V. SUMMARY

The first study

The aim of this study was to investigate general and specific combining ability, heterosis and types of gene action and their interaction with environments (irrigation treatments i.e. sprinkler irrigation every 4, 8 and 12 days) for plant height, height of peduncle leaf, grain, straw and biological yields, and some of yield components as well as protein content, wet and dry gluten percentages and semolina percentage.

Six parental durum varieties namely; Bani Sweif 1 (P_1), Bani Sweif 2 (P_2), Bani Sweif 3 (P_3), Sohag 1 (P_4), Sohag 2 (P_5) and Sohag 3 (P_6), representing wide range of variability in most of the studied traits, were used. These parental varieties were planted in 1996/1997 season and crossed in half diallel combinations without reciprocal to obtain seeds of 15 F_1 hybrids. A half diallel set of crosses involving six parents were evaluated under three sprinkler irrigation every treatments namely; 4, 8 and 12 days in three separate experiments, were used. Three adjacent experiments were conducted, the first, second and third experiments were sprinkler irrigated every 4, 8 and 12 days, respectively. In each experiment, the parental varieties and their possible crosses were arranged in a randomized complete block design with three replications at Ismailia Agricultural Research Station. Each plot comprised of two rows 2 meters long with 30 cm between rows. Plants within row were 20 cm apart. The data for each trait were analyzed on individual plant mean basis. An ordinary analysis of variance was firstly performed for each sprinkler irrigation

treatment. Combined analysis of the three experiments were carried out whenever homogeneity of error variance of three sprinkler irrigation treatments were detected. Heterosis was computed as mean squares and the percentage deviation of F_1 mean performance from either the mid- or the better parent mean values for the separate irrigation treatment as well as the combined data.

General and specific combining ability estimates were obtained by employing **Griffing's (1956)** diallel cross analysis designated as method II model 1. The obtained results can be summarized as follows:

1. Irrigation mean squares were significant for all the studied traits. The effect of sprinkler irrigation every 8 days increased significantly yield and some of its components. While, the effect of sprinkler irrigation every 4 days had the highest values for quality characters.
2. Mean squares for genotypes, parental variety and F_1 hybrids, were significant for all studied traits, except parent mean squares for number of spikes and semolina in the combined data.
3. The cross $P_4 \times P_5$ has the highest grain and biological yields per plant, but without significant superiority over the two crosses $P_2 \times P_5$ an $P_3 \times P_4$ in the combined analysis. The cross $P_2 \times P_3$ gave the highest values for dry and wet gluten percentages in the combined analysis.

4. Mean squares for parents vs. crosses as an indication to average heterosis overall crosses were significant for all traits in separate irrigation treatments as well as the combined analysis except straw yield and semolina percentage at the combined analysis, biological yield at sprinkler irrigation every 8 day, and dry gluten % at sprinkler irrigation every 4 and 8 days. F_1 means were significantly higher than parental mean for most traits.

5. The variance associated with general and specific combining abilities were significant for all studied traits in separate sprinkler irrigation treatment as well as the combined analysis except variance of GCA for 1000-kernel weight at sprinkler irrigation every eight days. Grain yield/plant at three irrigation treatments as well as the combined, straw yield, semolina and protein percentages at sprinkler irrigation every four days, biological yield at sprinkler irrigation every 4 and 12 days, plant height at sprinkler irrigation every 12, 1000-kernel weight at irrigation every 8 and 12 days and wet gluten percentage in the combined analysis exhibited low GCA/SCA ratio less than unity. While the magnitude of additive and non-additive types of gene action were similar for plant height at irrigation every 8 days as well as the combined analysis, number of spikes per plant and straw yield per plant at sprinkler irrigation every 12 days. On the other hand, high GCA/SCA ratio, which exceeded than the unity was detected for other cases.

6. The mean squares of interaction between both types of combining ability and irrigation treatments were significant for all studied traits, indicating that both additive and non-additive types of gene action varied from irrigation treatment to another.

7. The parent P_2 for dry gluten, P_3, P_5 and P_6 for protein percentage, and 1000-kernel weight, P4 for peduncle length, number of spikes, straw and biological yields, and P_5 for grain yield and some of yield components seemed to be the best general combiners.

8. The most desirable SCA effects were detected by crosses P_1 x P_4 and P_3 x P_4 for peduncle length, P_1 x P_5 for short plant, P_4 x P_5 for number of kernels/spike, P_3 x P_6 and P_4 x P_5 for 1000-kernel weight, P_1 x P_3, P_1 x P_4, P_2 x P_4 and P_5 x P_6 for straw yield, P_1 x P_4, P_2 x P_5, P_4 x P_6, P_3 x P_4, P_3 x P_6 and P_4 x P_5 for grain yield/plant, P_1 x P_4, P_2 x P_3 and P_5 x P_6 for biological yield, P_1 x P_5, P_1 x P_6, P_3 x P_5 and P_4 x P_6 for semolina percentage, P_2 x P_3 and P_5 x P_6 for dry gluten percentage and P_2 x P_3 and P_4 x P_6 for wet gluten.

The second study

A field experiment was carried out at Bahteen Experimental Station during 1996/1997 and 1997/1998 season to study the response of six varieties of *T. turgidum var. durum* and Gemmeiza 3 (*T. aestivum*) to nitrogen levels for some agronomic and quality characters. The materials used in this study involved six parents in the first series (Bani Sweif 1, Bani Sweif 2, Bani Sweif 3, Sohag 1, Sohag

2 and Sohag 3 as well as Gemmeiza 3 (*T. aestivum*). The varieties were fertilized by N levels in the form of Ammonium nitrate (33.5% N) as follows:

1. 75 kg N/fed (N1) were applied in three equal doses just before sowing, first and second irrigations.
2. 75 kg N/fed (N2) were applied in four equal doses, just before sowing, first, second irrigation and at heading time.
3. 100 kg N/fed (N3) were applied in four equal doses just before sowing, first, second irrigations and at heading date.

A split-plot design with four replications was used. The main plots were randomly assigned to three nitrogen fertilizer levels, while the six varieties of durum wheat as well as check variety Gemmeiza 3 (*T. aestivum*) represented sub-plots. The results could be summarized as follows:

A. Growth, yield and its components

1. All studied characters except plant height, peduncle length and number of kernels/spike were significantly differed from season to another.
2. Gemmeiza 3 cultivar gave the highest averages of straw yield/feddan in both seasons.
3. Bani Sweif 2 cultivar had the highest grain yield/feddan in both seasons, whereas both Gemmeiza 3 and Sohag 1 cultivars had the lowest grain yield/feddan in the first and second season, respectively.

4. The highest average of the biological yield/feddan recorded by Sohag 3 and Gemmeiza 3 cultivars in the first and second season, respectively.
5. The highest average of straw yield/feddan was obtained when applying N rate in four equal doses up to 75 kg N/feddan in the first season and up to 100 kg N/feddan in the second season, respectively.
6. The highest grain yield ardab/feddan was accompanied to N application level of 75 kg N/feddan when N rate was splitted into three doses in the first season and four doses in the second season.
7. The effect of nitrogen levels on grain ardab/feddan, biological yields (ton/fed) and yield components was changeable from season to season.
8. The effect of N rate up to 75 kg N/feddan in three doses with Gemmeiza 3 showed the highest value for straw yield ton/feddan.
9. The highest values for grain and biological yield ton/feddan were obtained when N rate up to 75 kg N/feddan in four doses were applied with Bani Sweif 1 cultivar.

B. Quality characters

1. Sohag 2 cultivar had the highest semolina, protein and wet gluten percentages. Whereas, the highest dry gluten percentage was recorded by Bani Sweif 3 cultivar.

2. The application of N levels in four equal doses up to 75 kg N/fed and 100 kg N/fed gave significant values of protein and dry gluten percentages, respectively.
3. The highest mean value of semolina percentage was detected by adding N rate in three doses up to 75 kg/feddan with Bani Sweif 2 cultivar.
4. The highest dry gluten percentage was obtained when applying N rate in four doses up to 75 kg N/fed with Sohag 2 and Gemmeiza 3 cultivars.
5. The highest wet gluten percentage was obtained by Sohag 1 cultivar given N rate in four doses up to 75 kg N/feddan.
6. Bani Sweif 3 cultivar produced highest concentration of protein percentage when received N rate in four doses up to 100 kg N/feddan.