IMPROVEMENT FOR PRODUCTIVITY, BULB QUALITY AND STORAGE ABILITY OF SOME ONION GENOTYPES

BY

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B.Sc. Agric. (Agronomy) Al-Azhar University, 2005

A Thesis submitted in partial fulfillment of

The requirements for the degree of

MASTER OF SCIENCE

in

Agricultural Sciences

(Crop Breeding)

Department of Agronomy

Faculty of Agriculture

Benha University

2022

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5. SUMMARY

The present investigation was carried out at Giza Research Station, Onion Research Department, Field Crops Research Institute, Agriculture Research Center, Ministry of Agriculture, during the three successive seasons, 2016 / 2017, 2017 / 2018 and 2018 / 2019.

The aim of the study is to obtain a superior genetic population in onion yield, quality and storability traits. Eight parents and their crosses in the first generation were evaluated and the best combinations were selected as promising nuclei for constitution of composites or bi-parental onion populations.

Natural cross pollination between the eight parents was done in isolated cages using broad of honey bees in two systems.

In the first one, the eight parents were planted under one insect proof cage, the cage included 8 ridges, the bulbs of each parents were planted one time in each ridge and position (Latin square) to allows for all possible natural random cross-pollination which was done by introducing broad of honey bees during full bloom.

Meanwhile, in the second system parent were dived into 4 groups, each one included two parents (genotypes) and planted in 4 isolates insect proof cages, each cage plot contained two ridges each parent planted in one ridge.

On April 2017, honey bees (broad) was entered in each cage to complete inter-pollination, on May 2017, seeds of the 16 mother bulbs (8 parents Seed) were harvested separately and massed to produce the first generation of composites or bi-parental population.

Field Evaluation: The eight parents and their crosses (8 composites and 8 bi-parental) were evaluated in the 2017/2018 and 2018/2019 seasons in Experimental field using RCBD with three replicates.

The results can be summarized as follows:-

Mean squares of genotypic effect were significant for all studied traits in both seasons and combined, except two traits in the first season plant height and number of leaves, and three traits in the second season plant height, culls yield, and total weight loss.

Concerning partitioning the genotypes mean squares into parent, crosses, parent vs. crosses, results revealed significant affect for parents, crosses populations in combined analysis for all studied traits except plant height trait. While parent vs. crosses was just significant for both bulb diameter, total soluble solids in combined also.

Performance of selected parents and their crosses:-

1. Vegetative characters

- **Plant height**

Parents P_7 and P_8 recorded the tallest plants, whereas P_6 showed the shortest plant.

The highest values of composites populations were obtained in C_5 followed by C_4 and C_8, C_2, C_7 and C_6 populations. Significant greater values of their overall means compered over all means of all parents was detected.

Results of bi-parental populations revealed that over all means of bi-parental was significantly lower than over all mean of all parents. The highest values of plant height were recorded for bi-parental B_1 and the reciprocal cross B_7 followed by B_4. Meanwhile, the reciprocal crosses B_5 exhibited the lower value.

- **Number of leaves:**

Parents P_8, P_7, P_2 and P_5 showed the highest number of leaves. Overall mean composites was significantly greater than that overall parents mean.

In addition, crosses C_7, C_8, C_2 and C_5 recorded higher number of leaves compared to overall parents mean.

Overall mean of bi-parental crosses was significantly higher compared to either overall composites mean or overall parents, the values of B_2 and its reciprocal cross B_3, B_5 and its reciprocal cross B_4 were greater than over all parents, whereas crosses B_1 was lower either than its reciprocal cross B_7 or overall mean parents also, B_6 was lower either than its reciprocal cross B_8 or over all parents mean.

- **Number of days to maturity:**

Parents significantly differed, the highest number of days to maturity (late maturity) was displayed by P_7, P_8 and P_5, whereas, the least number of days (early-maturity) was recorded in P_6, P_2, P_3 and P_4.

Composites crosses (C_8, C_7 and C_1) showed the highest number of days to mature (late –mature). Meanwhile, the lowest values (early – mature) were detected in C_6, C_3, C_4 and C_2.

Bi-parental crosses, B_8 recorded the highest value whereas it's reciprocal cross B_6 showed lower value. Cross B_7 and its reciprocal cross B_1 showed higher value, the lowest number of days to maturity (early – mature) was showed in B_3 and its reciprocal cross B_2 fallowed by B_4 and its reciprocal cross B_5.

2. yield characters:

- **Total yield**

Parents P_8, P_7 and P_6 gave the highest total yield. On the other hand the lowest yield was showed in P_5, P_2 and P_1.

Overall composites mean was significantly higher than parents overall mean. C_4, C_7, C_1 and C_3 gave the highest values. While, the lowest values were recorded in C_8, C_5 and C_3.

Overall mean of bi-parental population was significantly lower than overall mean of the evaluated parents. B_8 gave the highest yield

compared to its reciprocal cross B_6, similarly cross B_7 gave highest value. Meanwhile it's reciprocal cross B_1 produced lower value. Also B_4 gave higher yield compared to B_5 that produced lower yield, cross B_2 and its reciprocal cross B_3 produced relatively the same yield.

- **Marketable yield**

Parents P_7, P_3 and P_6 produced the highest marketable yield. Meanwhile, P_5, P_2 and P_8 showed lower marketable yield.

With the crosses were differed significantly, over all mean of composites was significantly higher in compared to overall mean of parents, the highest marketable yield were recorded for C_4 , C_1, C_7 and C_3, the lowest values were observed for C_8, C_2 and C_5.

Bi-parental crosses, B_7 gave significantly higher marketable yield than it's reciprocal cross B_1. While, cross B_4 was insignificantly higher than it's reciprocal cross B_5, cross B_8 was insignificantly higher than it's reciprocal cross B_6 and cross B_2 was insignificantly higher than it's reciprocal cross B_3.

- **Culls yield**

Parents P_8, P_5 and P_2 recorded the highest (undesirable) culls yield, whereas the lowest (desirable) values were exhibited by P_1, P_4 and P_3.

Overall mean of composites was significantly lower than overall parents mean, the highest culls yield was detected in C_8, whereas the rest of composites showed lower values with no significance between each other.

Overall mean of bi-parental population was significantly lower (0.660 t/fed) than overall parents mean (0.900 t/fed) the highest (undesirable) value of culls yield was recorded only in B_8, on the other hand it's reciprocal cross B_6 and the rest of bi-parental and their

reciprocal crosses showed lower values (desirable) of culls yield without significant difference between each other.

3. Bulbs characters:

- **Average bulbs weight:**

Significant differences among evaluated parents was detected, the highest values were observed in P_3, P_7 and P_8. Whereas, the lowest values were recorded in P_5 and P_2.

Overall mean of composite crosses was significantly higher as compared to overall parents mean. The highest values were recorded in C_1 followed by C_8 and C_4. Meanwhile, the lowest values were estimated in C_5 followed by C_7 and C_2.

Over all mean of bi-parental population was not significantly differed than over all mean of parents. However, cross B_8 gave the highest value while it's the reciprocal cross B_6 gave lower value. Cross B_4 gave higher value than it's reciprocal cross B_5, cross B_1 and it's reciprocal cross B_7 gave relatively high values meanwhile, cross B_2 and it's reciprocal cross B_3 gave relatively low average bulbs weight.

- **Bulb diameter**

Data of combined significant differences among parents was detected, the highest values of bulb diameter were observed in P_8, P_7 and P_3, while the lowest values were detected in P_4, P_2 and P_6.

Overall mean of composites crosses was significantly higher than that of overall mean of parents, the highest values were showed in C_1, C_8 and C_5, whereas the lowest values were recorded in C_4, C_2 and C_7.

Bi-parental crosses, overall mean was not significantly differed in compared to overall parents mean. However, the highest values of bulb diameter were recorded in B_7 and it's reciprocal cross B_1, B_8 and it's reciprocal cross B_6, B_3 and it's reciprocal cross B_2. On the other hand,

the lowest values of bulb diameter were observed in B_4 and it's reciprocal cross B_3.

- **Bulb height**

Parents were significantly differed, the highest value was observed in P_4, whereas the lowest value was exhibited by P_5.

Overall mean of composites was significantly higher than that of all parents mean. The highest value of bulb height was observed in C_4, whereas, the lowest values were recorded in C_5 followed by C_7 and C_6.

Overall mean of bi-parental was significantly higher than that of overall mean of parents. The highest bulb height was observed in B_4 while it's reciprocal cross showed lower value.

- **Number of complete rings**

Significant differences among evaluated parents was detected, the highest values of number of complete rings were given by P_4 followed by P_2, P_5. On the other hand the lowest values were observed in P_8 and P_7.

Composites crosses differed significantly, their overall mean was significantly higher than that of overall mean of parents, the highest number of complete rings was estimated in C_4, C_2 followed by C_6 and C_5. Meanwhile, the lowest values were observed in C_8 and C_7.

Overall mean of bi-parental population was decreased significantly in compared to over all mean of parents. The highest number of complete rings was observed in B_5 and it's reciprocal cross B_4. Whereas, B_7 gave higher value than that of it's reciprocal cross B_1. The lowest values of number of complete rings either in the cross or it's reciprocal cross were recorded for B_8 and it's reciprocal cross B_6 and, B_2 and B_3.

- **Number of growing center**

Parents were differed significantly, parents P_8 and P_3 gave the highest values of number of growing center whereas, P_4, P_2 and P_6 showed the lowest numbers.

Composites crosses were significantly differed, overall composites mean was significantly higher than that of overall parents mean, the highest number of growing center was observed in C_8, C_7 and C_1. Meanwhile, the lowest values were recorded in C_4, C_3 and C_6.

Overall mean of bi-parental population was significantly higher in compared with overall parents mean, cross B_1 and it's reciprocal cross B_7 showed higher number of growing center, cross B_2 and it's reciprocal cross B_3 gave higher numbers of growing center, cross B_8 recorded high value whereas, it's reciprocal cross B_6 showed lower numbers in addition, cross B_5 and it's reciprocal cross B_4 exhibited lower number of growing center.

- **Total soluble solids %:**

Parents were differed significantly, P_5, P_7 and P_8 exhibited the highest values of TSS%. Meanwhile, P_4 and P_2 gave the lowest values of TSS%.

Significant differences among evaluated composites were observed, their overall mean was significantly higher than that of overall mean of parents, the highest values of TSS% were detected in C_8, C_7 and C_6. Meanwhile, the lowest value was observed in C_4.

Overall mean of bi-parental population was significantly higher than that of overall parents mean. B_7 gave significant higher TSS% than that it's reciprocal cross B_1 who showed lower value. B_8 produced non-significant value of TSS% than it's reciprocal cross B_6.

Moreover, B_5 exhibited higher significant value of TSS% in compared to it's reciprocal cross B_4 who showed lower value whereas, B_3 and it's reciprocal cross B_2 gave relatively similarly percentage.

- **Dry matter content %**

Significant differences among evaluated parents was observed. P_5, P_7 and P_8 showed higher values of dry matter %.

On the other hand the lowest values of dry matter % were recorded for P_4, P_6 and P_2.

Composites populations were differed significantly, their overall mean was significantly higher in compared to overall parents mean. C_8, C_7 and C_5 gave the highest values of dry matter %, whereas C_4 and C_3 exhibited the lowest values.

Bi-parental crosses were differed significantly, their overall mean was significantly lower than that of overall parents mean, B_7 gave non-significant higher value than that of it's reciprocal cross B_1, while B_8 gave significant higher value than that of it's reciprocal cross B_6, B_3 gave non-significant lower value than it's reciprocal cross B_2, moreover, B_4 gave significant lower value of dry matter content than it's reciprocal cross B_5.

- **Total weight loss %**

Parents were significantly differed. P_5, P_1, P_2 and P_3 had the lowest values of TWL%. Whereas, P_4 followed by P_8 recorded the highest TWL% values.

Overall mean of composite populations was significantly lower than that overall of parents mean. Composites (C_5, C_8, C_2 and C_7) had the lowest values of TWL%. Meanwhile, Composites (C_1, C_4, C_6 and C_3) gave the highest values of TWL%.

Bi-parental crosses were differed significantly, their overall mean was significantly lower than overall parents mean. B_3 recorded the lowest value of TWL% than that of it's reciprocal cross B_2 which had highest values without significant differed between each other. Meanwhile, B_5 showed significant lower values of TWL% than it's reciprocal cross B_4 which had higher value. The rest of bi-parental crosses were similar.