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Impact of Cultivars and Planting Dates on Yield of Onion Bulbs

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ABSTRACT

Two promising onion cultivars, namely; Texas Yellow Grano 502 and Giza Synthetic cultivars were planted in two years at three planting dates from late September to early December. Early planting in September produced the highest yield and the largest weight per bulb. In the combined analysis, the average yield was 38.663, 22.133, and 11.692 tons per hectare and the mean bulb weight was 130.56, 74.58, and 38.27 g in the early, medium, and late planting dates, respectively. Texas Yellow Grano 502 produced a higher yield than Giza Synthetic. The average yield ranged from 27.552 to 31.530 tons/ha for the former and 17.563 to 20.007 tons/ha for the latter. The combined analysis showed that cultivar X planting date and planting date X year interactions were significant.

INTRODUCTION

Several studies on the relationship between yield of onion bulbs and date of planting were reported from different parts of the world. In the Ukraine, Usik and Batsei (12) showed that planting in mid-November produced 26% higher yields than in mid-April. Early studies in Bulgaria by Petkov *et al.* (9) indicated that higher yield was obtained from February and March plantings relative to September and November. Recent studies by Minkov and Todorov (7) showed that yields declined as sowing was delayed from March to April. Vik (13) found that transplanting on April 20, advanced maturity by 10 days compared to May 9. In India, Singh and Singh (10) planted onion during the period from October to January. Early sowing favoured leaf, root, and bulb growth, and gave the highest yield. Joshi *et al.* (6) transplanted onion seedlings from November to January. The highest yield was obtained from November transplants. Yield decreased with the delay in transplanting. Extensive experiments were conducted in U.S.A., where onion cultivars were seeded at different dates. In Illinois, Hopen and Peterson (4) found that late sowings gave the highest yield in 2 years, but in the third year yield was highest from early sowings. In Texas, Fuqua and Howell (3) showed that with autumn seeding the optimum date was the last week in September. In Egypt, Moursi *et al.* (8) investigated the effect of planting from August to October. The yield decreased in September and October plantings.

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Texas Yellow Grano 502 and Giza Synthetic cultivars were used in the present investigation since they were among the most promising cultivars in the Libyan Jamahiriya (1, 14). A suitable planting date of onion is not well documented. Thus, a knowledge on the performance of these two cultivars at three planting dates was urgent. This would be necessary to reveal the proper time for planting onion in Tripoli area.

MATERIALS AND METHODS

A split plot experiment with four replications was conducted at the University Research Farm in Tripoli, in the two successive seasons 1976–1977 and 1977–1978. The two cultivars, namely, Texas Yellow Grano 502 and Giza Synthetic were allotted to the main plots. Plants were grown from transplants that were raised in a seedbed. The sowing and transplanting dates and the seedlings age at transplanting during the two seasons were as follows:

	1976–1977			1977–1978		
Planting date	Seeding	Trans-planting	Age of seedlings, days	Seeding	Trans-planting	Age of seedlings days
First	Sept. 21	Feb. 3	135	Oct. 2	Feb. 4	125
Second	Oct. 18	Feb. 26	131	Nov. 2	March 5	123
Third	Dec. 8	March 21	103	Dec. 3	April 1	119

The three planting dates occupied the subplots. Plot size was 6 m^2 and consisted of 5 rows 4 meters long and 30 cms apart, and 10 cms between plants. Fertilization and irrigation were applied as commonly practiced.

Late in the growing season, maturity dates, i.e. date at which 50% or more of the tops fall down, were recorded.

The number and weight of singles, doubles, and off-coloured bulbs were recorded at harvest. Yield is expressed as marketable yield which consists only of single bulbs. Data were analysed by the analysis of variance with covariance adjustment on plant population.

The weight of single bulb, as a measure of size, was determined by dividing weight of single bulbs by their number. Data were analysed by the analysis of variance.

Yield data and weight of single bulb from the two years were combined into an overall analysis of variance.

RESULTS AND DISCUSSION

Yield

The first, second, and third planting dates referred to seeding from late September to early October, from late October to early November, and in early December, respectively. The period elapsed between planting dates was approximately one month. Mean monthly temperature and range of photoperiod in Tripoli area are shown in Table 6. Seedlings were transplanted as soon as they reached the proper size. This coincided with an age which ranged from 103 to 135 days. The difference in seedling

Table 1 Yield of onion bulbs as affected by two cultivars grown in 1976–1977 and 1977–1978 seasons.

Years	Adjusted mean yield of cultivar		
	Texas Yellow Grano T/ha	Giza Synthetic T/ha	F
1976–1977	31.530	20.007	26.011*
1977–1978	27.552	17.563	20.393*
Combined Analysis			
Cultivars	30.313	18.013	44.842**
	1976–1977	1977–1978	
Years	27.155	21.170	9.315*
CXY	—	—	0.055 NS

age was attributed to the apparent cessation of seedling growth during the very cold months from December, January to February. Low temperatures prevailed and averaged 14.0, 12.6, and 13.6°C, respectively.

The effect of cultivars on the yield of bulbs is presented in Table 1. Significant differences in yield between cultivars were found in each year. The combined analysis showed highly significant differences between cultivars. Texas Yellow Grano 502 gave a higher yield than Giza Synthetic. The average yield ranged from 27.552 to 31.530 tons/ha for the former and 17.563 to 20.007 tons/ha for the latter. The effect of year was significant. A higher yield was produced in 1976–1977 than in 1977–1978. The interaction between cultivars and years was not significant.

As to the effect of planting date, there were highly significant differences in each year (Table 2). The highest yield was obtained from the first planting date. In the combined analysis, the yield was significantly affected by planting date. In the combined analysis, the yield was significantly affected by planting date, and years X planting dates interaction. There was a decrease in yield by lateness in planting from September to

Table 2 Yield of onion bulbs as affected by three planting dates of cultivars grown in 1976–1977 and 1977–1978 seasons.

Planting date	Adjusted mean yield in year		
	1976–1977 T/ha	1977–1978 T/ha	Mean T/ha
First	42.260	35.865	
Second	25.913	15.932	
Third	9.133	15.875	
F	47.178**	44.493**	
L.S.D. (0.05)	6.363	4.983	
Combined analysis			
First	42.868	34.460	38.663
Second	26.627	17.640	22.133
Third	9.223	14.160	11.692
F	5.632*		93.005**
L.S.D. (0.05) for	planting dates =		3.770
	2 PD in 1 year =		5.333
	2 years at 1 PD =		5.935

Table 3 Yield of onion bulbs as affected by cultivar X planting date in 1976–1977 and 1977–1978 seasons.

Planting date	Adjusted mean yield of cultivar			
	Texas Yellow Grano T/ha			Giza Synthetic T/ha
1977–1978				
First	47.617			24.115
Second	21.367			10.495
Third	20.790			10.962
F		5.239*		
L.S.D. (0.05) for: 2 PD for 1 cultivar			=	7.047
2 C at 1 PD			=	8.655
Combined analysis				
First	48.403			28.923
Second	27.502			16.765
Third	15.407			7.978
F		5.541*		
L.S.D. (0.05) for: 2 PD for 1 cultivar			=	5.333
2 C at 1 PD			=	5.935

December. The average yield was 38.663, 22.133, and 11.692 tons per hectare in the first, second, and third planting dates, respectively. The interaction between planting dates and years excerted significant differences on yield. The yield in the first planting date (September) proved its superiority relative to the other dates.

The interaction between cultivars and planting dates significantly affected the yield of bulbs in 1977–1978, but was not significant in the preceeding year (Table 3). The combined analysis however, showed that the effect of this interaction was significant. Data for one cultivar planted at various dates indicated that the yield of Texas Yellow Grano 502 was highest, with an average of 48.403 tons per hectare, in the first planting, and lowest with an average of 15.407 tons per hectare in the third planting. The same trend was found to Giza Synthetic that yielded 28.923 and 7.978 tons per hectare in the first and third planting dates, respectively. When the two cultivars were compared at the same planting date results showed that Texas Yellow Grano 502 out-yielded Giza Synthetic at each date.

The coefficient of variation for cultivars ranged from 17.92 to 26.30%, whereas that of planting dates had a range from 20.07 to 22.44%.

Our results agree in general with the findings of El-Murabaa *et al.* (2) who worked under Tripoli conditions.

Weight of single bulb

Data on the effect of planting date on this trait are presented in Table 4. Significant differences in bulb weight existed due to the effect of cultivar and planting date. This was true in each year. The combined analysis showed significant differences between cultivars. The bulb of Texas Yellow Grano 502 was greater in weight than that of Giza Synthetic. The average bulb weight was 99.77 g for the former, and 62.50 g for the latter cultivar. Significant differences existed between planting dates. The highest weight was produced at the first planting date. Bulb weight was also affected by cultivar X planting

Table 4 Effect of planting date of two onion cultivars on single bulb weight, g, during 1976–1977 and 1977–1978 seasons.

Cultivar	1976–1977 Planting date			Mean	1977–1978 Planting date			Mean	Combined analysis Planting date			Mean
	First	Second	Third		First	Second	Third		First	Second	Third	
Texas Yellow Grano	169.53	106.07	30.39	101.99	149.69	76.85	66.14	97.56	159.61	91.46	48.26	99.77
Giza Synthetic	118.25	72.44	18.63	70.1	84.07	42.99	37.94	55.00	101.52	57.71	28.28	62.50
Mean	144.25	89.25	24.51		116.88	59.92	52.04		130.56	74.58	38.27	
Cultivars:												
F				13.72*				18.79*				27.81**
LSD 0.05				27.46				31.23				15.39
Planting dates:												
F	111.08**					46.38**				22.22**		
LSD 0.05	17.52					16.00				11.24		
CX planting date:												
F	N.S.					N.S.				6.27**		
LSD 0.05												
2 C at 1 Pl.D										25.64		
2 Pl.D. for 1 C										15.89		
				Year X planting date:								
				F						17.55**		
				LSD 0.05								
				2 PD in 1 year						15.89		
				2 years at 1 Pl. D.						25.64		

Table 5 Date of maturity in 1976–1977 and 1977–1978 seasons, and for the two seasons combined: days from transplanting to maturity, extra days of growth as compared with third planting date, yield, gain per day after standardization, and actual gain per day.

Planting	Texas Yellow Grano 502							Giza Synthetic						
	Date of maturity	Days from trans. to mat.	Extra days of growth	Yield T/ha	Contr. of planting date	Gain per day	Actual gain per day T/ha	Date of mat.	Days from trans. to mat.	Extra days of growth	Yield T/ha	Contr. of planting date	Gain per day	Actual gain per day T/ha
Third	June 15, 22	84	0	15.407	16.87	0.00	0.00	June 22, 30	92	0	7.978	14.87	0.00	0.00
Second	June 9, 11	101	17	27.502	30.12	0.78	0.711	June 22, 24	113	21	16.765	31.24	0.78	0.418
First	May 28, June 1	116	32	48.403	53.01	1.13	1.031	June 17, 22	136	44	28.923	53.89	0.89	0.476

date and year X planting date interactions. For each cultivar, the weight of bulb was larger at the first planting date than at other plantings. When the two cultivars were compared at a specific planting date only the first planting date produced a greater bulb weight than other plantings. In regard to year X planting date interaction there was a decrease in single bulb weight by lateness in planting. This tendency was pronounced in 1976–1977 season.

The coefficient of variation of single bulb weight ranged from 24.58 to 31.52% and from 18.70 to 19.26% for cultivars and planting dates, respectively.

The average date of maturity for 1976–1977 and 1977–1978 seasons and number of days from transplanting to maturity for the two seasons combined are given in Table 5. Plants of each cultivar reached maturity within one to three weeks regardless of time of planting because they started bulbing at the same time with the onset of the minimum photoperiod. Plants of each cultivar in each planting date matured within one week when the two seasons were compared. Evidently, Texas Yellow Grano 502 showed some earliness as compared with Giza Synthetic. If the third planting date was taken as a standard, then as the planting date became earlier, from third to second date, the gain per day for Texas Yellow Grano 502 was 0.78 and the actual gain was 0.711 tons per hectare per day. As planting date moved from the third to the first date, the gain per day was larger being 1.13, and the actual gain per day was 1.031 tons per hectare. This trend for Texas Yellow Grano 502 deviates to some extent from that of Giza Synthetic where the actual gain in yield per day was 0.476 and 0.418 tons/ha for the early and intermediate plantings, respectively.

Early studies by Thompson and Smith (11) showed that bulbing in onion is determined by the interaction of day length and temperature. Bulbing occurs when minimum photoperiod and temperature requirements are met. If the plants at bulbing are of small size, low yield results because of the formation of small mature bulbs. According to Jones and Mann (5), when plants begin to bulb, the formation of new leaves and roots almost cease and the entire plant enter into a state of rest. Subsequently the growth of bulb depends on the leaves already present when bulbing commences.

The two cultivars used in the present study are short day cultivars. Texas Yellow Grano 502 was slightly earlier than Giza Synthetic. This may be attributed to relatively longer minimum photoperiod required for bulbing of the latter. Variation in maturity

Table 6 Mean temperature °C, and range of photoperiod, hr, for Tripoli area.

Month	Mean temperature °C	Range of photoperiod hr
January	12.6	10.13–10.40
February	13.6	10.45–11.32
March	15.5	11.37–12.33
April	18.3	12.41–13.32
May	20.9	13.37–14.15
June	24.3	14.18–14.29
July	25.9	14.27–14.03
August	26.6	13.57–13.11
September	25.7	13.04–12.09
October	22.6	12.02–11.07
November	18.2	11.01–10.23
December	14.0	10.20–10.11

date from year to year of a given cultivar may be attributed to temperature. Maturity will be delayed if low temperature prevails. If temperature exceeds the minimum, the bulbing process will be more rapid and maturity is hastened. Following the recorded monthly photoperiod and temperature (Table 6), it was evident that the two cultivars under study started bulbing in February and March. Early planting of both cultivars resulted in higher yields because it permits the development of large size plants before bulbing starts.

Texas Yellow Grano 502 gave a higher yield than Giza Synthetic in both seasons because weight per bulb produced by the former was higher than that of the latter. Single bulb weight is considered an important yield component in onion.

Future research should be focused on the effect of planting in August and September. Different age of seedlings within a given planting date should also be tested.

LITERATURE CITED

1. El-Shafie, M. W. 1979. Onion varietal test under Libyan conditions. Libyan J. Agric. 8 (in press).
2. El-Murabaa, A., M. Dehem, and E. Fhema. 1979. Quantitative and qualitative evaluation of onion cultivars for the season 1977–1978 at Seidi AlMasri Station. Tech. Bull. No. 1. Onion Improvement Project. A.D.I., Tripoli (in press).
3. Fuqua, M. C. and G. R. Howell. 1975. Variety and planting date trials of spring and fall-field-seeded onions in the rolling plains of Texas. Progress Report, Texas Agric. Expt. Sta. No. PR-3301.
4. Hopen, H. J. and C. E. Peterson. 1974. Seeding rates, cultivars, and planting methods for small processing onions (*Allium cepa* L.). Illinois University Agric. Expt. Sta. Bull. No. 749.
5. Jones, H. A. and L. K. Mann. 1963. Onion and Their Allies. Interscience Publishers, Inc., New York.
6. Joshi, R. P., R. D. Singh, A. K. Singh, and K. P. S. Phogat, 1976. Effect of differed sowings on bulb production of onion var. Pusa Red. (Hort. Abstracts No. 10187, 1976).
7. Minkov, I. and I. Todorov. 1978. High quality sowing of onions grown as an annual crop. (Hort. Abstracts No. 5434, 1978).
8. Moursi, M. A., K. M. El-Habbasha, N. A. N. Eldin, and M. M. A. Magd. 1975. Effect of sowing date and seed rate on the growth and yield of direct sown onion (*Allium cepa* L.) plants. Egyptian J. Horticulture 2:243–256.
9. Petkov, M., B. Khristov, and S. B. Chvarov. 1975. Determination of a suitable sowing date for onions grown as an annual direct-sown crop. (Hort. Abstracts No. 3938, 1975).
10. Singh, D. P. and R. P. Singh. 1975. Studies on the effect of time of sowing and age of seedlings, on growth and yield of onion (*Allium cepa* L.). (Hort. Abstracts No. 3125, 1975).
11. Thompson, H. C. and Ora Smith. 1938. Seedstalk and bulb development in the onion (*Allium cepa* L.). Cornell Univ. Agric. Expt. Sta. Bull. 708.
12. Usik, G. E. and S. I. Batsei. 1975. Characteristics of yield production by autumn-sown onions. (Hort. Abstracts No. 4850, 1975).
13. Vik, J. 1976. Experiments with onion group transplants, onion sets and other factors influencing an early onion crop (*Allium cepa* L.). (Hort. Abstracts No. 295, 1976).

14. Warid, W. A. and S. Fallah. 1974. Plant bolting, bulb size, and marketable yield as indices of adaptability of onion cultivars. Proceedings of the XIX International Horticultural Congress, Vol. 1B. Warszawa.

تأثير الصنف وميعاد الزراعة على المحصول في البصل

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المستخلص

تمت زراعة صنفين من الأصناف المبشرة تحت الظروف المحلية وهما تكساس يلوجرانو ٥٠٢ وجيزه التركيبي في موسمين زراعيين وباستخدام ثلاثة مواعيد مختلفة من أواخر سبتمبر إلى أوائل ديسمبر. أوضحت النتائج أن الزراعة المبكرة في سبتمبر أعطت أعلى محصول وأكبر وزن للبصلة حيث تبعا للتحليل الإحصائي للموسمين معا كان متوسط المحصول ٣٨,٦٦٣ ، ٢٢,١٣٣ ، ١١,٦٩٢ طنا للهكتار وكان متوسط وزن البصلة ١٣٠,٥٦ ، ٧٤,٥٨ ، ٣٨,٢٧ جراما وذلك بالنسبة للزراعة المبكرة والمتوسطة والمتأخرة على التوالى. هذا وأعطى الصنف تكساس يلوجرانوا ٥٠٢ محصولا أعلى من الصنف جيزه التركيبي حيث تراوح المحصول بالنسبة للأول من ٢٧,٥٥٢ إلى ٣١,٥٣٠ طنا للهكتار وبالنسبة للثاني من ١٧,٥٦٣ إلى ٢٠,٠٠٧ طنا للهكتار . . وأشار التحليل الإحصائي إلى أن التفاعل بين الصنف وميعاد الزراعة والتفاعل بين ميعاد الزراعة والسنة كانت معنوية.