J. of Plant Production, Vol. 1 (2): 205 - 212, 2010

STUDY ON THE INTERNAL BULB QUALITY OF SAME NEW EGYPTIAN ONION CULTIVARS UNDER DIFFERENT IRRIGATION REGIMES.

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ABSTRACT

This investigation was carried out at Gemmeiza Agriculture Research Station Farm, Gharbeia Governorate during 2006/2007 and 2007/2008 onion growth seasons. The objectives of this study was aimed to study the effect of four irrigation regimes (one, two, three and four irrigations) and six onion cultivars selected by Onion Research Section (Composite 9, Giza white, Behairy no pink, 1866 Globe, Giza Red and Giza 20) on internal bulb quality. A separate experiment for each irrigation treatment was used Randomize Complete Blocks Design in four replications.

The main obtained results from this investigation cane be summarized as follows:

1- Average weight of bulbs, average number of growing points and average number of complete rings increased with every increase of irrigations up to 3 irrigations. Whereas, total soluble solids and average percentage of dry matter decreased with every increase of irrigations. Shape index and stem plate diameter were not affected by irrigation regimes.

2- Giza 20 and Comp. 9 cultivars have the heaviest bulb weight followed by Giza Red. Whereas, Giza White have the lowest bulb weight. Behairy no Pink and 1866 Globe cultivars were nearly globe. Shape index and the another tested cultivars seemed to be thick flat and highly thick flat shape index. Giza White and Giza 20 cultivars have the widest stem plate diameter, whereas, 1866 Globe and Behairy no Pink cultivars have the lowest stem plate diameter. Giza Red and Giza 20 cultivars have the highest number of growing points/bulb. 1866 Globe cultivar have the highest average number of complete rings/bulb. Whereas, Giza 20 cultivar have the lowest average number of complete rings/bulb. Giza White cultivar have the highest values of total soluble solids. Whereas, Comp. 9 cultivar have the lowest values of total soluble solids. Giza White cultivar have the highest values of dry matter content followed by Giza 20 and Giza Red. Whereas, Comp. 9 cultivar have the lowest values of dry matter content in bulbs.

3- The interaction between irrigation regimes and cultivars showed significant effects on average stem plate diameter/bulb in the second season of study. Giza White have the widest stem plate diameter when gave three irrigations.

INTRODUCTION

Onion (*Allium cepa* L.) is an important crop in Egypt, for local consumption and exportation. It is a delicate and perishable commodity, difficult to store for long duration at room temperature due to its high water content (Shinde and Sontakke, 1990). Hence, a great attention should be paid towards improving the yield and internal bulb quality to complete other countries in supplying the world and local markets. One of the important lines of research towards this improvement is to evaluate the internal bulb quality of some new onion cultivars under different irrigation regimes. Several

authors showed that internal bulb quality are highly influenced by irrigation regimes. Basilious (1975), El-Tabbakh *et al*. (1979) and Abu Grab (1987) concluded that total soluble solids and percentage of dry matter were affected by irrigation regimes. Mostafa and Leilah (1993), Mahmoud (1999) and El-Sharkawy *et al*. (2006) summarized that irrigation of onion plant at 30 days intervals increased number of complete rings, bulb weight. Whereas, total soluble solids and dry matter percentage were increased with widening of irrigation intervals to 40 or 50 days.

Concerning onion cultivars performance, El-Shafei and Warid (1979), El-Kafoury (1986), El-Kafoury *et al*. (1996) and Mostafa and Abd El-Megid (1998) onion cultivars significality different in bulb quality .

Internal bulb quality and chemical composition were greatly differed due to variety, in this respect, Brewster *et al*. (1987), Mostafa and Abd El-Megid (1998) and El-Kafoury *et al*. (1999) mentioned that average bulb weight, bulb diameter, total soluble solids and dry matter content were varietal characteristics.

The objectives of this investigation are aimed to evaluate six onion cultivars under different four irrigation regimes with respect to internal quality of bulbs.

MATERIALS AND METHODS

Eight field experiments were carried out at Gemmeiza Agriculture Research Station Farm at Gharbeia Governorate during 2006/2007 and 2007/2008 onion growth seasons. The objectives of this investigation are aimed to study the effect of four irrigation regimes and new six onion cultivars on internal bulb quality. A separate experiment for each irrigation treatment was used Randomize Complete Blocks Design in four replications. The four irrigation treatments were; one at 45 days from transplanting, two irrigation at 45 and 105 days from transplanting, three irrigations at 45, 90 and 125 days from transplanting and four irrigations at 45, 75, 105 and 125 days from transplanting.

Six onion cultivars were Composite 9, which is a anew nucleus selected by Onion Research Section from single cross between 10 American and 2 Egyptian cultivars, bulbs are uniform with high thick flat to globe shape and stored for long period ; Giza white which is a selection from Egyptian strains types, bulbs are thick flat, white outer dry scales and excellent in keeping ; Behairy no pink which is a new Deltian selection free pink colour in bulb flesh, total soluble solids (TSS) and dry matter are relatively high and excellent in keeping ; 1866 which is a new nucleus selected from Behairy strain, its bulbs are high thick flat, white flesh and excellent in keeping quality ; Giza Red which is a selection from Behairy strain, red scales and flesh had high content from total soluble solids and dry matter and excellent in keeping quality ; Giza 20 which is a selection from Egyptian Deltian types, bulbs are thick flat, white flesh, yellow brownish outer dry scales and excellent in keeping quality.

The previous crop was maize in both seasons. Experimental soil was clay loam with medium fertility. Well seedbed preparation for both nursery and permanent soils were done. Seedlings 60 days ago were spaced 7 cm

apart in double – row ridges 60 cm width. Onion plants received 120 kg N/fed. One half at transplanting and the remained at 45 days from transplanting. Phosphorus was applied 15 kg P_2O_5/fed with soil preparation. Other cultural practices for onion growing were followed.

Studied characters:

1- Average weight of bulb (g) *i.e.,* weight of marketable yield/number of single bulbs.
2- Shape index; *i.e.* bulbs length / bulb diameter according to Bednary (1990).
3- Average diameter of stem plate in cm.
4- Average number of growing points/bulb.
5- Average number of complete rings/bulb.
6- Total Soluble Solids (TSS): Random samples, each of 10 single bulbs were taken from every plot to determinate the total soluble solids by hand Referactometer.
7- Average percentage of dry matter in bulbs: 10 bulbs from each plot were finely sliced and 3 samples each of 200 grams were dehydrated in electric oven at 70 Cº for a constant weight (about 72 hours).

Random samples each of 10 bulbs from each plot were horizontally cut at the widest diameter of bulb then the previous data were recorded. Data were statistically analyzed using the analysis of variance technique according to Das and Giri (1986). Treatment means were compared using the New Least Significant of Difference as mentioned by Waller and Duncan (1969).

RESULTS AND DISCUSSION

I- Irrigation regime:

Results presented in Tables 1 and 2 show that rotandaty index and stem plate diameter did not markedly affected by number of irrigations. These results may be due to shape index and stem plate diameter are a genetic characters affecting by genotype of cultivar. Mostafa (1998), Mostafa and Abd El-Megid (1998) and El-Kafoury *et al*. (1999) came to the same conclusion. There was an increase in average number of growing points/bulb with increase in irrigation number till to three irrigations. So, the less number of growing points/bulb was observed with giving one irrigation. These results may be attributed to the fact that decreasing in soil moisture content may increased the internal water deficit of the plants and this would probably decrease all internal plant processes such as bud enlargement and division. According to Basilious (1975), 5-8 water application were optimal, whereas, over of irrigation was harmful. In the present investigation no more four irrigation were applied. These results are in accordance with those of El-Lakany (1971), Mostafa (1998) and El-Kafoury *et al*. (1999).

Addition of 2-3 irrigations to onion plants increased average number of complete rings/bulb. These results may be because the increase in soil moisture was reflected on bulb growth. Basilious (1975) recommended that less frequent irrigation at early stages of growth and more frequent irrigation at early stages of growth and more frequent irrigation later in the season *i.e.* as bulbs were developing in suitable to increase number of complete rings/bulb.

Table 1: Average bulb weight (g), total soluble solids (TSS) and percentage of dry matter as affected by irrigation treatments of some onion cultivars during 2007 and 2008 seasons.

Characters / Treatments	Average bulb weight (g)		Total soluble solids (TSS)		Percentage of dry matter	
	06/2007	07/2008	06/2007	07/2008	06/2007	07/2008
A- Irrigation treatments:						
One irrigation	102.4	101.7	11.7	10.4	12.6	12.8
Two irrigations	117.2	113.5	11.5	10.2	12.3	12.4
Three irrigations	118.1	115.3	11.1	9.4	12.1	12.3
Four irrigations	113.3	105.6	11.0	8.6	11.9	12.3
F. test	*	**	*	*	*	*
LSD 5 %	7.1	4.2	0.5	1.2	0.6	0.4
LSD 1 %	-	5.8	-	-	-	-
B- Cultivars:						
Comp. 9	117.4	113.9	10.7	8.8	11.5	11.9
Giza White	99.5	87.6	12.0	10.6	13.2	13.2
Behairy no Pink	110.3	104.1	11.0	9.7	11.9	12.3
1866 Globe	111.9	107.4	11.2	9.5	11.9	12.3
Giza Red	114.6	114.9	11.4	9.2	12.5	12.2
Giza 20	112.9	127.8	11.7	10.1	12.3	12.8
F. test	*	**	*	*	*	**
LSD 5 %	14.6	20.1	0.7	1.0	0.4	0.6
LSD 1 %	-	27.1	-	-	-	0.8
C- Interactions:						
	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Table 2: Rotandaty index, stem plate diameter (cm), number of growing points and number of complete rings as affected by irrigation treatments of some onion cultivars during 2006/2007 and 2007/2008 seasons.

Characters / Treatments	Rotandaty index		Stem plate diameter (cm)		Number of growing points		Number of complete rings	
	06/2007	07/2008	06/2007	07/2008	06/2007	07/2008	06/2007	07/2008
A- Irrigation treatments:								
One irrigation	0.87	0.88	1.68	1.76	1.88	1.87	4.23	4.12
Two irrigations	0.92	0.91	1.70	1.79	1.93	1.90	4.74	4.70
Three irrigations	0.90	0.89	1.78	1.98	2.14	2.05	4.88	4.78
Four irrigations	0.85	0.88	1.72	1.89	1.94	1.96	4.72	4.37
F. test	N.S.	N.S.	N.S.	N.S.	**	*	*	**
LSD 5 %	-	-	-	-	0.18	0.18	0.30	0.28
LSD 1 %					0.24	-	-	0.36
B- Cultivars:								
Comp. 9	0.85	0.82	1.72	1.88	1.79	1.76	4.41	4.48
Giza White	0.81	0.83	1.94	2.04	1.61	1.63	5.05	4.90
Behairy no Pink	1.09	1.00	1.65	1.73	1.76	1.74	4.46	4.5
1866 Globe	1.05	1.05	1.53	1.65	1.83	1.74	5.17	5.05
Giza Red	0.83	0.82	1.61	1.83	2.45	2.37	4.85	4.58
Giza 20	0.69	0.83	1.77	2.02	2.38	2.42	4.01	3.45
F. test	**	**	**	**	**	**	**	**
LSD 5 %	0.17	0.04	0.15	0.15	0.21	0.23	0.43	0.54
LSD 1 %	0.23	0.05	0.19	0.21	0.30	0.29	0.57	0.69
C- Interactions:								
	N.S.	N.S.	N.S.	**	N.S.	N.S.	N.S.	N.S.

In spite of the insignificant effect in some cases, the total soluble solids values recorded a partial reduction with decreasing available soil moisture. It is worth to mentioned that the highest TSS values were obtained in onion bulbs of plants which gave one irrigation. On the contrary, the lowest TSS values were noticed when onion plants were irrigated four times. The obtained data are in good accordance with those reported by El-Tabbakh *et al*. (1979) and Mahmoud (1999) on onion. Contra trend was suggested by Abdalla (1992) who stated that, the irrigation regime treatment had no statistical effect on the values of TSS.

The percentage of dry matter in bulbs tended to be higher with less frequent irrigation. Similar results were reported by El-Lakany (1971) and Basilious (1975). On the other hand, it seems likely that dry matter content is determined by complex of physiological processes rather that by the actual rates of water uptakes and transpiration, as suggested by Mostafa and Leilah (1993).

II- Cultivars:

Results in Table 1 show that variation due to cultivars may be detected in indicated characteristics. Giza 20 and Comp. 9 have the heaviest bulb weight (120.38 and 115.62 g), respectively followed by Giza Red (114.73 g) and 1866 Globe (109.66 g) followed by tested cultivars which show wide variation in between. The lowest bulb weight were recorded with Giza White (93.53 g) as an average in both seasons. Nearly globe shape index was observed with 1866 Globe and Behairy no Pink cultivars. Another cultivars were seemed to be thick flat and highly thick flat shape. Since, shape index is a genetic character affecting by genotype, such results are expected. These results are in agreement with those obtained by Mostafa (1998) and El-Kafoury *et al*. (1999).

With respect to stem plate diameter, data in Table 2 show that the wider stem plate (1.99 cm) was observed with Giza White and Giza 20 (1.89 cm) as an average in both seasons. Whereas, the lowest stem plate was associated with 1866 Globe and Behairy no Pink (1.59 and 1.69). Another cultivars were ranked in between. These results may be because stem plate diameter is a genetic characters affecting by environmental conditions. These results are in harmony with those of Mostafa (1998) and El-Kafoury *et al*. (1999).

The highest number of growing points per bulb (2.41 and 2.40) were observed with Giza Red and Giza 20 cultivars in the first and second seasons, respectively. These results may be due to number of growing points in bulb is a genetic character. These results are in harmony with those obtained by Mostafa (1998) and El-Kafoury *et al*. (1999).

The highest number of complete rings/bulb (5.17 and 5.05) were resulted from 1866 Globe cultivar in the first and second seasons, respectively. Whereas, the lowest number of complete rings/bulb (4.01 and 3.45) were observed with Giza 20 cultivar in the first and second seasons, respectively. Another cultivars were ranked in between. Mostafa (1998) and El-Kafoury *et al*. (1999) came to the same conclusion.

The highest values of TSS (12.08 and 10.62) were observed with Giza White cultivar in both seasons, respectively. Whereas, the lowest values of

TSS (10.70 and 8.66) were recorded with Comp. 9 in both seasons, respectively. Other cultivars ranked in between. These results may be due to genetic variations between cultivars. These results are in accordance with that obtained by Mostafa (1998) and El-Kafoury *et al*. (1999).

Giza White cultivar have a highest values of dry matter content, followed by Giza 20 cultivar and Giza Red. Whereas, the lowest percentage of dry matter in bulbs was observed with Comp.9 cultivar in both seasons. According to Mostafa and Abd El-Megid (1998) and Hegazy and El-Sheikh (1999) mentioned that there are a genetic variation between cultivars in affecting dry matter content in bulbs.

III- Interaction effects:

The interaction between irrigation regime and onion cultivars had significant effect on average of stem plate diameter in the second season of study Table 3. The wider stem plate (2.20 cm) was observed with Giza White cultivar when gave three irrigations. Whereas, the lowest stem plate (1.50 cm) was associated with 1866 Globe cultivar when gave two irrigations. Mostafa and Leilah (1993) amd Mahmoud (1999) came to the same conclusion.

Table 3: Means of stem plate diameter (cm) as affected by the interaction between irrigation treatments and onion cultivars during 2007/2008 season.

Irrigation treatments / Cultivars	One irrigation	Two irrigations	Three irrigations	Four irrigations
Comp. 9	1.77	1.67	1.97	2.10
Giza White	2.03	2.03	2.20	1.88
Behairy no Pink	1.57	1.77	1.90	1.67
1866 Globe	1.57	1.50	1.83	1.68
Giza Red	1.73	1.80	1.87	1.93
Giza 20	1.90	1.97	2.10	2.10
F. test	**			
LSD 5 %	0.26			
LSD 1 %	0.34			

Finally, it can be concluded that new Egyptian onion cultivars differed in internal bulb quality at harvest and differed in response to irrigation regime, but most of cultivars are suitable with giving 2-3 irrigations after transplanting.

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دراسة على صفات الجودة الداخلية لأبصال بعض الأصناف الجديدة من البصل المصرى تحت نظم رى مختلفة

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أجريت هذه الدراسة فى مزرعة محطة البحوث الزراعية بالجميزة محافظة الغربية خلال موسمى ٢٠٠٦/٢٠٠٧ و٢٠٠٧/٢٠٠٨ بهدف تقييم أربع معاملات للرى وهى رية واحدة ، ريتان ، ثلاث ريات وأربعة ريات بعد الشتل وذلك لستة أصناف جديدة من البصل تم إنتاجها بقسم بحوث البصل (مركز البحوث الزراعية) وهى الصنف التركيبى رقم ٩ ، جيزة أبيض ، بحيرى خالى من اللون الأحمر ، النوية ١٨٦٦ كروى ، جيزة أحمر وجيزة ٢٠ من صفات الجودة الداخلية.

تم عمل تجربة منفصلة لكل معاملة من معاملات الرى فى تصميم القطاعات كاملة العشوائية. وإشتملت الدراسة على ثمانى تجارب فى ٤ مكررات حيث إشتملت كل تجربة على ٢٤ قطعة تحريبية هى عبارة عن ٦ أصناف فى ٤ مكررات ويمكن تلخيص أهم النتائج فى الآتى:

١- أظهرت النتائج أن إعطاء ٢-٣ ريات لنبات البصل أدت إلى زيادة واضحة فى متوسط وزن البصلة ومتوسط عدد القمم النامية ومتوسط عدد الحلقات الكاملة لكل نبات. بينما على العكس من ذلك أدى زيادة عدد الريات إلى إنخفاض النسبة المئوية للمواد الصلبة الذائبة ومتوسط نسبة المادة الجافة. بينما لم يتأثر معامل الإستدارة وقطر الساق القرصية بعدد الريات.

٢- أشارت النتائج إلى أن أبصال الصنفين جيزة ٢٠ والصنف التركيبى رقم ٩ هما الأكبر من حيث متوسط وزن البصلة ثم تبعهما الصنف جيزة أحمر. بينما كان الصنف جيزة أبيض الأصفر من حيث متوسط وزن البصلة. كان الصنفين البحيرى الخالى من اللون الأحمر والنوية ١٨٦٦ كروى الأقرب إلى الشكل الكروى بينما باقى الأصناف كانت قريبة من الشكل المسطح السميك والمسطح السميك العالى. كان الصنفين جيزة أبيض وجيزة ٢٠ الأكبر من حيث سمك الساق القرصة بينما النوية ١٨٦٦ كروى والبحيرى الخالى من اللون الأحمر كانا الأصغر من حيث قطر الساق القرصية. كان الصنفين جيزة أحمر وجيزة ٢٠ الأكثر من حيث عدد القمم النامية. كان الصنف ١٨٦٦ كروى الأكثر من حيث عدد الحلقات الكاملة بينما على العكس كان الصنف جيزة ٢٠ من حيث نفس الصفة. كان الصنف جيزة أبيض الأكبر من حيث نسبة المواد الصلبة الذائبة بينما على العكس كان الصنف التركيبى ٩ الأقل من حيث نفس الصفة. كان الصنف جيزة أبيض الأكبر من حيث نسبة المادة الجافة يليه الصنف جيزة ٢٠.

٣- أوضحت النتائج أن للتفاعل بين عدد الريات والأصناف تأثيرا معنويا على صفات قطر الساق القرصية فى العام الثانى من الدراسة. وقد سجل الصنف جيزة أبيض أكبر قطر للساق القرصية عند إعطاءه ثلاث ريات.

وتوصى هذة الدراسة بإعطاء ٢-٣ ريات لأي من الصنفين جيزة أحمر وجيزة ٢٠ والذي يؤدى إلى إنتاج محصول أبصال عالي ذو صفات جودة داخلية عالية.

قام بتحكيم البحث

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