EFFECT OF TRANSPLANTING DATE AND PLANTING DENSITY ON BULB YIELD AND QUALITY OF GIZA 20 ONION IN UPPER EGYPT

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Abstract

This investigation was caarried out at Shandaweel Experimental Station, Sohag Governorate in 1989/90, 1990/91 and 1991/92 seasons to study the effect of Two transplanting dates and three planting densities (80, 120 and 160 plants/m2) on bulb yield and quality of onion variety Giza 20. Results were as follows :

1. Highest marketable and exportable bulb yields were produced by transplanting 160 plant/m2 in November 15.
2. Percentages of external doubling and bolting were significantly decreased by planting on February 5.
3. Percentages of external doubling was significanting 80 plants/m2 on February 5.
5. Average bulb weight was significantly decreased by transplanting 160 plants/m2 on February 5.
6. Plants matured on April 17 and 27 for Nov. 15 and Feb. 5 transplanting dates.
7. Bulb weight was greatly reduced in late transplanting date (Feb.5).

INTRODUCTION

Onion (Allium cepa L.) is one of the most important crops in Egypt for export and local consumption. Bulbs of the variety "Giza 20" are acceptable overseas but will receive more acceptance when their maturity and shipments are earlier. Early maturity and performance of the variety in Upper Egypt, where it has not been thoroughly studied, is the theme of this study.

Singh and Singh (1974) found that early transplanting (October 16) in India

favoured leaf, root and bulb growth and gave the highest yield.

El-Murabaa *et al.* (1978) tested eleven onion cultivars in two transplanting dates, namely, December 3681 and February 15 under Tripoli conditions, Lybia. The earlier date resulted in higher yield in all cultivars except Yellow Sweet Spanish which performed better at late transplanting.

Nagre *et al.* (1985) in India found that mid-December transplanting increased bolting to >10%, mid-January planting resulted in <1% bolting and a mid-February transplanted crop was free from bolting.

Tronickove (1966) recommended for the production of mediumsized onion bulbs a row spacing of 35 cm and a seed rate of 46 seed per meter. However, for the production of large bulbs, a seed rate of 29 seed per row meter was recommended.

Bleasdale (1966) indicated the effect of plant density on total yield of direct sown bulb crop. Total yield of ripe bulbs was increased with increasing number of plants per square foot until an optimum was reached beyond which yield declined. Decreased distance between ros at a given plant density increased the total yield of onion bulbs.

In Egypt, Gamie (1984) found that total and exportable yields of onion were increased and average bulb weight was decreased with increasing density up to 100 plant/m2. Planting density had no significant effect on percentage of bolters, doubles or culls.

MATERIALS AND METHODS

A split plot experiment was conducted, 1989/90, 1990/91 and 1991/92. Transplanting dates (November 15, and February 5) were in the whole plots and densities (80, 120 and 160 plant/m2) occupied the sub plots. The sub plot size was 3x3.5 m (1/400 feddan). In both transplanting dates, transplants were 60-65 days old. The sub-plots contained 14, 21 and 28 rows 3 m long. Row distances were 25, 17 and 13cm while transplants were spaced 5 cm apart within the row.

Calcium superphosphate was broadcast at the rate of 100 kg/feddan before transplanting. Normal cultural practices of growing onions were followed. Urea

(46.5% N) at the rate of 200 kgs faddan was applied in 2 equal split doses; the first was a month after transplanting and the second a month later. Irrigation was applied as required.

Plants were pulled when 75% of tops fell down, then cured in the field for two weeks. Roots and tops were removed.

Measurements were recorded for :

1- Percentage of external doubles (split bulbs).
2- Percentage of bolters.
3- Total yield (ton /feddan).
4- Average bulb weight (gm) $= \frac{\text{Total yield}}{\text{Number of bulbs}}$
5- Exportable yield (ton/feddan), bulbs 3-6 cm in diameter that were free from culls.
6- Marketable yield (ton/feddan): Exportable yield plus bulbs above 6 cm in diameter.
7- Culls yield (ton/feddan) which included bulbs less than 3 cm in diameter, doubles, bolters, off-color and scallions.

RESULTS AND DISCUSSION

a- Total yield :

Results on total yield of different treatments are shown in Table (1). Total yield was highly significantly increased with early transplanting in all growing seasons. In 1989/90, planting on November 15, produced the highest total yield (16.57 T/F). The February 5 date gave only 2.34 T/F.

Total yield was also highly significantly increased with increasing the number of plants/m2 in all growing seasons. In 1989/90 density of 160 plants/m2 gave the highest yield (11.51 T/F), while 80 plants/m2 produced the lowest (7.28 T/F).

The interaction of transplanting date and plant density was significant. The highest total yield was always obtained by transplanting 160 plants/m2 on November, 15. This combination gave 20.09 T/F. In 1989/90, it gave 17.33 T/F in 1990/91 and 17.72 T/F in 1991/92 season.

Table 1. Effect of planting date (A) and plant density (B) on total yield (T/F) of "Giza 20" onions in 1989/90, 1990/91 and 1991/92 seasons.

Planting density plants/m2 (B)	1989/90			1990/91			1991/92		
	Planting date (A)			Planting date (A)			Planting date (A)		
	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)
80	12.59	1.97	7.28	12.98	1.83	7.40	13.49	1.72	7.61
120	17.04	2.12	9.58	14.68	2.01	8.34	15.15	1.84	8.50
160	20.09	2.94	11.51	17.33	2.83	10.08	17.72	2.19	9.96
Mean (A)	16.57	2.34		15.00	2.22		15.45	1.92	

L.S.D. at	0.05	0.01	0.05	0.01	0.05	0.01
Planting date (A)	1.69	3.08	0.68	1.23	2.01	3.66
Plant density (B)	1.14	1.59	0.90	1.26	0.57	0.79
A X B	2.10	3.42	1.22	1.83	2.09	3.70

b- Marketable yield :

As shown in Table (2), marketable yield was highly significantly affected by transplanting date in the three seasons. Transplanting on November 15 gave the highest marketable yield (13.87 T/F), while that of February 5 produced the lowest one. Lower marketable yield is related to the prevalence of small bulbs.

Marketable yield also was significantly increased as number of plants/m2 increased in all seasons. In 1989/90 transplanting 160 plants/m2 gave the highest marketable yield (8.22 T/F), while 80 plants/m2 produced the lowest marketable yield (5.44 T/F).

Transplanting date and planting density significantly affected the marketable yield in all seasons. Transplanting 160 plants/m2 on November 15 gave the highest marketable yield (16.36 T/F). Oppositely, transplanting 160 plants/m2 produced the lowest one (0.08 T/F) when planted on February 5 in 1989/90.

c- Exportable yield :

Results on exportable yield are presented in Table (3). It is evident that transplanting date significantly affected exportable yield in all seasons. Transplanting on November 15, always gave the highest exportable yield in all seasons, while that on February 5 produced the lowest.

As transplanting density was increased, exportable yield was increased. For example in 1989/90, 160 plants/m2 gave the highest exportable yield (8.05 T/F), while 80 plants/m2 produced the lowest exportable yield (5.16 T/F).

Transplanting date and density significantly affected the exportable yield in all seasons. The highest exportable yield was always obtained from 160 plants/m2 on November 15 while the lowest exportable yield was produced from 160 plants/m2, planted on February 5.

It can be generally concluded that transplanting date and density affected yield and quality of "Giza 20" onions. The early transplanting date (November, 15) gave the highest total yield (16.57 T/F), marketable yield (13.87 T/F) and exportable yield (13.43 T/F), in the three seasons of study. These results are similar to those obtained by Singh and Singh (1974) who indicated that earlier transplanting date always gave yields higher than did later transplanting.

Table 2. Effect of planting date (A) and plant density (B) on marketable yield (T/F) of "Giza 20" onions in 1989/90, 1990/91 and 1991/92 seasons.

Planting density plants/m2 (B)	1989/90			1990/91			1991/92		
	Planting date (A)			Planting date (A)			Planting date (A)		
	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)	November 15	February .5	Mean (B)
80	10.69	0.19	5.4	10.55	0.17	5.36	12.16	0.41	6.29
120	14.57	0.13	7.35	11.60	0.07	5.83	13.69	0.31	7.00
160	16.36	0.08	8.2	13.81	0.06	6.93	14.42	0.28	7.35
Mean (A)	13.87	0.13		11.98	0.10		13.42	0.33	

L.S.D. at	0.05	0.01	0.05	0.01	0.05	0.01
Planting date (A)	1.67	3.05	0.47	0.86	2.25	4.09
Plant density (B)	1.06	1.48	1.09	N.S.	0.67	N.S.
A X B	2.03	3.33	1.33	N.S.	2.36	4.15

Table 3. Effect of planting date (A) and plant density (B) on exportable yield (T/F) of "Giza 20" onions in 1989/90, 1990/91 and 1991/92 seasons.

Planting density plants/m2 (B)	1989/90			1990/91			1991/92		
	Planting date (A)			Planting date (A)			Planting date (A)		
	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)
80	10.13	0.19	5.16	10.32	0.17	5.24	9.87	0.41	5.14
120	14.13	0.13	7.13	11.43	0.07	5.75	11.69	0.31	6.00
160	16.02	0.08	8.05	13.66	0.06	6.86	13.00	0.28	6.64
Mean (A)	13.43	0.13		11.80	0.10		11.52	0.33	

L.S.D. at	0.05	0.01	0.05	0.01	0.05	0.01
Planting date (A)	1.33	2.42	0.47	0.85	0.92	1.67
Plant density (B)	0.88	1.23	1.06	N.S.	0.30	0.42
A X B	1.64	2.67	1.30	N.S.	0.97	1.70

d- Yield of culls :

Results in Table (4) show that there was no significant difference between both transplanting dates in yield of culls.

However, yield of culls was significantly influenced by density of plants in all seasons of study. In 1990/91transplanting 160 plants/m2 gave the highest yield of culls (3.15 T/F) which was mostly pickles, while 80 plants/m2 produced the lowest yield of culls (2.05 T/F).

The interaction of transplanting date x density significantly affected yield of culls, in 1989/90 and 1991/92. The highest yield of culls (doubles and bolters) was always obtained when 160 plants/m2 were transplated on November, 15. This treatment gave (3.30 T/F), while the lowest culls yield (mostly pickles) was produced from the February 5 transplanting of 80 plants/m2.

e- Average bulb weight (gm) :

Results on average bulb weight are presented in Table (5). This was highly significantly and significantly affected by transplanting date and density, respectively, in all seasons. In 1990/91 transplanting 160 plants/m2 gave the lightest bulb (23.28 gm).

The interaction of transplanting date and density was significant. The heaviest bulb was always obtained with transplanting 80 plants/m2 on November 15, while the lightest was produced with transplanting 160 plants/m2 on February 5 in 1989/90. Late transplanting is recommended to reduce production costs. It is thus necessary to establish a) selections (from the variety) with much larger bulbs and / or b) cultural practices which lead to their production.

f- Percentage of external doubling :

Results in Table (6) show that the percentage of external doubling was significantly affected by transplanting date in 1989/90 and 1991/92. February 5 transplanting produced no external doubling in all seasons. November 15 gave more external doubles (5.67%) in 1989/90, Moreover, percentage of external doubling was not significantly influenced by transplanting density in all seasons.

The interaction of transplanting date and density did not affect the percentage of external doubling.

Table 4. Effect of planting date (A) and plant density (B) on yield of culls (T/F) of "Giza 20" onions in 1989/90, 1990/91 and 1991/92 seasons.

Planting density plants/m2 (B)	1989/90			1990/91			1991/92		
	Planting date (A)			Planting date (A)			Planting date (A)		
	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)
80	1.90	1.78	1.84	2.43	1.67	2.05	1.33	1.31	1.32
120	2.47	1.99	2.23	3.08	1.94	2.51	1.46	1.53	1.50
160	3.72	2.78	3.25	3.53	2.77	3.15	3.30	1.91	2.61
Mean (A)	2.70	2.18		3.01	2.13		2.03	1.58	

L.S.D. at	0.05	0.01	0.05	0.01	0.05	0.01
Planting date (A)	0.34	N.S.	N.S.	N.S.	N.S.	N.S.
Plant density (B)	0.32	N.S.	0.45	0.64	0.44	0.61
A X B	0.49	N.S.	N.S.	N.S.	0.72	1.15

Table 5. Effect of planting date (A) and plant density (B) on average bulb weight (gm) of "Giza 20" onions in 1989/90, 1990/91 and 1991/92 seasons.

Planting density plants/m2 (B)	1989/90			1990/91			1991/92		
	Planting date (A)			Planting date (A)			Planting date (A)		
	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)
80	55.55	10.44	33.00	46.36	11.28	28.82	56.69	11.58	34.14
120	49.50	8.14	28.82	42.33	8.10	25.22	47.25	9.89	28.57
160	44.11	7.78	25.82	38.49	8.00	23.25	43.86	9.71	26.79
Mean (A)	49.72	8.79	25.95	42.39	9.13		49.27	10.39	

	1989/90		1990/91		1991/92	
L.S.D. at	0.05	0.01	0.05	0.01	0.05	0.01
Planting date (A)	3.69	6.72	4.41	8.03	9.51	17.35
Plant density (B)	2.78	3.90	3.38	N.S.	4.25	5.96
A X B	4.80	N.S.	N.S.	N.S.	10.55	N.S.

Table 6. Effect of planting date (A) and plant density (B) on percentage of external doubling of "Giza 20" onions in 1989/90, 1990/91 and 1991/92 seasons.

Planting density plants/m2 (B)	1989/90			1990/91			1991/92		
	Planting date (A)			Planting date (A)			Planting date (A)		
	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)
80	6.43	0.0	3.22	8.08	0.0	4.04	0.96	0.0	0.48
120	3.96	0.0	1.98	5.32	0.0	2.66	0.86	0.0	0.43
160	3.14	0.0	1.57	3.60	0.0	1.80	0.80	0.0	0.40
Mean (A)	4.51	0.0		5.67	0.0		0.87	0.0	

L.S.D. at	1989/90		1990/91		1991/92	
	0.05	0.01	0.05	0.01	0.05	0.01
Planting date (A)	3.18	N.S.	N.S.	N.S.	0.10	0.18
Plant density (B)	N.S.	N.S.	N.S.	0.64	N.S.	N.S.
A X B	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

g- Percentage of bolters :

Effect of transplanting date and density on the percentage of bolting appears in Table (7). This was significantly affected by transplanting date in 1991/92 only, and in all seasons for density and the interaction of transplanting date with density.

Results obtained on effects of transplanting date and density on external doubling, average bulb weight and bolters % are similar to those of Gamie (1984) and Ngra *et al.* (1985). Their earlier trans-planting dates produced more external doubles and heavier bulbs.

As far as the effect of plant density, it was found that density of 160 plants/ m2 gave the highest total yield (11.51 T/F), marketable yield (8.22 T/F) and exportable yield (8.05 T/F). These yields increased with increasing plant density within the range studied, i.e., 80 to 160 plants per m2. Gamie (1984) and Bleasdale (1966) found that total yield of mature bulbs increased with increased density until an optimum was attained thenafter it declined. Density of 77 plants/m2 was the most suitable for commercial dry bulb production. Bulb weight was reduced in the present study with increased density (160 plants/m2). Density did not, however, affect external doubling and bolting percentages. These results are in line with those obtained by Bleasdale (1966)and Gamie (1984), as external doubling and bolting percentage were not significantly affected by density in their studies.

Table 7. Effect of planting date (A) and plant density (B) on percentage of external doubling of "Giza 20" onions in 1989/90, 1990/91 and 1991/92 seasons.

Planting density plants/m2 (B)	1989/90			1990/91			1991/92		
	Planting date (A)			Planting date (A)			Planting date (A)		
	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)	November 15	February 5	Mean (B)
80	0.51	0.0	0.26	0.11	0.0	0.06	2.17	0.0	1.09
120	0.43	0.0	0.22	0.07	0.0	0.04	2.07	0.0	1.04
160	0.14	0.0	0.07	0.04	0.0	0.02	1.71	0.0	0.86
Mean (A)	0.36	0.0		0.04	0.0		1.98	0.0	

REFERENCES

1. Bleasdale, J.K.A., 1966. The effect of plant spacing on the yield of bulb onions (Allium cepa L.) grown from seed. J. Hort. Sci. 41 : 145-53. (C.F. Hort. Abstr. 36, Abstr. No. 4821).

2. Brewster, J.L., and P.J. Salter. 1980. The effect of plant spacing on the yield and bolting of two cultivars of overwintered bulb onions. J. Hort. Sci., 55 (2) : 97-107. (C.F. Hort. Abstr. 50, Abstr. No. 7709) .

3. El-Murabaa, A.I.M., M. Dehaim and F. Fehema. 1978. Quantitative and qualitative evaluation of onion cultivars in Sidi El-Marsri region in 1977/1978 season. ADI, Tripoli, Lybia. onion Improvement Project Bull. 1 : 21-52. (In Arabic) .

4. Gamie, A.M.A.1984. Effect of some cultural practices on growth and yield of Giza 6 onion. M.Sc. Thesis, Fac. Agric., Assiut Univ., pp. 79.

5. Nagre, P.K., L.V. Kubual and P.B. Kale. 1985. Effect of different dates of transplanting and spacing on growth and yield of onion cv. Local white. Hort. Abstr. 57, Abstr. No. 3318 .

6. Singh, D.P. and R.P. Singh. 1979. Studies on the effect of time of sowing and age of seedling on growth and yield of onion. Ind. J. Hort., 31 (7), 69-73.

7. Tronickove, E. 1966. The suitability of onion varieties grown throughout the world for autumn sowing. I- Sowing in August. Hort. Abstr. 37, Abstr. No. 1043 .

تأثير مواعيد الشتل والكثافات النباتية على محصول وجودة الأبصال فى صنف البصل جيزة ٢٠ فى الوجه القبلى

جمال حسين عبد الرحيم ، دكتور جميل اسماعيل شلبى ،
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تم دراسة تأثير ميعادى الشتل (١٥ نوفمبر و ٥ فبراير) وكثافة الشتلات (٨٠ ، ١٢٠ ، ١٦٠ شتلة /م٢) على صفات المحصول وبعض مكوناته وكانت النتائج كالاتى:

١ – زاد المحصول الكلى والمحصول التسويقى والمحصول التصديرى معنويا بالشتل المبكر (١٥ نوفمبر) والكثافات المرتفعة (١٦٠ نبات/م٢).

٢ – نقص محصول النقضة (الأبصال المستبعدة) معنويا بتأخير الشتل الى ٥ فبراير وكثافة ٨٠ نبات/م٢ .

٣ – نقصت النسبة المئوية للابصال المزدوجة والابصال الحنبوط نقصا معنويا بالزراعة فى ٥ فبراير.

٤ – نقصت نسبة الابصال المزدوجة معنويا عند زراعة ١٦٠ شتلة لكل متر مربع.

٥ – نقص متوسط وزن البصلة معنويا بشتل ١٦٠ / م٢ فى ٥ فبراير.

٦ – تم نضج وتقليع النباتات التى تم شتلها فى ١٥ نوفمبر و ٥ فبراير فى ١٧ ، ٢٧ أبريل على التوالى.

٧ – أدى الشتل المتأخر فى ٥ فبراير الى انتاج أبصال صغيرة الحجم غير صالحة للتسويق.