

## **EFFECTS OF INBREEDING ON SOME GIZA 20 ONION BULB CHARACTERS.**

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### **ABSTRACT**

This work was carried out at Shandweel Experiment Station, Sohag, Gvernorate from 1998 to 2000 to investigate the effect of inbreeding on some onion bulb characters in the second generation ( $S_2$ ) of " Giza 20 " cultivar.

Percentage of single growing point and single center bulbs were increased by inbreeding in the second generation while, internal and external doubles, mean bulb weight, bolters and culls were decreased.

Predicted gain was more than realized for the single growing point and single center bulb characters while, realized gain was more than predicted in internal and external doubles, bolters, mean bulb weight and culls in  $S_2$  populations.

### **INTRODUCTION**

Onion (*Allium cepa*, L.) is one of the most important vegetable crops in Egypt. Exports to Europe were considerably decreased. Reasons for this include bulb quality. Internal doubling is an important bulb aspect.

Internal doubling in onions was found by Shalaby (1966) to be controlled by several genes and relatively high heritability.

Abd El-Hafez *et al.* (1976) studies carried out on 12 onion cultivars, show that Behairy had maximum growing points while, "Yellow Bermuda Ecell 986", "Texas Yellow Gerano" and "New Maxico Early Grano" had the in least.

Dowker and Fennall (1981) compared five open-pollinated populations with three inbreds of onion all descending from Rijnsburger at five localities. They found that all the open-pollinated populations gave higher yields than inbreds, while inbreds had less doubles than open pollinated populations.

Hanna (1987) tested 6 varieties of onion, namely, Giza 6 Mohassan, Giza 20, kerdasy (a local strain), Puss B.p.r.r., Bethalpha and Extra Early Yellow Bermuda for the number of growing points. The range was from 1.43 in "Kerdasy" onion to 1.83 in "Extra Early Yellow Bermuda".

Shalaby *et al.* (1991) reported that after two cycles of mass selection, onion bulb crop grown from sets was improved in single-center bulbs,

marketable and exportable yields, but internal, external doubling, bolters, weight of bulb, total and culls yields were significantly decreased.

Abd El-Rehim *et al.* (1996) found that "Giza 20" was significantly increased in bulbs with single growing points, single center bulbs, marketable and exportable yields, while internal and external doubling, bolters, average bulb weight, total and culls yields were decreased. Predicted gain due to selection was more than realized in all selected populations and for all studied characters.

## MATERIALS AND METHODS

This work was conducted at Shandweel Research Station with loam clay soil using the onion cultivar "Giza 20" .

In November 1998 (at the end of bulb storage period) out of S<sub>1</sub> massed "Giza 20" generation, 969 apparently single bulbs were halfway horizontally sectioned. Out of these only 54 bulbs with single growing point were selected, i.e., the intensity of selection was 5.57%. The 54 selected bulbs were planted under an isolation lumite cage and left to inter-pollinate using honey bee insects during flowering. One umbel from each plant was selfed. In May, 1999, selfed seeds were collected and mixed to produce full and half sibs. In September 1999, 2<sup>nd</sup> selection cycle full and half sibs along with S<sub>0</sub> commercial "Giza 20" were sown in a seed bed. In November 1999, seedlings were transplanted in randomized complete block design with four replications. Plot size was 2x3 m (1/700 faddan). Each plot consisted of 10 rows 3m long. Transplants were spaced 7 cm apart. Normal cultural practices of growing onion bulb crop were followed. Plants were pulled when about 75 percent of plant tops had fallen down. Results were recorded in April, 2000 for the following characters.

- Percentage of bulbs with a single growing point in marketable yield.
- Percentage of bulbs with a single center (bulbs with one center which contains one or more growing points).
- Percentage of internal doubles (bulbs with one or more centers).
- Percentage of external doubles and splits.
- Percentage of bolters.
- Mean bulb weight (gm).
- Total yield (t/f).
- Marketable yield (t/f).
- Exportable yield t/f (bulbs 3-6 cm in diameter and free from culls).
- Culls yield, i.e., doubles, bolters and scallions(t/f).

Data were statistically analysed using F-test. Means were compared using the L.S.D method and the coefficient of variability (c.v %) was calculated according to Snedecor and Cochran (1967). Expected genetic advance was calculated according to Miller (1958). The difference between expected and realized genetic advance was calculated according to Pesek and Baker (1970).

## RESULTS AND DISCUSSION

Mean percentage and coefficient of variability (c.v %) of some bulb characters of S<sub>0</sub> "Giza 20" original, full and half sibs are presented in Table (1) and Fig. (1). It is clear that the percentage of single growing point and single center bulbs were significantly increased. It reached 16.86% and 57.40% in the second cycle of selection, while, they were 0.33% and 3.21% in the S<sub>0</sub> original, respectively (Table 1).

Internal and external doubles, bolters and mean bulb weight were significantly decreased by inbreeding. Internal doubles were decreased from 89.57% in the S<sub>0</sub> original to 23.92% in the 2<sup>nd</sup> selection cycle population (Fig 1). External doubles were 5.21% in the S<sub>0</sub> original and reached 2.05% and 1.61% in full and half sibs, respectively. Bolters were decreased from 1.67% in the S<sub>0</sub> original population to 0.20% in the 2<sup>nd</sup> cycle. Bulb weight was 94.49 gm in S<sub>0</sub> original and reached 67.86 gm in the 2<sup>nd</sup> selection cycle (Table 1).

**Table 1: Mean percentage and coefficient of variability (c.v. %) for some bulb characters of "Giza 20" onion in the S<sub>0</sub> original, second cycle bulk and second cycle selfed populations.**

Characters		S <sub>0</sub> original	Pedigree		L.S.D	
			2 <sup>nd</sup> cycle bulk	2 <sup>nd</sup> cycle full & half sibs	0.05*	0.01**
Single growing point	Mean	1.25	41.75	62.75	16.11	24.48
	percentage	0.33	11.19	16.86	5.67	8.58
Coefficient of variability	(c.v. %)	16.19	7.84	5.22		
	Mean	12.00	192.21	214.10	54.00	81.80
Single center bulbs	percentage	3.21	51.53	57.40	14.09	21.34
	(c.v. %)	8.24	6.96	5.84		
Internal doubles	Mean	335.0	130.04	89.40	43.24	65.50
	percentage	89.57	34.88	23.92	12.47	18.89
Coefficient of variability	(c.v. %)	4.92	3.91	2.15		
	Mean	19.50	7.65	6.00	1.69	2.55
External doubles	percentage	5.21	2.05	1.61	2.21	N.S
	(c.v. %)	21.34	16.01	6.57		
Bolters	Mean	6.25	1.25	0.75	3.51	N.S
	percentage	1.67	0.34	0.20	0.98	N.S
Coefficient of variability	(c.v. %)	29.05	27.25	25.42		
	Mean	94.49	80.06	67.86	24.58	N.S
Bulb weight	Mean	94.49	80.06	67.86	24.58	N.S
	(c.v. %)	11.31	9.59	8.12		

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

N.S = Not significant.

The coefficient of variability (c.v %) for bulbs of S<sub>0</sub> original, full and half sibs, appear in Table (2) and Fig (2). It is clear that total, marketable and exportable yield were not significantly affected by inbreeding (Table 2). Culls were significantly decreased by inbreeding from 5.06 t/f in the S<sub>0</sub> original to 1.56 t/f in full sibs (Fig 2).

Results in Tables (1 and 2) show that the second inbreeding generation effectively improved some bulb characters and yield, i.e., single growing point, single center bulbs, internal, external doubles and culls. This result agree with those obtained by Hanna (1987), Dowker and Fennell

(1988), Shalaby *et al.* (1991) and Abd El-Rehim *et al.* (1996), who indicated increases in single center bulbs, bulbs with a single growing point, while internal and external doubles, total and culls yields were decreased.

The efficiency of inbreeding in improving some bulb characters and yield were measured as predicted and realized responses (Tables 3 and 4). Calculation were made on the assumption that selection of the superior 5.57% in the first generation bulb population was effective.

The differences between predicted and realized responses were significant in all bulb characters in the second generation, bulk and selfed populations, except for total, marketable and exportable yield which were not significant, Tables (3 and 4).

It is also noticed that the predicted responses due to inbreeding were greater than the realized in the single growing point and single center bulbs in full and half sibs.

This result was similarity to that of Abd El-Rhim *et al.* (1996) who showed that the predicted responses were greater than realized for most of all studied characters.

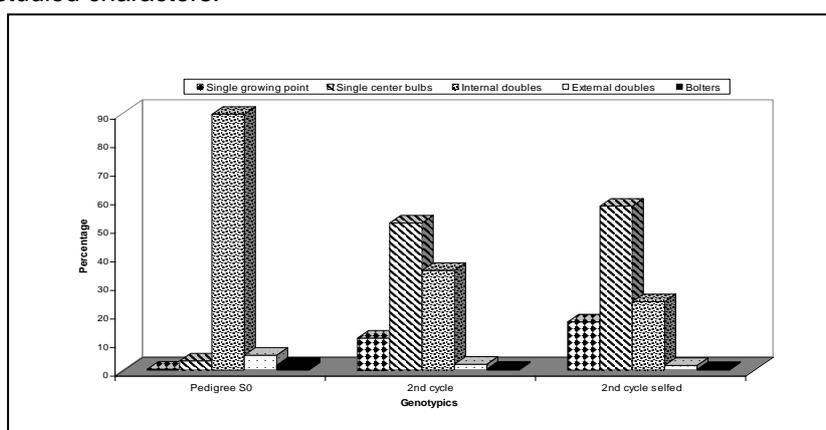


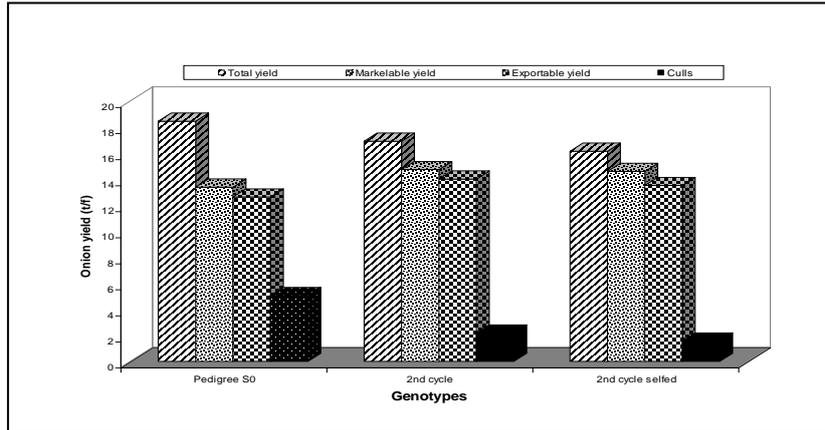
Fig. (1): Percentage on incidence of some onion bulb characters in the original S<sub>0</sub>, 2<sup>nd</sup> cycle bulk and 2<sup>nd</sup> cycle (full and half sibs) in the 1999/2000 season.

Table 2: Mean and coefficient of variability (c.v %) for bulbs yield of "Giza 20" onion in the S<sub>0</sub> original, second selection cycle, full and half sibs.

Characters		S <sub>0</sub> original	Pedigree		L.S.D	
			2 <sup>nd</sup> cycle bulk	2 <sup>nd</sup> cycle selfed	0.05*	0.01**
Total yield	Mean (t/f)	18.45	16.92	16.15	N.S	N.S
Coefficient of variability	(c.v. %)	14.84	13.85	13.63		
Marketable yield	Mean (t/f)	13.39	14.74	14.59	N.S	N.S
Coefficient of variability	(c.v. %)	16.21	16.04	15.36		
Exportable yield	Mean (t/f)	12.63	14.01	13.52	N.S	N.S
Coefficient of variability	(c.v. %)	16.13	15.03	14.91		
Culls bulb	Mean (t/f)	5.06	2.18	1.56	1.19*	1.80*
Coefficient of variability	(c.v %)	32.70	15.69	13.39		

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

N.S = Not significant.



**Fig. 2. Yield components in the S<sub>0</sub> (original), 2<sup>nd</sup> selection cycle , full and half sibs in 1999 and 2000.**

**Table 3: Predicted and realized genetic advance due to inbreeding for some bulb characters of "Giza 20" onion in second cycle full and half sibs**

Character		Predicted %		Realized %		D	
		2 <sup>nd</sup> cycle half sibs	2 <sup>nd</sup> cycle full sibs	2 <sup>nd</sup> cycle half sibs	2 <sup>nd</sup> cycle full sibs	2 <sup>nd</sup> cycle half sibs	2 <sup>nd</sup> cycle full sibs
Bulbs with a Single growing point	Mean	122.75	186.83	41.75	62.75	81.00*	124.1*
	%	32.90	50.09	11.19	16.86	21.72*	33.23*
Single center bulbs	Mean	263.03	295.00	192.21	214.10	70.82*	80.90*
	%	70.52	79.09	51.53	57.40	18.98*	21.69*
Internal doubles	Mean	88.12	60.56	130.04	89.40	-41.92*	-28.84*
	%	23.62	16.24	34.88	23.92	-11.26*	-7.68*
External doubles	Mean	5.52	3.91	7.65	6.00	-1.79*	-2.09*
	%	1.47	0.95	2.05	1.61	-0.57*	-0.66*
Bolters	Mean	0.09	-0.53	1.25	0.75	-1.16*	-1.28*
	%	0.04	-0.13	0.34	0.20	0.30*	-0.33*
Bulb weight	Mean gm	79.00	65.92	80.06	67.86	-1.06*	-1.94*

**D** = The difference between predicted and realized responses.

**\*** = Significant at 0.05 level of probability.

**N.S** = Not Significant.

**Table 4: Predicted and realized genetic advance due to inbreeding for bulbs yield of " Giza 20" onion in 2<sup>nd</sup> selection cycle full and half sibs in the 1999/2000.**

Character		Predicted %		Realized %		D	
		2 <sup>nd</sup> cycle half sibs	2 <sup>nd</sup> cycle full sibs	2 <sup>nd</sup> cycle half sibs	2 <sup>nd</sup> cycle full sibs	2 <sup>nd</sup> cycle half sibs	2 <sup>nd</sup> cycle full sibs
Total yield	Mean (t/f)	16.90	16.12	16.92	16.15	-0.02	-0.03
Marketable yield	Mean (t/f)	14.77	14.62	14.74	14.59	0.03	0.03
Exportable yield	Mean (t/f)	14.03	13.53	14.01	13.52	0.02	0.01
Culls	Mean (t/f)	1.87	1.19	2.18	1.56	-0.31*	-0.37*

**D** = The difference between predicted and realized responses.

**\*** = Significant at 0.05 level of probability.

**N.S** = Not Significant.

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تأثير التربية الذاتية على بعض الصفات في البصل جيزة ٢٠ .  
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قسم بحوث البصل - معهد المحاصيل الحقلية - مركز البحوث الزراعية

- أجرى هذا البحث بمحطة البحوث الزراعية بجزيرة شندويل - سوهاج - في الفترة من ١٩٩٨ حتى ٢٠٠٠م لدراسة تأثير التربية الذاتية على بعض صفات البصل جيزة ٢٠ حيث أخذت أبصال الجيل الأول ناتج التلقيح الذاتي وأنتجت أبصال وحيدة البرعم وأبصال وحيدة القمة بعد تقطيعها وأجرى لها تلقيح ذاتي كلاً على حده وأختبر نسلها حيث إتضح بالجيل الثاني ما يلي :
- زادت النسبة المئوية للأبصال وحيدة البرعم والأبصال ذات القمة الواحدة المحتوية على أكثر من برعم زيادة معنوية. كما نقصت النسبة المئوية للأبصال المزدوجة داخلياً ووزن البصلة والبصل النقصه في الجيل الثاني من التربية الذاتية.
  - لم يتأثر المحصول الكلي والقابل للتسويق و للتصدير والنسبة المئوية للحنبوط معنوياً بالتربية الذاتية.
  - الإستجابة المتوقعة للتربية الذاتية أعلى من الإستجابة الفعلية لصفتي الأبصال ذات البرعم الواحد والأبصال ذات القمة الواحدة في الجيل الثاني.
  - الفرق بين الإستجابة المتوقعة والفعلية كان معنوياً لكل الصفات تحت الدراسة ما عدا الصفات الكمية للمحصول في الجيل الثاني للبصل.