

Onion Varietal Test Under Libyan Conditions

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ABSTRACT

Twelve onion cultivars were tested at the Faculty of Agriculture, Tripoli during the period from 1976 to 1978. Cultivars tested included three Egyptian and eight American cultivars. The last cultivar was composite 10 that represent a hybrid between Egyptian and American cultivars. Cultivars were compared in respect to weight of marketable and total yields, average weight of single bulbs, and the percentage of total soluble solids. The highest marketable yield was produced by Texas Yellow Grano 502. Granex 33 was the next highest with respect to marketable yield. A lower marketable yield was given by the Egyptian and other American cultivars. Total yield showed a similar trend.

Bulb size as measured by bulb weight behaved in a parallel manner to weight of marketable yield. The largest bulb size was expressed by Texas Yellow Grano 502 and Granex 33, followed by San Joaquin and Excel. The cultivars were grouped according to maturity dates. Four cultivars, namely, Downing Yellow Globe, Rocket, Yellow Sweet Spanish L., and Autumn Spice were unadapted to Libyan conditions because some plants failed to form definite bulbs. They showed late maturity without the tops falling down, indicating the need for longer photoperiods.

Highly significant differences existed among cultivars in respect to percent total soluble solids. The Egyptian cultivars had the highest level of T.S.S. Texas Yellow Grano 502, Granex 33, San Joaquin, and Excel showed the lowest percentage of soluble solids. Composite 10 showed an intermediate T.S.S. According to percentage T.S.S., the cultivars were classified into three storage groups; good keeper, intermediate, and poor keeper cultivars. The various aspects of results and recommendations for onion production in Jamahiriya were discussed.

INTRODUCTION

Many studies were made in several countries to determine the performance of onion cultivars under the conditions of each country. Warid and Fallah (4) tested 14 cultivars from transplants at Tripoli. They reported that Ring Master, Sweet Spanish Red Globe, Sweet Spanish Yellow Globe were unadapted cultivars. Two Egyptian cultivars, namely, Behairy and Giza 6 and four American cultivars, namely, Dessex, Granex, Grano Ringer and Texas Grano 502 showed no difference in marketable yield under Tripoli conditions and were adapted to the region.

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Table 1 Name, source, and brief description for each of the cultivars under evaluation.

Cultivar	Source	Brief description ¹		
1. Behairy	Ministry of Agriculture, Egypt	O.	P. ²	, Medium Day
2. Giza Synthetic	Developed by Cairo University	O.	P.	, Medium Day
3. Giza 6 Mohassan	Imported from Egypt	O.	P.	, Short Day
4. Composite 10	Developed by the Ministry of Agriculture, Ebypt	O.	P.	, Short Day
5. Excel	Asgrow Seed Co.	O.	P.	, Short Day
6. Texas Yellow Grano 502.	Desert and Asgrow Seed Co.	O.	P.	, Short Day
7. Granex 33	Asgrow Seed Co.	F ₁	Hybrid,	Short Day
8. San Joaquin	Asgrow Seed Co.	O.	P.	, Medium Day
9. Downing Yellow Globe	Asgrow Seed Co.	O.	P.	, Long Day
10. Yellow Sweet Spanish L.	Asgrow Seed Co.	O.	P.	, Long Day
11. Autumn Spice	Asgrow Seed Co.	F ₁	Hybrid,	Long Day
12. Rocket	Asgrow Seed Co.	F ₁	Hybrid,	Long Day

¹ All cultivars have yellow scale colour.

² O P. = Open pollinated.

Warid *et al.* (5) studied the performance of the Egyptian and some American cultivars of onion under Egyptian conditions. They found that Golden, Yellow Granex, Dessex, Early Premium, and Y 28 gave higher marketable yield than Yellow Creole, Yellow Bermuda Excel 986 and Tropicana. Generally the two Egyptian cultivars Giza 6 Mohassan and Behairy occupied a middle position. El-Shafie *et al.* (1) found that Behairy cultivar gave more higher marketable and total yield than Giza 6 Mohassan in several locations.

According to Foskett and Peterson (2), onion cultivars having high dry matter content or high percentage of total soluble solids showed no sprouting during storage period. Positive correlation existed between storage ability and dry matter content or percent total soluble solids.

The objective of the present investigation was to study the performance of 12 onion cultivars under Tripoli conditions with respect to weight of marketable and total yields, average weight of single bulbs, and the percentage of total soluble solids.

MATERIALS AND METHODS

Onion cultivars were tested in a randomized complete block design with 4 replicates. The plot size was 1.8 × 4 meters and consisted of 5 rows. The planting distance was 30 cm between rows and 10 cm between plants within row. Plants were grown from transplants in two successive seasons, 1976–1977 and 1977–1978, at the farm of the Faculty of Agriculture, Alfateh University of Sidi El-Masri, Tripoli. The latitude for Tripoli is 35, 52°N. Ten cultivars were used in the first season, and in the second season two cultivars, namely, Giza 6 Mohassan and Composite 10 were added to the list of cultivars. Table 1 summarizes the name of the cultivars under study, sources, and brief description for each.

The dates of planting seed in the seed-bed, transplanting, and harvesting were as follows:

	1976-1977	1977-1978
Planting date of seed	18/10/1976	2/10/1977
Transplanting date	26/2/1977	1/2/1978
Harvesting dates	19-21/6/1977	20-21/6/1978
	1/7/1977	5/7/1978

Fertilization and irrigation were applied as commonly practiced.

At harvest, number and weight of singles, off-coloured bulbs, doubles, and bolters were taken. The yield is expressed here in two forms: total and marketable yield. The marketable yield consisted only of single bulbs. The total yield contained single bulbs and culls that include off-coloured bulbs, doubles, and bolters, i.e. scape-developing plants.

Data of marketable and total yield were statistically analyzed by the covariance method. Average weight of single bulbs, as a measure of bulb size, was calculated by dividing the weight of single bulbs by their number. Means were compared according to Duncan multiple range test.

At the end of the season, time of maturity, i.e. date at which 50% or more of the tops fall down, was recorded.

In the 1977-1978 season, three bulbs of medium size were taken from each replicate. For the extracted juice from each bulb, percentage of total soluble solids was determined using a hand refractometer. The readings were taken in the first week of September, 1978. Means were compared according to Duncan multiple range test.

RESULTS AND DISCUSSION

Tables 2 and 3 show the means of marketable and total yield given by the cultivars under evaluation in 1976-1977 and 1977-1978 seasons, respectively. For both marketable and total yield mean yield in kilograms per plot, adjusted mean yield in kilograms per plot, and adjusted mean yield in tons per hectare were tabulated. In 1976-1977 season, the highest yield of marketable bulbs was produced by Texas Yellow Grano 502 and followed by Granex 33. The average yield per hectare was 28.874 and 22.792 tons, respectively. The difference in yield between these two cultivars was significant. These two cultivars were followed by San Joaquin and Excel that were characterized by intermediate yield. The average yield per hectare of San Joaquin was 16.600 tons and that of Excel 13.791 tons. The difference between them was not significant. The lowest yield was produced by Behairy, Autumn Spice, and Downing Yellow Globe with no significant differences between them. The average yield per hectare for these cultivars were 9.857, 8.951, and 7.528 tons, respectively. The cultivars: Rocket, Yellow Sweet Spanish, Autumn Spice, and Downing Yellow Globe showed low yield because bulbing of these cultivars requires a longer photoperiod than that available under Tripoli conditions. Total yield in 1976-1977 season showed a similar trend. The difference between marketable and total yield, i.e. culls, was larger in the two Egyptian cultivars as compared with that of the American cultivars. The latter group showed closer marketable and total yields because of less doubles and red bulbs. The population in 1976-1977 season was 240, 694 plants per hectare.

In 1977-1978 season, the highest yield of marketable bulbs was produced by Granex 33 and Texas Yellow Grano 502 with no significant difference between them. (Table 3)

Table 2 Means of marketable and total yield of bulbs of several onion cultivars under Tripoli conditions in 1976-1977.

Cultivar	Marketable yield			Total yield		
	Mean yield kgs/plot	Adj. mean yield kgs/plot	Adj. mean yield tons/hectare	Mean yield kgs/plot	Adj. mean yield kgs/plot	Adj. mean yield tons/hectare
Behairy	7.202	7.097	9.857	9.255	9.145	12.701
Giza Synthetic	8.440	8.418	11.692	8.673	8.650	12.014
T.Y.G. 502	21.170	20.789	28.874	21.260	20.862	28.975
Rocket	7.740	7.718	10.719	7.751	7.728	10.733
Granex 33	17.370	16.410	22.792	17.411	16.408	22.789
Aut. Spice	4.895	6.445	8.951	4.913	6.533	9.074
Y.S.S.L.	8.785	7.577	10.524	8.785	7.522	10.447
Excel	8.380	9.930	13.791	8.380	10.000	13.889
D.Y.G.	4.642	5.420	7.528	4.655	5.468	7.594
San Joaquin	13.132	11.952	16.600	13.148	11.914	16.547
L.S.D. (0.05)	—	2.385	3.312	—	2.278	3.164
C.V. %			15.54			14.49
Population/ hectare			240,694			240,694

Table 3 Means of marketable and total yield of bulbs of several onion cultivars under Tripoli conditions in 1977-1978.

Cultivar	Marketable yield			Total yield		
	Mean yield kgs/plot	Adj. mean yield kgs/plot	Adj. mean yield tons/hectare	Mean yield kgs/plot	Adj. mean yield kgs/plot	Adj. mean yield tons/hectare
Behairy	17.742	17.109	23.762	22.010	21.309	29.596
Giza Synthetic	18.070	17.837	24.773	20.148	19.890	27.625
Giza 6 M	11.080	14.131	19.626	11.485	14.862	20.642
T.Y.G. 502	37.420	36.555	50.770	37.470	36.513	50.712
Rocket	17.800	17.672	24.544	17.918	17.776	24.689
Granex 33	40.422	39.747	55.204	40.902	40.155	55.771
Aut. Spice	13.725	13.744	19.089	13.798	13.819	19.193
Y.S.S.L.	26.462	26.271	36.487	26.565	26.353	36.601
Excel	30.380	30.252	42.017	30.380	30.238	41.997
D.Y.G.	15.650	16.322	22.669	15.838	16.582	23.031
San Joaquin	33.495	32.799	45.554	33.558	32.787	45.537
Composite 10	14.367	14.176	19.689	14.367	14.157	19.662
L.S.D.(.05)	—	5.357	7.441	—	6.047	8.397
C.V. %			15.13			15.09
Population/ hectare			259.693			259.693

The average yield per hectare was 55.204 and 50.770 tons, respectively. These two cultivars were followed by San Joaquin, Excel, and Yellow Sweet Spanish with an average of 45.554, 42.017 and 36.487 tons per hectare, respectively. Other cultivars produced significantly lower yield. These cultivars included Giza Synthetic, Rocket, Behairy, Downing Yellow Globe, Composite 10, Giza 6 Mohassan, and Autumn Spice with an average of 24.773, 24.544, 23.762, 22.669, 19.689, 19.626, and 19.089 tons per hectare. The differences between the latter group of cultivars were not significant. Total yield in 1977-1978 season showed a similar situation, with the three Egyptian cultivars showing more culls than the American cultivars. Composite 10 that represent a hybrid between American and Egyptian cultivars showed no culls. In the 1977-1978 season the population was 259, 693 plants per hectare.

Table 4 shows the average weight of single bulbs in the two growing seasons. It can

Table 4 Average weight, in grams, of single bulbs, of several onion cultivars, in 1976-1977 and 1977-1978 seasons under Tripoli conditions.

1976-1977		1977-1978	
Cultivar	Av. weight grs.	Cultivar	Av. weight grs.
Downing Y.G.	27.63 e	Giza 6 M	72.85 f
A. Spice	30.23 e	A. Spice	73.73 f
Rocket	45.16 d	Composite 10	76.00 f
Y.S.S.L.	47.67 d	Downing Y G.	88.86 ef
Giza Synthetic	49.66 d	Rocket	94.47 ef
Behairy	51.78 d	Giza Synthetic	101.60 e
Excel	52.88 d	Behairy	110.62 e
San Joaquin	71.65 c	Y.S.S.L.	141.50 d
Granex 33	95.13 b	Excel	160.18 cd
T.Y.G. 502	119.64 a	San Joaquin	171.55 bc
		T.Y.G. 502	190.05 ab
		Granex 33	208.86 a
F	39.244**	F	28.846**

Means followed by the same letter are not significantly different from each other at 5% level of significance.

Table 5 Classification of onion cultivars under evaluation according to degree of maturity under Tripoli conditions.

Degree of maturity	Approximate time of maturity	Cultivars
1. Very early	Middle of May	Composite 10
2. Early	End of May and the first two weeks of June	T.Y.G. 502
		Granex 33
		Excel
		Giza 6 M
3. Intermediate	Second two weeks of June	San Joaquin
		Behairy
		Giza Synthetic
4. Late	July	Rocket
	Tops do not fall down	Y.S.S.L.
	Some plants fall to bulb	Autumn Spice
	Thick neck	Downing Y.G.

be seen that in both seasons, bulb size as measured by bulb weight is almost parallel to weight of marketable yield. In both seasons, the largest bulb size was given by Texas Yellow Grano 502 and Granex 33, then followed by San Joaquin and Excel. Other cultivars showed lower bulb size.

Maturity dates in both growing seasons were recorded. Cultivars under evaluation can be grouped under four groups: very early, early, intermediate, and late as shown in Table 5.

Bolters or percent of plants that develop seedstalk was very small and can be neglected. Bolting was found only in Behairy cultivar in 1976-1977 season and only in Rocket and Yellow Sweet Spanish L. in 1977-1978 season. Bolting averaged 0.17, 0.14, and 0.14 in the three cultivars, respectively.

Table 6 shows means of percent total soluble solids for the cultivars under evaluation. Highly significant differences existed among cultivars with respect to percentage of total soluble solids. Behairy, Giza Synthetic, and Giza 6 Mohassan had the highest level of soluble solids. There were no significant differences among these three cultivars. Texas Yellow Grano 502, Granex 33, San Joaquin, and Excel showed the lowest percent of soluble solids. There were no significant differences among these four cultivars. Composite 10 showed intermediate percentage of soluble solids that averaged 9.28. It was significantly different from the means of the three cultivars of the highest group and from the means of the four cultivars of the lowest group. The means of the four unadapted cultivars occupied a position between the intermediate cultivar, i.e. Composite 10, and the cultivars that showed the highest percent of soluble solids.

In both seasons 1976-1977 and 1977-1978, there were highly significant differences among cultivars with respect to marketable yield, total yield, and bulb size. These three characters showed higher values in 1977-1978 season than in 1976-1977 season. This can be attributed to fluctuations in environmental conditions. In addition, plants of onion were intercropped with olive trees in 1976-1977 season and planted as a single crop in the second growing season, i.e. 1977-1978. Population of plants per hectare was larger in the second season because of better stand.

The parallelism between yield and bulb size in both season was clear. This agreed

Table 6 Average percentage of total soluble solids for the cultivars under evaluation.

Cultivars	Range	Mean %
Behairy	12.0-15.5	13.78 a
G. Synthetic	12.5-14.5	13.67 a
G. 6 M	12.0-15.0	13.39 ab
Rocket	10.0-13.5	12.45 bc
A. Spice	10.0-14.0	12.22 c
D.Y.G.	10.0-13.5	11.56 c
Y.S.S.L.	8.5-12.0	9.55 d
Composite 10	8.0-12.0	9.28 d
Excel	8.0-8.5	8.22 e
San Joaquin	7.5-9.0	8.17 e
Granex 33	7.0-8.0	7.61 e
T.Y.G. 502	7.0-8.0	7.44 e
F		49.323**

Means followed by the same letter are not significantly different from each other at 5% level of significance.

with Warid and Fallah (4). They reported that a degree of association existed between marketable yield and bulb size since the correlation coefficient was significant, $r = +0.512$.

The absence of bolters in almost all cultivars tested may be due to lateness in transplanting date since it was in February in both growing seasons. Warid and Fallah (4) reported that bolting averaged 0.1–0.3% in Behairy and Giza 6 and 5.3–17% in the American cultivars. This higher percent of bolting can be attributed to earlier planting date since they mentioned that transplanting in their experiment was in late November or early December. The plants may get larger so that exposure to low temperature during winter may induce bolting. In the present study plants were transplanted in February after the plants reached the suitable size for transplanting so that small plants were overwintered and almost there was no bolting.

In both seasons, the Egyptian cultivars, namely, Giza 6 Mohassan, Behairy, and Giza Synthetic showed significantly lower marketable yield than that given by the American cultivars Texas Yellow Grano 502 and Grenex 33. This result was different from that reported by Warid and Fallah (4). They reported that Giza 6, Behairy, Dessex, Granex, Grano Ringer, and Texas Grano 502 showed no difference in marketable yield in two growing seasons at Tripoli. This discrepancy may be attributed to different planting dates. In the present study Composite 10 cultivar which is a hybrid between Egyptian and American cultivars showed no significant difference in marketable yield when compared with that given by the Egyptian cultivars.

If comparisons between marketable and total yield of the different cultivars under evaluation are made in both seasons, we will find that culls that represent the difference between marketable and total yield is largest in Behairy, followed by Giza Synthetic and Giza 6 Mohassan. Culls were low in Composite 10 and the American cultivars. Giza 6 Mohassan and Giza Synthetic showed lower culls than Behairy because they received more attention from onion breeders than Behairy.

Refractometer readings can be used to select bulbs characterized by high dry matter content, and in turn can be used as a guide for selection to improve keeping quality and to improve cultivars that are used for dehydration, Mann and Hoyle (3). Good keeping quality is a function of a high percentage of soluble solids and a high dry matter content. Cultivars under evaluation can be classified into three storage groups as follows: good keeper cultivars-Behairy, Giza Synthetic, Giza 6 Mohassan; intermediate cultivars-Composite 10; poor keeper cultivars-Excel, San Toaquin, Granex 33, Texas Yellow Grano 502. The good keeper cultivars are of Egyptian origin and had the highest level of soluble solids. They can be stored successfully during summer and stand rough handling and long distance shipment. Intermediate cultivar, i.e. Composite 10, was developed by the Ministry of Agriculture, in Egypt, after hybridization between Egyptian and American cultivars. Composite 10 combined some of the good keeping qualities of the Egyptian cultivars and better bulb characteristics of the American cultivars, e.g. thin neck, globe shape and small stem. It was the earliest of all cultivars tested in the present work. The poor keeper cultivars, although gave the highest yield, possessed a low percentage of total soluble solids. But the mild flavour of their bulbs makes them generally acceptable to human taste as fresh onion. The four unadapted cultivars showed lower total soluble solids than the Egyptian cultivars and should not be recommended because they need more light requirements.

As to onion growing in Jamahiriya and considering all factors, it is suggested that a proportion of the area devoted for onion production should be planted with Texax Yellow Grano 502 and Granex 33 because of their high yield and to be consumed

directly in the first two to three months of the season. The other proportion of the area should be planted with the Egyptian cultivars and to be consumed later in the season. These Egyptian cultivars gave lower yield than that of Texas Yellow Grano 502 and Granex 33 but their good keeping is a desirable trait. The higher price later in the season will compensate for the reduction in yield.

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تقييم لأصناف البصل تحت الظروف الليبية

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المستخلص

تمت مقارنة اثني عشر صنفا مختلفا من البصل في مزرعة كلية الزراعة جامعة الفاتح في الموسمين الزراعيين ١٩٧٧-٧٦ م و ٧٧-١٩٧٨ م. واشتملت الأصناف على ثلاثة أصناف مصرية وثمانية أصناف أمريكية وصنف آخر هجين بين الأصناف الأمريكية والمصرية. وقد قورنت هذه الأصناف من حيث كمية المحصول الصالح للتسويق والمحصول الكلي ومتوسط وزن البصلة المفرد وتاريخ النضج ونسبة المواد الصلبة الذائبة الكلية. ويمكن تلخيص النتائج فيما يأتي :

١ — محصول الصالح للتسويق والمحصول الكلي : كانت هناك فروق جوهرية بين الأصناف المختلفة حيث أعطى الصنف تكساس يلوجرانو ٥٠٢ أعلى محصول صالح للتسويق ثم تلاه الهجين جرانكس ٣٣ وأعطت الأصناف المصرية وبقية الأصناف الأمريكية محصولا صالحا للتسويق أقل . هذا وكانت نتائج المحصول الكلي مماثلة في اتجاهها للمحصول الصالح للتسويق .

٢ — متوسط وزن البصلة المفرد : أعطى الصنف تكساس يلوجرانو ٥٠٢ أعلى متوسط لوزن البصلة المفرد ثم تلاه الهجين جرانكس ٣٣ وسان واكبير واكسل واتضح من النتائج أن متوسط وزن البصلة المفرد سلك سلوكا موازيا لوزن محصول الصالح للتسويق .

٣ — تاريخ النضج : قسمت الأصناف تحت الاختبار إلى أربع مجموعات : مبكرة جدا ، مبكرة ، ومتوسطة ، ومتأخرة النضج ، وقد أوضحت المجموعة الأخيرة عدم تأقلم للظروف الليبية لأن بعض نباتاتها لم تكون أبصالا محددة وعدم رقاد عروشها وذلك نظرا لاحتياجها لفترات ضوئية أطول من المتوفرة تحت ظروف طرابلس .

٤ — نسبة المواد الصلبة الذائبة الكلية : وجدت فروق مؤكدة بين الأصناف وتبعاً لذلك قسمت الأصناف إلى ثلاث مجاميع : جيدة التخزين (الأصناف المصرية) ، وسط (الصنف التركي ١٠) ووردية التخزين (تكساس يلوجرانو ٥٠٢ وجرانكس ٣٣ وسان واكبين واكسل) وذلك نظراً لوجود ارتباط موجب بين المقدرة على التخزين ونسبة المواد الصلبة الذائبة الكلية .

وتمت مناقشة النتائج والتوصيات الواجب مراعاتها بالنسبة لإنتاج البصل في الجماهيرية العربية الليبية الشعبية الاشتراكية .