EFFECT OF SELFING AND SELECTION ON SOME BULB CHARACTERS OF THE ONION "GIZA 20 " Gamie. A. A.

Onion Research Section, Field Crops Research Institute, A.R.C.

ABSTRACT

This investigation was carried out at Shandweel Agric. Res. Station, Sohag, Egypt, from 1996 to 1998 seasons to study the effect of selfpollination and one cycle of selection on some bulb characters and yield components of Giza-20 cultivar.

Percentage of single growing point, single center bulbs and those free from pink flesh, were significantly increased in the S₁ population, while percentage of internal doubling, average bulb weight, external doubling, yield of culls and total yield were decreased.

Predicted gain due to selection was more than realized in all selected populations and for all studied characters, except free from pink flesh in the three selected populations.

The differences between predicted and realized responses were significant in all characters except external doubling, bolting, marketable and exportable yields in the three selected populations.

INTRODUCTION

Onion (*Allium cepa L.*) is a biennial cross pollinated crop. In the last two decades, exports were considerably decreased to Europe. The reason for this decrease was due to many factors include bulb quality. Internal doubling is an important aspect of bulb quality which' could be decreased through an efficient breeding program as recommended by Frankline (1974) for the improvement of the Egyptian onion.

Internal doubling in onion was found by Shalaby (1966) to be controlled by several genes. These genes control number of growing points, time of their initiation, or both. The genotype and environment contribute to internal doubling expression, calculated heritability was found to be 64 %.

Mc Collum (1971) at Beltville, U.S.A proved that coefficient of variability of bulb weight is largely influenced by environmental conditions rather than genetic factors.

Ahmed and Ahmed (1976) indicated that the percentage of single - center bulbs was increased from one to 37 % through one generation of mass selection in "Giza-6M." onion cultivar, Percentage of bulbs with two contact centric growing centers was also increased from 9 to 35 %. Oppositely, percentages of internal doubling was decreased from 90 to 28 %.

Ahmed et al (1977) tested five strains and reported that Giza-6 M and the bulk white had less growing points with lighter bulbs due to inbreeding.

Sherif et al (1988) found that F₁ bulbs have more growing points than the Egyptian better parent "Kerdasy " with less growing points.

Corgan (1988) indicated that recurrent selection for non bolting in " Ben Shamen " onion produced two new varieties, which were more resistant to bolting than the parent stock " Ben Shamen " .

Sidhu et al (1988) reported that the total yield of bulbs and bolting percentage had high phenotypic and genotypic coefficient of variations. High heritability estimates for both characters and bulb diameter were found.

Shalaby et al (1991) showed after two cycles of mass-selection that, onion bulb, grown from sets was improved in single center bulbs, marketable and exportable yields. While, internal, external doubling, bolters, weight of bulb, total and culls yield were significantly decreased.

Gamal (1994) found after two cycles of mass selection of Giza-20 onion that, the percentage of bulb with single growing points were increased, while, internal and external doubling, bolters, bulb weight, total and culls yield were decreased.

MATERIALS AND METHODS

The aims of the present study were to find out the effect of self pollination and one cycle of selection on some bulb characteristics and yield quality of Giza-20 cultivar to increase exports. The soil of Exp. Farm was loam clay. The onion cultivar "Giza 20" was used in this work; This cultivar is a selection from Egyptian Deltan Types (EI-Gammal et al, 1980).

At the end of storage period (in November 1996), 2000 apparently single bulbs were selected. Out of these, only 18 bulbs with a single growing points and free from pink colour in the flesh were found. The intensity of selection was 0.90 %.

Fifteen (out of the 18 selected bulbs) with single growing points were planted under isolation (lumite cage) and left to inter-pollinate using honey bee insects during flowering, with one seed stalk from each plant was selfed.

The other three selected bulbs with a single growing point were outside left the cage for open pollination.

In May 1997, selfed (S₁ sel.) , S₁ mixed seeds (under the lumite cage) were harvested and S₁ open pollinated (S₁op.), S₁ means selection for one generation .

In September 1997, S_1 selfed seed, S_1 bulk, S_1 open pollinated populations and S_0 original commercial "Giza 20 " cultivar were sown in a seed-bed.

In November1997, seedlings were transplanted in a randomized complete

block design with three replications. The plot size was 2×2 m. (1/1050 feddan). Each plot consisted of 8 rows 2 m. long. Transplants were spaced 7 cm. apart. Normal cultural practices of growing onion for bulb production were followed. Plants were pulled when about 75 percent of tops had fallen down. Data were recorded for the following character:

1st- Yield attributes :

- 1- Total yield all bulbs (t/fed.) .
- 2- Marketable yield (t/fed.) (exportable yield + bulbs large than 6 cm in diameter , free from culls) .

- 3- Exportable yield, (t/fed.) (bulbs 3-6 cm. in diameter, free from culls).
- 4- Culls yield, (t/fed.) (double + bolters + scallions + damaged bulbs).

B- Bulb quality :

1- Percentage of bulbs with a single growing points (in the markeable yield).

2- Percentage of single center bulbs (bulbs with more than one growing point within one center).

- 3- Percentage of internal doubling (bulbs with more contact centric growing centers within the complete scales).
- 4- Percentage of bulbs free from pink flesh .
- 5- Percentage of external doubles(split bulbs).
- 6- Percentage of bolters .

7- Average bulb weight (gm).

The differences in values of all studied characters were calculated for S_0 , S_1 selfing, S_1 bulk and S_1 open pollinated populations and statistically analyzed using the normal F-test and the means were compared using L.S.D.

1 - The coefficient of variability (c.v %) was also calculated (Snedecor and Cochran, 1967).

2 - The phenotypic and genotypic variances were calculated according to the following formula (Steel and Torrie, 1960)

$$\sigma^2$$
 ph = σ^2 g + σ^2 / r

$$\sigma^2 g = (M_2 - M_1) / r$$

where: r number of replications. σ^2 = error variance.

3- Expected genetic advance : calculated according to Miller's *et al.* Formula (1958) :

$$\Delta G = - \frac{\sigma^2 g}{\times K \sigma ph}$$

$$\sigma^2 ph$$

Where: K = the selection differential (2.66) which is the expectation in the case of 0.90 % intenisty of selection with S₀. σ^2 ph is the phenotypic standard deviation.

4 - The differences between predicted and realized genetic advance was Calculate according to Pesek and Baker, 1970.

$$D = \sqrt{\begin{array}{ccc} V & V \\ -- & + & -- \end{array}}$$

n₁

where: V is the estimate of the phenotypic variance of line (error mean square) , n_1 is the number of families in the base population and n_2 is the number of selected families.

n₂

RESULTS AND DISCUSSION

A - Quality characters of " Giza 20 " onion after one cycle of selection: -

Number, percentage and coefficient of variability (c.v %) of some quality characters of "Giza 20" cultivar of onion in the S_0 , S_1 selfing, S_1 bulk and S_1 open pollinated populations are presented in Table (1). It is clear that the percentage of bulbs with a single growing point and with a single center were highly significantly increased in the S_1 selfed population. They reached 6.25 % and 50.68 % respectively. Respective values were 0.58 % and 3.49 % in the original S_0 population.

Also, bulbs free from pink flesh colour was highly significantly increased after one cycle of selection. It was 49.57 % in the S_0 original population and reached 72.25 %, 80.34 % and 86.74 % in the S_1 open pollinated, S_1 bulk and S_1 selfed populations respectively.

Oppositely, internal and external doubles were significantly decreased by selection. Internal doubles were decreased from 86.24 % in the S_0 original population to 39.84 % in the S_1 selfed population. External doubles was 2.02 % in the S_1 bulk population and 7.95 % in the S_0 original (Table 1). Bolters were not significantly affected by selfing.

Average bulb weight was significantly decreased from 82.07 g in the S_0 original to 55.76 g in the S_1 selfed population (table1)

Results on coefficient of variability (c.v %) of the studied characters are presented in (Table1). Coefficient variability (c.v.%) decreased progressively in the S₁ selfed and S₁ bulk populations.

Results in Table (1) indicate that one cycle of selfing and selection was effective in improving quality characters of onion bulbs. These results were similarly obtained by Shalaby (1966) who found a relatively high heritability value for internal doubling. Moreover, results of Ahmed and Ahmed (1976), Sherif et al (1988) and Gamal (1994) indicated that percentage of single center bulbs was increased with one or two cycles of selection.

The efficiency of selection for improving some quality characters was measured as predicted and realized responses to selection (table 2). Calculations were made on the assumption of selection intensity 0.90 % in the S_0 original population .

The predicted and realized genetic advance in the three selected populations of some quality characters appear in (Table 2)

The differences were found to be significant in all selected populations for most of studied characters, i.e, bulbs with single growing point, bulbs with single center internal doubles, bulbs free from pink flesh and average bulb weight in the three selected populations. Means of single center bulbs was not significant in the S₁ open population.

The predicted responses were greater than realized for some studied characters, namely, single growing point, internal doubles and average bulb weight. Realized gain was greater than predicted in the bulbs free from pink flesh in all selected populations (Table 2).

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Charactera		Geno	L. \$.D			
Characters	So	S₁ sel	S₁bul	S₁ op	0.05*	0.01**
Single – growing point						
Means	1.00	10.19	10.12	6.34	2.21	3.34
Percentage	0.58	6.25	5.72	3.75	1.66	2.51
Coefficient of variability	15.41	3.65	3.81	4.71		
Single center bulbs						
Means	6.00	82.61	79.19	18.34	5.62	8.52
Percentage	3.49	50.68	44.74	10.85	2.94	4.46
Coefficient of variability	6.81	2.91	3.29	3.95		
Internal doublers						
Means	148.33	64.94	82.20	132.33	12.60	19.08
Percentage	86.24	39.84	46.44	78.30	2.98	4.52
Coefficient of variability	3.75	1.65	1.84	3.21		
Bulbs free from pink						
<u>flesh</u>						
Means	85.26	141.38	142.18	122.10	19.23	29.14
Percentage	49.57	86.74	80.34	72.25	7.25	10.98
Coefficient of variability	7.31	4.18	4.51	5.02		
External doubling						
Means	13.67	3.49	3.58	10.00	8.01	n.s
Percentage	7.95	2.14	2.02	5.92	1.99	n.s
Coefficient of variability	7.02	4.34	5.57	6.82		
Bolters						
Means	3.00	1.76	1.91	1.99	n.s	n.s
Percentage	1.74	1.08	1.08	1.18	n.s	n.s
Coefficient of variability	11.62	9.01	9.01	10.47		
Average bulb weight						
Means	82.07	55.76	59.38	64.47	7.79	11.80
Coefficient of variability	6.99	4.75	6.05	6.56		

Table1:Number, percentage and coefficient of variability of some quality characters in the original S_o, S₁ selfed, S₁ bulk and S₁ open populations for 1997 / 1998 season.

*, ** = Significant at 0.05 and 0.01 levels of probability.

N.S = Not Significant. S1sel = selfing. S1bul = bulk. S1op = open pollinated.

So = original population.

B - Bulb yield components: -

Data presented in (Table 3) show means and coefficients of variability (c.v%) of some

yield components of "Giza 20 " onion in the original S_0 , S_1 selfed, S_1 bulk and S_1 open populations.

Total yield was significantly decreased from 23.26 (t/f)in the S_0 original to 17.54 t/f in the S_1 selfed . This may be attributed to the decrease in bulb weight with inbreeding (Table 3). However, marketable and exportable yield were not significantly affected by selection. Culls yield was highly significantly decreased. It was 6.18 in the S_0 original 0.91 and 0.30 (t/f) in the S_1 selfed and S_1 bulk populations, respectively. The coefficients of variability of all studied yield components were decreased due to inbreeding (Table 3). These results are in agreement with those obtained by Mc Collum (1971), Sidhu et al (1988) and Gamal (1994) who found that it seems feasible to improve studied bulb characters in one or two cycles of selection .

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Characters		G	L. S.D							
	S。	S₁ sel	S₁ bul	S₁ op	0.05	0.01				
Total yield										
Means	23.26	17.54	18.03 8.36	20.40 9.46	3.41*	5.16**				
Coefficient of Variability	9.12	7.33								
Marketable yield			17.73 8.28	17.41 8.44						
Means	17.08	16.63			n.s	n.s				
Coefficient of Variability	8.65	8.13	14.93 5.25	16.25 5.52						
Exportable yield										
Means	15.71	15.37	0.30 5.11	2.99 6.03	n.s	n.s				
Coefficient of Variability	5.38	5.07								
Culls yield										
Means	6.18	0.91			1.11*	2.06**				
Coefficient of Variability	13.62	3 23								

Table 3: Effect of selfing on yield components (t/fed) in the "Giza 20" onion variety in the original (S_o) , S_1 selfed, S_1 bulk and S_1 open populations,1998season.

*, ** Significant at 0.05 and 0.01 levels of probability respectively.

N.S : not Significant.

The efficiency of selection for improving some yield components was measured as predicted and realized responses to selection (table 4). Calculation was made on the assumption of selection intensity depth of 0.90

% in the S_0 original. The differences between predicted and realized responses were significant in total and culls yields in the three selected populations (Table 4)

It is also noticed that the predicted responses were greater than the realized in total and culls yields in all selected populations.

Generally, it could be concluded that high quality bulbs i.e single growing point, single center bulbs, and bulbs free from pink flesh after one generation of selection could be gained.

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تأثير التلقيح الذاتي والانتخاب على بعض صفات صنف البصل جيزة20 عبد المنعم عباس جامع قسم بحوث البصل - معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية 0

أجري هذا البحث بمحطة البحوث الزراعية بجزيرة شندويل بسوهاج في الفترة من61996 الى 1998 لدراسة تأثير التلقيح الذاتي على بعض صفات البصل جيزة 20 0

في نوفمبر 1997 تم تقطيع حوالي 2000 بصله جيزة 20 لإنتخاب أبصال وحيدة البرعم و خالية من اللون القرمزي 0 زرعت المنتخبات تحت منعزل وأثناء التزهير تم التلقيح الذاتي لنورة من كل نبات كما أدخل تحت المنعزل نحل لتلقيح النورات تحت المنعزل (بلك) كما عرضت بعض النورات خارج المنعزل لتبقى مفتوحة التلقيح و في مايو 1997 جمعت بذور كل عشيرة مجمعة على حده و زرعت في تجربة مقارنه وكانت النتائج كما يلي : -

- زادت الأبصال وحيدة البرعم و كذا الأبصال ذات القمة الواحدة و الأبصال الخالية من اللون القرمزي في العشائر الثلاثة المنتخبة ()
- بينما نقصت نسبة الاذدواج الداخلي و الاذدواج الخارجي و معدل وزن البصلة ووزن الأبصال الكلية و كذا البصل النقضة في العشائر المنتخبة الثلاثة ()
 - الأبصال الحنبوط و القابلة للتصدير و القابلة للتسويق أظهرت فروق غير معنوية ولم نتأثر بالانتخاب 0
- الاستجابة المتوقعة للانتخاب كانت أعلى من الاستجابة الحقيقية بالنسبة لجميع الصفات المدروسة في العشائر الثلاثة المنتخبة ما عدا صفة الخلو من اللون القرمزي 0
- كانت الفروق بين الاستجابة الفعلية و المتوقعة معنوية لجميع الصفات المدروسة ما عدا صفات الازدواج الخارجي والحنبوط و القابلة للتصدير والقابل للتسويق في العشائر الثلاث المنتخبة .

Characters	Predicted			Realized			D		
	S ₁ sel	S₁ bul	S₁ op	S ₁ sel	S₁ bul	S₁ op	S ₁ sel	S₁ bul	S₁ op
Single – growing point									
Means	36.66	36.38	21.30	10.19	10.12	6.34	26.47*	26.26*	14.96*
Percentage	28.15	25.52	15.74	6.25	5.72	3.75	21.90*	19.80*	11.99*
Single center bulbs									
Means	114.75	109.66	18.53	82.61	79.19	18.34	32.14*	30.47*	0.19
Percentage	62.06	54.25	9.68	50.68	44.74	10.85	11.38*	9.51*	1.17*
Internal doubles									
Means	82.87	96.42	135.77	64.94	82.20	132.33	17.93*	14.22*	3.44*
Percentage	51.82	56.71	80.35	39.84	46.44	78.30	11.98*	10.27*	2.05*
Bulbs free from pink flesh									
Means	123.31	123.85	110.24	141.38	142.18	122.10	-18.07*	-18.33*	-11.86*
Percentage	73.81	69.63	64.36.	86.74	80.34	72.25	-12.93*	-10.71*	-7.89*
External doubles									
Means	5.79	5.86	10.83	3.49	3.58	10.00	2.30*	2.28*	0.88
Percentage	2.20	2.09	5.94	2.14	2.02	5.92	0.06	0.07	0.02
Bolters									
Means	1.80	1.94	2.02	1.76	1.91	1.99	0.04	0.03	0.03
Percentage	1.16	1.16	1.25	1.08	1.08	1.18	0.08	0.08	0.07
Average bulb weight									
Means gm.	59.64	62.73	67.47	55.76	59.38	64.47	3.88*	3.35*	2.59*

Table 2 : Predicted and realized genetic advance due to selection for some quality characters of " Giza 20 " onion in, S_1 selfed S_1 bulk and S_1 open populations.

D = the difference between predicted and realized responses.

* = Significant at 0.05 level of probability.

N.S = Not Significant.

J. Agric. Sci. Mansoura Univ., 25 (4), April, 2000.

Characters -	Predicted			Realized			D		
	S₁ sel	S₁ bul	S₁ op	S ₁ sel	S₁ bul	S₁ op	S ₁ sel	S₁ bul	S₁ op
- Total yield	18.50	18.91	20.88	17.54	18.03	20.40	0.96*	0.88*	0.48*
- Marketable yield	16.69	17.67	17.37	16.63	17.73	17.41	0.06	0.09	0.04
- Exportable yield	15.42	15.04	16.18	15.37	14.93	16.25	0.05	0.11	0.07
- Culls yield	2.82	2.43	4.14	0.91	0.30	2.99	1.91*	2.13*	1.15*

Table 4 : Predicted and realized genetic advance due to selfing for yield components in the " Giza 20 " onion in 1998 season.

D = the difference between predicted and realized responses.

* = Significant at 0.05 level of probability. N.S = not Significant.