- 2- Increasing N levels tended to increase reducing sugars content at dough stage, purity percent in juice and syrup yield per feddan at the three maturity stages.
- 3- The application of 120 kg N/ feddan resulted in increasing the syrup yield/ feddan by 55.44%, 43.40% and 83.29% at milk, dough, and ripe

stages, respectively over the control treatment in the combined analysis of 1993 and 1994 seasons.

### **B- Effect of phosphorus levels:**

- 1- The application of phosphorus fertilizer levels had no significant effect on T.S.S at dough and ripe stages, sucrose percent at ripe stage and reducing sugar content at different maturity stages.
- 2- The mean values of juice extraction percent, sucrose percent at different maturity stages, purity percent at milk and ripe stages and syrup yield per feddan at the three maturity stages increased by increasing the levels of phosphorus fertilizer.
- 3- The application of 16 kg P<sub>2</sub>O<sub>5</sub>/ feddan caused increases in syrup yield/ feddan by 17.94% and 8.78% at dough and ripe stages, respectively over the treatment received zero phosphorus fertilization.

### **C- Effect of varieties:**

- 1- Honey cultivar produced the highest juice extraction percent, T.S.S percent, sucrose percent in juice, reducing sugar content in juice and syrup yield per feddan.
- 2- Hybrid 405 surpassed significantly Honey cultivar in purity percent in juice at milk and dough stages.
- 3- In general, juice extraction and reducing sugar concentration reached its maximum at milk stage, whereas total soluble solids, sucrose percent in juice and syrup yield/ feddan increased gradually from stage to another up to ripe stage.

### **Interaction Effect:**

- 1- The interaction between N and P levels significantly affected the juice extraction at dough and ripe stage, T.S.S % at milk and ripe stages, purity percent and syrup yield at dough stage.
- 2- The mean values of reducing sugar content and syrup yield at dough and ripe stages were significantly affected by the interaction between N levels and sweet sorghum cultivars.
- 3- There was a significant interaction between P levels and cultivars for juice extraction at milk and dough stages, T.S.S at the three maturity stages, reducing sugar content at dough stage and syrup yield/ feddan at milk stage.
- 4- The highest percent of juice extraction was obtained from Honey cultivar with applying 120 kg N/ feddan alone. Honey cultivar produced the highest reducing sugar content when added 32 kg P<sub>2</sub>O<sub>5</sub>/ feddan alone. On the other hand, Hybrid 405 with 120 kg N + 32 kg P<sub>2</sub>O<sub>5</sub>/ feddan gave the greatest purity percent. Honey cultivar received 80 kg N + 16 kg P<sub>2</sub>O<sub>5</sub> or with 32 kg P<sub>2</sub>O<sub>5</sub>/ feddan alone gave the maximum syrup yield/ feddan at dough and ripe stages, respectively.

### **V- Correlation studies**

Positive and significant correlation coefficients was detected between the whole yield and each of plant height, stem diameter, clean yield, juice %, T.S.S %, sucrose %, extraction% and purity %. The respective correlation values were 0.519, 0.847, 0.888, 0.875, 0.765, 0.838, 0.432, and 0.581. Such results indicate that selection for any of these characters will certainly lead to the increase in the whole yield (ton/feddan).