



Research paper

Yield and Quality Evaluation of Six Local Onion (*Allium cepa* L.) Varieties

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ABSTRACT

Research was carried out at Hudeiba Research Station Experimental Farm, in the River Nile State, during seasons 2003/04 – 2004/05 to evaluate bulb yield and quality of six local varieties, open pollinated onion namely; Saggai (an improved cultivar with pink red skin colour); Kamleen (with yellow skin colour); El-Hillo (with white skin colour); Abufrewa (with deep red skin colour); Wadhamid (with yellow skin colour) and Zeidab (with red skin colour). Results showed a considerable variation in vegetative growth among the six varieties, where Kamleen and Wadhamid produced more foliage and earliness in bulbing than others. Kamleen gave the highest total and marketable yield, while Zeidab gave the lowest yield in the two seasons. Saggai, Kamleen and El-Hilo varieties showed less splitting, doubling and premature bolting. Wadhamid, Abufrewa and Zeidab gave the lowest values in quality characters. However, Abufrewa matured earlier, while cultivar Saggai matured late.

Keywords: *Cultivar, onion, Sudan, yield*

تقويم الإنتاجية والخواص النوعية لستة اصناف من البصل في السودان

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أجريت هذه الدراسة بمحطة البحوث الزراعية بالحديبة بولاية نهر النيل في موسمي 04/2003 و 05/2004 لدراسة وتقويم خصائص ستة من اصناف البصل السودانية مفتوحة التلقيح وهي سقاي محسن (احمر اللون) كاملين (اصفر اللون)، الحلو (ابيض اللون)، ابو فريوة (باللون الاحمر الداكن)، ود حامد (اصفر اللون)، وزيداب (احمر اللون). اوضحت النتائج وجود اختلافات في النمو الخضري بين الاصناف حيث اعطت الاصناف كاملين وود حامد نمو خضري قوى وتكبير في الابصال واعطى الصنف كاملين اعلى انتاجية كلية وانتاجية ابصال قابلة للتسويق بينما اعطى الصنف زيداب اقل انتاجية في الموسمين. اعطت الاصناف المجازة (سقاي محسن، كاملين والحلو) اقل النسب للابصال المزدوجة والمزهرة مبكرا (البنبون)، مقارنة مع الاصناف غير المجازة (ابوفريوة، ودحامد وزيداب). النتائج اوضحت ان الصنف ابوفريوة صنف مبكر النضج وسقاي صنف متأخر النضج.

Introduction

Onion (*Allium cepa* L.) is the most important of the bulb crops and is one of the most important vegetable crops grown in most parts of the world. Onion is probably a native of Asia. It belongs to the family Alliaceae, genus *Allium*.

Onions have relatively high nutritive value, being rich in vitamins moderate in carbohydrates, calcium and riboflavin. Its extract has antibacterial properties. Also the shoot system of onion is rich in a number of vitamins.

Onion is the leading vegetable crop in Sudan. It is eaten fresh, pickled, dry or cooked. Onion is planted annually as a winter crop. Estimation of total production of onion in Sudan is one million tons from 84,000 hectares (Mohamed Ali, 2009) and the River Nile State produces 162,648 tons from 11,340 hectares (27,000 feddans) (Mohamed *et al.*, 2003). Sudanese onion cultivars are good in quality characters (total soluble solids, dry matter, etc...) (Nourai, 2003).

The present study was conducted to test and compare the yield and quality characters of six different local released and promising onion cultivars.

Materials and Methods

Six local Sudanese cultivars of onion (*Allium cepa* L.) namely; Saggai (an improved cultivar with pink red skin colour), kamleen (with yellow skin colour), El-Hilo – Nassi (with white skin colour),

Abufrewa (with deep red skin colour), Wadhamid (with yellow skin colour) and Zeidab (with red skin colour) were tested for yield and quality. The experiment was carried out during seasons 2003/4 and 2004/5, at Hudeiba Research Station (Lat. 17° 34' N, Long. 33° 56' E, Elev. 350 m above sea level) in the River Nile State. The soil of the experimental site is thick loamy with pH 7.8 - 8.4.

The source of seeds was the Agricultural Research Corporation. The seeds were sown during the first week of October in the nursery and transplanted to the field after 60 days. A randomized complete block design with six replications was used. Seedlings were planted on both sides of the ridge of 60 cm width at 10 cm spacing between plants. Irrigation was applied at 8 days interval and stopped 15 days before harvesting. Manual weeding was practiced. Fertilization and insects control were applied as recommended.

Parameters to be measured were: number of leaves per plant, blubbing ratio (Bulb diameter/ neck diameter), average bulb dry weight in grams, total yield (t/ha), marketable yield (t/ha), days to maturity, total soluble solids (TSS) and dry matter content (%).

Analysis of variance was carried out for each experiment separately with mean separation for comparison among means (LSD) at 5 % level of significance following Gomez and Gomez, (1984).

Results

Number of leaves/plant

Differences in number of leaves/plant among the cultivars were significant ($P=05$). The number of leaves increased with the plant development in both seasons (Table 1). Kamleen and Wadhamid produced the highest number of leaves/plant and Zeidab gave the lowest number in both seasons.

Bulbing ratio

Significant differences among the six cultivars in bulbing ratio in the two seasons were observed. The cultivar Kamleen produced the highest bulbing ratio and cultivar Zeidab gave the lowest bulbing ratio (Table1).

Average bulbs fresh weight (g)

Analysis of variance showed significant differences among the six cultivars for bulb fresh weight in the two seasons. The highest bulb fresh weight was obtained by Wadhamid in the first season (174.3 g) and Kamleen in the second season (186.4 g). The lowest bulb fresh weight (151.1 g) was produced by the cultivar Zeidab (Table 1).

Average bulbs dry weight (g)

Table (1) shows significant differences among the six onion cultivars in the two seasons regarding bulb dry weight. Cultivar Kamleen produced the highest bulb dry weight in both seasons 23, 36 and 25, 62 (g), respectively, while the lowest bulb dry weight of 18.31 (g) in the first season and 20.79 (g) in the second season, was produced by cultivar Zeidab.

Total yield (t/ha)

Differences in the yield among the six cultivars were significant in both seasons (Table 1). Cultivar Kamleen produced the highest total yield followed by Wadhamid, El- Hilo and Saggai. While Abufrewa and Zeidab produced the lowest yield in both seasons.

Marketable yield (t/ha)

Table (1) showed significant differences among the cultivars in marketable yield. Kamleen cultivar produced the highest marketable yield of 13.28 and 15.71 t/ha in the first and second seasons, respectively, followed by El- Hilo and Saggai, while Wadhamid, Abufrewa and Zeidab cultivars produced lower marketable yield in both seasons.

Days to maturity

As presented in Table (3), cultivar Abufrewa matured early (after 134.3 days in the first season and 140.3 days in the second season) and Saggai matured late (after 172.2 days in the first season and 165,7 days in the second season).

Quality characters

Total soluble solids (TSS)

Differences among the six cultivars in TSS were significant in both seasons (Table 2). In the first growing season, Kamleen gave the highest TSS of 17.43 %, while in the second El-Hilo recorded the highest TSS of 17.78 %.

Meanwhile, the lowest TSS was obtained by Cultivar Zeidab (14.18%) in the first season and Wadhamid (15.07 %) in the second season.

Dry matter content (%)

Differences among six cultivars in dry matter content were not significant (Table 2). In both seasons Kamleen gave the highest dry matter content (15.73 % in the first season and 16.40 % in the second season), while the lowest dry mater was recorded by Wadhamid (13.95 %) in the first season and Abufrewa (13.88 %) in the second season.

Percentage of doubles and splits

Significant differences among the six cultivars were obtained regarding doubles and splits in the two seasons (Table 2). The cultivars Zeidab and Wadhamid produced the highest percentage of doubles and splits of 13.22 % and 15.77 % in the first and second seasons, respectively. On the other hand, cultivar Kamleen produced the lowest percent (7.83 %) in the first season and Saggai (9.83 %) in the second season.

Percentage of premature bolting

Table (2) shows that the differences among the six cultivars in premature bolting were significant in both seasons. Cultivar Zeidab produced the highest percentage of premature bolting of 9.83 % in the first season and 17.08 % in the second season while cultivar El-Hilo produced the lowest premature bolting in the second season (8.55 %).

Discussion

The six onion cultivars under study varied considerably in their growth components including the number of leaves/plant, bulbing ratio, bulb fresh

weight (g) and bulb dry weight (g). Cultivars differed in their yield that may be due to the fact that those cultivars differ in their genetic makeup which interacts differently with the prevailing environmental conditions as temperature, humidity and soil type. Such conclusion was indicated by Brewster (2008), who stated that successful onion bulb production depends mainly upon selection of cultivars. Cultivar Kamleen gave the highest number of leaves in both seasons, while cultivar Zeidab gave the lowest number of leaves. The number and size of leaves corresponds with high yields. These findings agreed with that of Gough *et al.* (2010) who reported that leaves production appears to be genetically controlled. Kamleen and Wadhamid showed a high percentage of bulbing ratios. The results accord with the findings of Mettananda and Fordham (1997) who reported that bulbing in onion is primarily controlled by photoperiod. They also showed that cultivars differ in their response to the length of the photoperiod. Differences among the six cultivars in premature bolting, in which Kamleen, Saggai and El-Hilo showed lowest percentage of bolting, while, cultivars Wadhamid, Abufrewa and Zeidab showed the highest percentage of bolting, was discussed earlier and related to different factors. Abdalla and El-Hassan (1977) reported that temperature from July to October in Sudan tend to promote leaves production resulting in large plants which are more susceptible to premature bolting when exposed to low temperature of the winter season. Brewster (2008) indicated that cultivars vary considerably in their tendency to bolt.

The total soluble solids of the six local onion cultivars studied in both seasons differed ranging between 14.18 % and 17.78 %. The dry matter content ranged between 13.88 % and 16.40 %. High total soluble solids and dry matter content which is positively correlated with good keeping quality, was indicated by Randle (1992) who observed that cultivars vary in dry matter from 3.03 to 20 %. Also Yoo *et al.* (2006), Simon (1995), Bedford (1999) and Sand Chope *et al.* (2007) reported that the accumulation of organo-sulphur compounds in onions depends upon many factors, the most important of which are sulphur-based fertilization, the environment and the genotype of the cultivars.

There were significant differences among the cultivars in percent doubling and splitting in both seasons. This is in an agreement with the finding of Ahmed (1984), who reported that the percentage of splitting differs from one cultivar to another.

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Table 1: Growth and yield performance of six local onion varieties during 2003/04 – 2004/0

Season		2003/04					2004/05					
Cultivars	Leaves/ plant	Bulbing rate (%)	Fresh weight (g)	Dry weight (g)	Total yield (t/ha)	Mar/ yield (t/ha)	Leaves/ plant	Bulbing rate (%)	Fresh weight (g)	Dry weight (g)	Total yield (t/ha)	Mar/ yield (t/ha)
Saggai	13	1.87	163.2	21.86	17.75	9.28	13	1.89	174.5	22.70	20.47	11.47
Kamleen	14	1.86	172.6	23.36	22.40	13.28	14	1.94	186.4	25.62	23.35	15.71
El-Hilo	13	1.93	158.6	18.63	19.35	12.78	13	1.84	165.7	25.24	19.94	13.85
Abufrewa	13	1.93	144.3	18.88	15.26	7.78	13	1.84	162.5	21.13	17.10	9.47
Wadhamid	14	1.91	174.3	21.45	19.66	5.55	14	1.91	183.1	28.04	21.87	9.57
Zeidab	12	1.86	151.1	18.31	14.16	5.47	12	1.77	162.2	20.79	14.95	7.50
C.V. (%)	6.72	3.01	5.27	10.27	12.46	18.20	6.72	4.12	7.22	12.88	10.20	20.91
LSD	1.0	0.07	10.07	2.51	1.13	0.84	1.0	0.09	14.51	3.66	1.00	1.18

Table 2: Quality evaluation of six local onion varieties during 2003/04 – 2004/05

Cultivars	2003/4				2004/5				
	TSS %	Dry mat %	Doub %	Bolt %	TSS %	Dry mat %	Doub %	Bolt %	Rott %
Saggai	15.88	15.12	9.08	8.69	16.12	14.9	9.83	9.08	3.47
Kamleen	17.45	15.73	7.83	6.90	17.20	16.4	9.85	8.55	2.67
El-Hilo	16.85	15.68	10.75	4.98	17.78	13.9	14.87	9.03	2.72
Abufrewa	15.17	15.35	11.17	9.62	15.75	13.8	13.17	14.17	2.70
Wadhami	14.27	13.95	13.14	7.48	15.07	15.3	15.77	13.57	5.52
Zeidab	14.18	14.17	13.22	9.83	15.62	14.7	15.15	17.08	4.40
C.V. (%)	7.22	9.24	14.34	15.55	8.60	13.3	13.4	18.52	31.02
LSD	1.34	1.65	1.85	1.46	1.66	2.37	2.08	2.62	1.32

Table 3: Days to maturity of six local onion varieties during 2003/04 – 2004/05

Variety	Season 2003/04	Season 2004/05
Saggai	172.0	165.7
Kamleen	162.2	158.0
Nassi	155.0	164.3
Abufrewa	134.3	140.3
Wadhamid	162.0	160.3
Zeidab	161.0	155.7
<i>SE</i> [±]	4.52	5.11
<i>C.V</i> (%)	21.8	23.9

Table 4: Temperature data during experimental period (2003– 2005)

Month	Season 2003/04	Season 2004/05
	(°C)	(°C)
October	39.2	41.7
November	39.0	40.6
December	37.1	33.5
January	35.9	34.2
February	40.3	37.3
March	42.0	38.7
April	41.7	41.5
May	46.6	44.3