

**SELECTION AND EVALUATION OF SOME BALADY AND CHINESE (SIDS-40)
 GARLIC "*Allium sativum* L." CLONES**

BY

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ABSTRACT

This investigation was carried out at Kaha Vegetables Research Farm, Hort. Res. Inst. during five seasons i.e. 2003/2004, 2004/2005, 2005/2006, 2006/2007 and 2007/2008 seasons to select and evaluate new clones from two local cultivars which are planted in Egypt i.e. purple Chinese cv. (Sids-40) and white garlic Balady cv. which were collected from different locations in Egypt in order to improve yield and quality of Egyptian garlic for both local consumption and exportation, also studying the chemical composition of the bulbs of selected clones. Significant differences were found among different selected clones concerning vegetative growth, yield, bulb characteristics, i.e., bulb weight, diameter, cloves number, clove weight in addition to chemical contents of the cloves i.e., nitrogen, phosphorus, potassium, calcium, sodium, protein and carbohydrate percentages. Some clones showed high degree of superiority in certain characteristics compared to other selected clones as follow:

A. Purple clones selected from Chinese garlic cv. Sids-40:

- 1- Clones St.₄₄, St.₃₅, St.₃₆ and St.₃₈ produced the highest total yield/fed and highest bulb weight.
- 2- Clones St.₄₄, St.₁₄ and St.₃₈ were characterized by lowest number of cloves per bulb besides the highest clove weight.

B. White clones selected from Balady cv.:

- 1- Clones Sil.₁₆, Sil.₁₅, Sil.₁₇ and Sil.₁₉ produced the highest total yield per feddan and the highest bulb weight.
- 2- Clones Sil.₁₁, Sil.₁₂, Sil.₁₈ and Sil.₁₇ produced the lowest cloves number per bulb while the highest clove weight was produced by clones Sil.₁₁, Sil.₁₂ and Sil.₁₇.

C. Chemical composition of cloves:

Concerning purple selected clones it was found that clone St.₃₆ was superior in nitrogen, calcium and protein percentage compared with clone St.₄₄, while clone St.₄₄ contained more potassium, sodium and carbohydrate than that of clone St.₃₆.

As for white selected garlic clones it was found that clones Sil.₁₀, Sil.₄ and Sil.₁₈ contained the highest percentage of nitrogen and protein but clone Sil.₁₀ was characterized by highest percentage of phosphorus and carbohydrate. The highest percentage of potassium was found in clones Sil.₁₈, Sil.₄ and Sil.₅ whereas clones Sil.₁₁, Sil.₁₉ and Sil.₁₈ were bioneer in calcium content, while clones Sil.₁₇ and Sil.₄ produced the highest percentage of sodium content.

Such variations that were observed among the different selected clones will be of great value in garlic breeding programs to develop new clones of garlic characterized by high yield and good quality for local consumption and exportation.

INTRODUCTION

Garlic "*Allium sativum* L." is known one of the important vegetable crops for local consumption as well as for export. in Egypt since pre- history, and is considered

The Egyptian growers used to save bulbs for planting from one season to the next. Such behavior led to deteriorating garlic productivity and quality. Increasing the productivity and quality of garlic is a national target and can be achieved by using high yielding cultivars and improving cultural practices (Gad El-Hak *et al.*, 1996).

Few genotypes of garlic are available because hybridization can not be carried out (Novak *et al.*, 1987) and garlic does not set seed under standard growing conditions (Volk *et al.*, 2004) and new genotypes have not been obtained through hybridization of spontaneous and induced mutations.

Several investigators worked on improving garlic. In this respect Menzes (1979), reported that breeding work on garlic is mainly concerned with studying the morphological variability resulting from the interaction between genotypes and environment effect.

Maksoud *et al.* (1984) and (Hassan and Osman, 1990), reported that Egyptian cv. was the tallest one, whereas Chinese garlic plants were the shortest, while American cv. was intermediate. Also, Hassan and Osman (1990), mentioned that the Egyptian cv. had the highest yield before and after the curing process. Lammerink (1988), selected better garlic clones from commercial cultivars, with high yields larger bulbs with fewer and larger cloves and high storage ability.

Several attempts have been carried under Egyptian conditions to improve garlic yield and quality (Osman and Abd El-Hamid, 1990 and 1994), Al-Zahim *et al.* (1997), Volk *et al.* (2004) and Abd El-Hamid *et al.* (2006) mentioned that the diversity of the clones is described by a set of phenotypic and morphological descriptors. The aim of the present study was to select new clones characterized by high yield with good quality to increase garlic exportation.

MATERIALS AND METHODS

This investigation was carried out at Kaha vegetables Research Farm, Hort. Res. Inst. It includes two parts:

Part.I. A selection program in Chinese purple garlic i.e. Sids-40 collected from two location i.e. Minia and Nubaria.

Part.II. A selection program in white garlic i.e. Balady cv. collected from five location i.e. Minia, Beni-Suef, Dakahlia, Gharbia and Senai governorates.

Part .I. Started in 2003 by choosing about two hundred bulbs from each source which were planted in 2002/2003 season and examined, then 44 bulbs with good quality were chosen and coded Star,1, Star,2....Star, 44 while, the other bulbs were discarded. Each bulb from the chosen bulbs were planted in one row as a clone and allowed to grow and produce bulbs. In 2003/2004 the produced bulbs of these clones were also examined and 23 clones with good quality were chosen and the other clones were discarded. The bulbs of the chosen clones were prepared and planted in 2004/2005 season and allowed to grow and produce bulbs. These bulbs were examined and the bulbs of 18 clones which were characterized by good

quality were chosen and the other clones were discarded. The chosen clones were planted and allowed to grow and produce bulbs. In 2005/2006 season the bulbs of 15 clones which were characterized by good quality were chosen and the other clones were discarded. The chosen clones were planted with the standard cv. in a randomized complete block design with three replicates during 2006/2007 and 2007/2008 seasons.

Part .II. Started in the season of 2003, with about one hundred and fifty white bulbs from each location and examined, then, 24 bulbs with good quality were chosen and the other bulbs were discarded, while the chosen bulbs were coded as clones Silver 1, Silver 2.....Silver 24 and each clone was planted in one row during the season of 2003/2004 and allowed to grow and produce bulbs. The produced bulbs were also examined and 20 clones were chosen according to their good quality, while the other clones were discarded. The chosen clones were planted in 2004/2005 season and allowed to grow and produce bulbs. The produced bulbs of these clones were examined and the clones of good quality

were chosen, while that of unfavorable quality were discarded. Sixteen clones of good quality were chosen and planted in 2005/2006 season and allowed to grow and produce bulbs. The produced bulbs of these clones were examined and planted in a randomized complete block design with three replicates with the standard cv. during 2006/2007 and 2007/2008 seasons.

Plot size either with purple garlic or with white garlic was 30m² (10 rows with 60cm width and 5m long). Planting date of purple clones was in the third week of October, in 2003/2004, 2004/2005, 2005/2006, 2006/2007 and 2007/2008, respectively, while planting date of white garlic was in the first week of October in 2003/2004, 2004/2005, 2005/2006, 2006/2007 and 2007/2008, respectively. The soil of the experimental area was sandy clay loam with pH 7.32. All agricultural treatments were applied according to the recommendations of the Ministry of Agriculture. Plants of the selected clones of white garlic balady cv. were harvested at the full maturity stage in the first week of April, while the selected clones of Chinese purple garlic Sids-40 were harvested in the second week of April during the seasons of study.

A. In 2003/2004, 2004/2005 and 2005/2006 seasons the following data were recorded on purple and white garlic after harvest.

A.I. Bulb characteristics:

- A.I.1. Bulb weight (B.W) g.
- A.I.2. Bulb diameter (B.D) cm.
- A.I.3. Cloves number per bulb(C. No.).
- A.I.4. Clove weight (C.W)g.

B. In 2006/2007 and 2007/2008 seasons the following data were recorded on clones of purple garlic and clones of white garlic:

B.I. Vegetative growth:

At 125 days after planting 10 plants were randomly taken from each plot and the following characters were measured.

- B.I.1. Plant height (P.H) cm.
- B.I.2. Leaves number (L. No)/plant.
- B.I.3. Leaves fresh weight (L.F.W.) g.
- B.I.4. Bulb fresh weight (B.F.W.) g.

- B.I.5. Plant fresh weight (P.F.W.) g.
- B.I.6. Neck diameter (N.D.) cm.
- B.I.7. Bulb diameter (B.D.) cm.
- B.I.8. Bulbing Ratio (B.R.). It is calculated as neck of bulb diameter over bulb diameter.

B.II. Fresh yield and bulb characteristics:

Fresh yield was estimated immediately after harvest and bulbs characters were measured by taken 150 bulbs from each clone (50 bulbs from each replicate) and the following data were recorded:

B.II.1. Fresh yield (F.Y.) expressed in Ton/fed.

B.II.2. Bulb characteristics:

- B.II.2.1. Bulb weight (B.W.) g.
- B.II.2.2. Bulb diameter (B.D) cm.
- B.II.2.3. Cloves number per bulb(C. No.).
- B.II.2.3. Clove weight (C.W.) g.

B.III. Chemical composition of cloves:

Nitrogen (N), Phosphorus (P), Potassium (K), Calcium (Ca), Sodium (Na), Protein and Carbohydrates percentage were determined in random samples from dry matter of selected clones bulbs at the end of storing period (for 6 months at room temperature) during 2007/2008 season for certain clones, i.e. St.₃₆, St.₄₄, Sil.₄, Sil.₅, Sil.₇, Sil.₁₀, Sil.₁₁, Sil.₁₂, Sil.₁₇, Sil.₁₈ and Sil.₁₉.

Nitrogen % was determined according to Plummer (1971). Phosphorus% was determined gravimetrically according to Jackson (1958). Potassium %, Calcium % and Sodium % were determined using the flame photometer as mentioned by Jackson (1958). Total carbohydrate (%) according to phenol sulphuric procedure, (Dubois *et al.*, 1956), Protein content was determined as nitrogen content and convert to its equivalent protein content by multiplying with 6.25 as described by Pregl (1945).

Statistical analysis:

The obtained data were statistically analyzed according to the procedure outlined by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Part .I. Selection program in Chinese purpal garlic i.e. Sids-40 cultivar:

In 2003/2004, 2004/2005 and 2005/2006 seasons, the clones of Chinese purpal garlic were selected according to their good bulb characteristics and free from diseases. In 2003/2004 season, 44 clones were selected Table (1), and in 2004/2005 season, 23 clones were selected as shown in Table (2), while Table (3) show bulb characteristics of 18 clones selected during 2005/2006 season.

A.I. Bulb characteristics:**A.I.1. Bulb weight (B.W) g.:**

Data presented in Table (1) illustrated that there were obvious differences in bulb weight among the selected clones in the season of 2003/2004. The highest bulb weight was produced by clones St.₄₄, St.₃₈, and St.₂₀. Their bulb weights were 106.50, 105.58, and 104.4g., respectively, while in 2004/2005 season clone St.₄₄ produced plants of the highest bulb weight followed by clone St.₃₈ and St.₃₆. Their bulb weight were 93, 90 and 89g., respectively, (Table 2). Concerning bulb weight in the season of 2005/2006, data in Table (3) show that clone St.₄₄ produced the highest B.W. followed by clones St.₃₆ and St.₂. Their bulb weights were 90, 86 and 85g., respectively.

A.I.2. Bulb diameter (B.D) cm.:

Data presented in Table (1) show that there were obvious differences in bulb diameter among the selected clones in the season of 2003/2004. The highest values of bulb diameter were obtained by clones St.₂₉, St.₃₂ and St.₃₆ (7.10cm).

Regarding B.D. in the season of 2004/2005, data presented in Table (2) indicate that the highest values of B.D. were obtained from clones St.₂ and St.₁. They produced bulbs with diameters of 7.46 and 7cm. respectively. With regard to B.D. in the season of 2005/2006, it is clear from data presented in Table (3) that the highest values of B.D. were obtained from clones St.₃₆ and St.₃₈. They produced bulbs with diameters of 6.90 and 6.80cm., respectively.

A.I.3. Cloves number per bulb(C. No.):

It is well known that the lower cloves number per bulb, the better bulb quality.

Data presented in Table (1) show that there were differences among the selected clones in the season of 2003/2004. Clones St.₂₈, St.₃₄ and St.₈ produced the lowest (C. No.)/bulb i.e., 12, 13 and 13 cloves per bulb, respectively.

Concerning the season of 2004/2005, data presented in Table (2) show that the lowest values of (C. No.)/bulb were obtained from clones St.₁₄ and St.₄₄. They produced 11 and 13 cloves per bulb, respectively.

Regarding C.No./bulb in the season of 2005/2006, it is clear from data presented in Table (3) that clones St.₁₄, St.₂₇, St.₄₄ and St.₃₀ produced the lowest cloves number, i.e., 11.2, 13, 13 and 14.33 cloves per bulb, respectively.

A.I.4. Clove weight (C.W)g.:

It is clear from data shown in Table (1) that in the season of 2003/2004, there were obvious variations among the selected clones in clove weight. The highest C.W. was produced by clones St.₂₁ and St.₄₄. Their average clove weight values were 7.70 and 7 respectively, while in 2004/2005 season clone St.₄₄ produced the highest clove weight followed by clone St.₃₈. They produced cloves of weight 6.70 and 5.32g., respectively, (Table 2).

Concerning clove weight in 2005/2006 season, data presented in Table (3) indicate that clone St.₄₄ produced the highest (C.W.) followed by clone St.₆. Their clove weight were 6.77 and 5.92g., respectively. The variation among the selected clones in bulb characters i.e. bulb weight and diameter, cloves number per bulb and clove weight are in line with those obtained by Lee and Kim (1977). Osman and Abd El-Hamid (1990) and Abd El-Hamid *et al.* (2006).

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Table (1): Bulb characteristics of Chines garlic (Sids-40) selected clones in 2003/2004 season.

Clone	Bulb weight (g)	Bulb diameter (cm)	Cloves number per bulb	Clove weight (g)
*St. ₁	81.5	6.80	22.00	3.48
St. ₂	61.00	5.95	13.50	4.40
St. ₃	88.00	5.60	19.50	4.54
St. ₄	74.58	4.81	17.17	2.30
St. ₅	60.00	5.40	20.50	2.87
St. ₆	89.50	6.76	16.00	3.76
St. ₇	55.75	5.15	19.50	3.14
St. ₈	76.50	6.30	13.00	5.62
St. ₉	81.16	6.00	18.00	4.32
St. ₁₀	57.00	5.56	17.00	3.24
St. ₁₁	65.75	6.10	16.50	5.17
St. ₁₂	57.00	5.90	17.50	3.16
St. ₁₃	61.00	5.85	20.50	3.01
St. ₁₄	85.66	5.03	19.00	4.02
St. ₁₅	79.31	6.10	15.00	4.50
St. ₁₆	86.50	6.35	19.00	4.46
St. ₁₇	68.70	6.10	16.00	4.11
St. ₁₈	81.00	6.75	17.50	4.40
St. ₁₉	83.00	6.70	20.50	3.93
St. ₂₀	104.40	4.50	16.40	5.67
St. ₂₁	86.67	4.27	10.03	7.70
St. ₂₂	80.67	6.80	17.00	4.60
St. ₂₃	64.33	6.06	14.00	4.92
St. ₂₄	70.75	5.90	16.00	4.22
St. ₂₅	86.50	5.00	16.00	3.35
St. ₂₆	78.33	6.33	18.67	4.60
St. ₂₇	72.33	6.23	15.00	4.60
St. ₂₈	53.50	5.40	12.00	4.29
St. ₂₉	88.25	7.10	16.00	5.19
St. ₃₀	88.00	6.60	14.00	6.00
St. ₃₁	62.00	6.10	16.00	3.70
St. ₃₂	91.00	7.10	18.50	4.76
St. ₃₃	85.50	6.80	18.67	4.46
St. ₃₄	74.50	6.20	13.00	5.63
St. ₃₅	74.17	6.16	16.33	4.38
St. ₃₆	97.25	7.10	19.50	4.82
St. ₃₇	72.83	6.40	18.00	3.83
St. ₃₈	105.58	6.80	13.67	6.57
St. ₃₉	94.00	6.80	20.00	4.44
St. ₄₀	86.83	6.53	18.33	4.32
St. ₄₁	63.00	5.00	18.80	3.17
St. ₄₂	70.20	4.54	18.20	3.57
St. ₄₃	70.10	6.36	15.80	4.34
St. ₄₄	106.50	6.85	13.60	7.00
**Cont.	73.00	4.20	18.00	3.63

*St.: Star.

**Cont: The common used variety (Sids-40).

Table (2): Bulb characteristics of Chines garlic (Sids-40) selected clones in 2004/2005 season.

Clone	Bulb weight (g)	Bulb diameter (cm)	Cloves number per bulb	Cloves weight (g)
*St. ₁	84.00	7.00	19.90	3.66
St. ₂	73.30	7.46	20.00	3.50
St. ₃	56.60	5.50	14.00	3.80
St. ₆	81.60	6.44	18.80	4.15
St. ₈	72.60	5.94	17.20	3.60
St. ₁₄	54.00	4.60	11.00	3.73
St. ₁₆	60.00	5.10	14.00	4.41
St. ₁₉	85.00	6.40	17.50	4.71
St. ₂₀	58.50	5.26	13.80	3.57
St. ₂₇	69.00	5.57	18.50	3.73
St. ₂₉	73.00	6.20	15.00	4.00
St. ₃₀	78.86	6.09	17.80	4.05
St. ₃₁	57.00	5.44	14.20	3.86
St. ₃₂	61.50	5.49	17.00	3.47
St. ₃₃	82.50	6.25	16.25	4.89
St. ₃₄	65.2	5.84	15.60	3.88
St. ₃₅	80.00	5.90	16.30	4.72
St. ₃₆	89.00	5.90	18.00	4.90
St. ₃₇	66.00	6.82	15.60	3.91
St. ₃₈	90.50	6.40	16.00	5.32
St. ₄₁	74.00	5.83	20.10	3.51
St. ₄₃	70.00	5.90	20.00	3.30
St. ₄₄	93.00	6.80	13.00	6.70
**Cont.	50.00	4.60	17.00	3.01

Table (3): Bulb characteristics of Chines garlic (Sids-40) selected clones in 2005/2006 season.

Clone	Bulb weight (g)	Bulb diameter (cm)	Cloves number per bulb	Clove weight (g)
*St. ₁	80.50	5.90	20.00	3.95
St. ₂	85.00	6.06	17.00	4.75
St. ₃	76.00	6.00	15.00	5.10
St. ₆	80.42	6.17	13.17	5.92
St. ₈	71.00	6.50	16.00	4.38
St. ₁₄	70.40	5.78	11.20	5.65
St. ₁₆	75.00	6.00	17.00	4.12
St. ₁₉	77.66	5.77	15.25	4.19
St. ₂₇	66.00	5.60	13.00	4.92
St. ₂₉	78.25	6.20	15.50	4.85
St. ₃₀	79.00	5.93	14.33	5.18
St. ₃₁	65.10	5.60	16.00	3.63
St. ₃₅	82.00	6.00	15.00	5.33
St. ₃₆	86.00	6.90	18.00	4.67
St. ₃₈	82.00	6.80	17.00	4.79
St. ₄₁	75.25	6.05	17.75	4.05
St. ₄₃	71.22	5.70	14.33	4.64
St. ₄₄	90.00	6.50	13.00	6.77
**Cont.	61.00	5.50	20.00	2.90

*St.: Star.

**Cont: The common used variety (Sids-40).

Part .II. Selection program in white garlic i.e. Balady cultivar:

In 2003/2004, 2004/2005 and 2005/2006 seasons, clones of white garlic cv. balady were selected according to their good bulb characteristics specially lowest number of cloves per bulb besides highest weight of clove and bulb, also high yield and bulbs free from diseases. In 2003/2004 season, 23 clones were selected as shown in Table (4), in next season 2004/2005, 18 clones were selected as shown in Table (5), while Table (6) show bulb characteristics of 15 clones selected during 2005/2006 season.

A.I. Bulb characteristics:

A.I.1. Bulb weight (B.W) g.:

Data presented in Table (4) show that there were obvious differences in bulb weight among the selected clones of Balady cv. in the season of 2003/2004 season. The highest bulb weight was produced by clones Sil.₁₆, Sil.₁₅ and Sil.₁₇. Their average bulb weight values were 88.6, 86 and 85.19g., respectively, while in 2004/2005 season clone Sil.₁₇ produced plants of the highest bulb weight followed by clones Sil.₁₆ and Sil.₁₉. Their bulbs weight were 93.50, 92 and 84.64g., respectively, (Table 5).

Regarding the bulb weight in the season of 2005/2006, it is clear from data presented in Table (6) that clones Sil.₁₆, Sil.₁₇ and Sil.₁₉ produced the highest bulb weight values, i.e., 92.5, 90.2 and 90g., respectively.

A.I.2. Bulb diameter (B.D) cm.:

It is clear from data presented in Table (4) that there were clear differences in B.D. among the selected Balady clones in the season of 2003/2004. The highest values of this trait were obtained from clones Sil.₁₆ and Sil.₁₇. They produced bulbs with diameter of 6.54 and 6.5cm., respectively, while in 2004/2005 season clone Sil.₁₇ produced plants with highest (B.D.) followed by clones Sil.₁₆ and Sil.₁₉, which produced bulb values of 7, 6.8 and 6.7cm., respectively (Table 5).

With regard to B.D. in the season of 2005/2006, it is clear from data presented in Table (6) that the heights values of B.D. were obtained from clones Sil.₁₉ and Sil.₁₁. They produced bulbs with diameter of 6.5 and 6.4cm., respectively.

A.I.3. Cloves number per bulb (C. No./bulb):

It is clear from data shown in Table (4) that in the season of 2003/2004, there were obvious variations among the selected clones in C. No./bulb. Clone Sil.₁₁, produced the lowest C. No/bulb i.e., 17.33 cloves per bulb, while in 2004/2005 season clones Sil.₁₁ and Sil.₁₄, produced the lowest number of cloves i.e., 10 and 24, cloves per bulb, respectively (Table 5).

Regarding C. No./bulb in the season of 2005/2006, it is clear from data presented in Table (6) that clones Sil.₁₁ and Sil.₁₂, produced the lowest cloves number, i.e. 12 and 24, cloves per bulb, respectively.

A.I.4. Clove weight (C.W)g.:

Data presented in Table (4) indicate that there were obvious variations in clove weight among the selected clones in the season of 2003/2004. The highest values of C.W. were 4.1 and 2.59g. These values were produced by clones Sil.₁₁ and Sil.₁₂, while in 2004/2005 season clone Sil.₁₁ produced the highest C.W. It produced C.W. 6.02g., (Table 5). Concerning C.W. in 2005/2006 season, data presented in Table (6) revealed that clone Sil.₁₁ produced the highest C.W. Its clove weight was 5.75g.

B. In 2006/2007 and 2007/2008 the following results on purple garlic (Sids-40) selected clones were:

B.1. Vegetative growth:

B.1.1. Plant height (P.H.)cm.:

It is clear from data illustrated in Table (7), that there were significant differences among plant height of the selected clones in both seasons of study. In 2006/2007 season the highest P.H. value was obtained from clone St.₄₄ (94.33cm.), while the lowest P.H. value was recorded by clone St.₁₄ (76.67cm.). In 2007/2008 season the highest P.H. (88.33cm.) was produced by clone St.₃₆, while the lowest P.H. was obtained from clone St.₁₄ (62.33). There were significant differences between St.₄₄ and all other selected clones except clone St.₆ for this trait in 2006/2007 season, while in 2007/2008 season, there were no significant differences among clones St.₃₆, St.₁₉, St.₂₇, St.₃₈, St.₄₄, St.₈ and St.₃₅, but there were significant differences among clones St.₁₆, St.₁₉, St.₂₇, St.₃₈ and all other selected clones with exception to clones St.₄₄, St.₈, and St.₃₅. The obtained results agree with those obtained by Osman and Abd El-Hamid (1990, 1994) and Abd El-Hamid *et al.* (2006).

Table (4): Bulb characteristics of Balady garlic selected clones in 2003/2004 season.

Clone	Bulb weight (g)	Bulb diameter (cm)	Cloves number per bulb	Clove weight (g)
*Sil. ₁	61.00	5.55	54.25	0.93
Sil. ₂	65.00	5.60	35.00	1.43
Sil. ₃	74.00	5.40	40.00	1.50
Sil. ₄	57.00	5.80	34.00	1.62
Sil. ₅	71.00	6.20	54.00	1.18
Sil. ₆	55.83	5.50	43.33	0.80
Sil. ₇	84.43	6.10	41.00	1.66
Sil. ₈	47.00	5.30	43.00	0.68
Sil. ₉	74.23	5.80	35.50	1.54
Sil. ₁₀	59.00	5.70	35.00	1.53
Sil. ₁₁	79.33	6.30	17.33	4.10
Sil. ₁₂	78.00	6.10	27.00	2.59
Sil. ₁₃	55.00	5.00	35.00	1.43
Sil. ₁₄	77.60	6.20	32.00	2.28
Sil. ₁₅	86.00	6.13	47.60	1.64
Sil. ₁₆	88.60	6.54	39.00	1.92
Sil. ₁₇	85.19	6.50	36.00	1.94
Sil. ₁₈	67.00	5.80	26.00	2.26
Sil. ₁₉	84.00	5.70	42.00	1.76
Sil. ₂₀	76.50	6.40	54.75	1.30
Sil. ₂₁	70.66	5.95	53.66	1.10
Sil. ₂₂	74.60	6.13	53.66	1.27
Sil. ₂₃	79.00	6.31	52.33	1.38
Sil. ₂₄	64.18	5.98	43.00	1.38
**Cont.	50.00	5.60	46.00	1.03

Table (5): Bulb characteristics of selected Balady garlic clones in 2004/2005 season.

Clone	Bulb weight (g)	Bulb diameter (cm)	Cloves number per bulb	Clove weight (g)
*Sil. ₁	77.00	6.30	41.40	1.81
Sil. ₂	57.00	5.50	37.80	1.46
Sil. ₃	75.00	6.10	40.25	1.73
Sil. ₄	55.50	5.45	48.30	1.09
Sil. ₅	70.00	6.10	37.00	1.78
Sil. ₆	55.00	5.80	42.00	1.29
Sil. ₇	70.00	6.00	38.00	1.79
Sil. ₈	64.00	5.50	45.00	1.20
Sil. ₉	69.00	6.00	40.00	1.40
Sil. ₁₀	56.00	5.50	30.00	1.67
Sil. ₁₁	79.80	5.92	10.00	6.02
Sil. ₁₂	75.00	6.10	27.00	2.59
Sil. ₁₃	65.00	5.70	28.00	2.20
Sil. ₁₄	66.00	6.00	24.00	2.70
Sil. ₁₅	74.66	5.97	48.00	1.60
Sil. ₁₆	92.00	6.80	37.55	1.89
Sil. ₁₇	93.50	7.10	33.50	2.79
Sil. ₁₈	55.00	5.55	25.00	2.00
Sil. ₁₉	84.64	6.70	42.00	1.76
Sil. ₂₀	73.66	6.50	52.00	1.20
**Cont.	55.00	4.90	47.00	1.08

*Sil.: Silver.

**Cont: The common used variety (Balady).

Table (6): Bulb characteristics of selected Balady garlic clones in 2005/2006 season.

Clone	Bulb weight (g)	Bulb diameter (cm)	Cloves number per bulb	Clove weight (g)
*Sil. ₁	70.00	4.90	39.00	1.60
Sil. ₃	73.00	5.70	37.00	1.50
Sil. ₄	53.00	5.40	35.00	1.46
Sil. ₅	80.00	5.90	34.00	1.76
Sil. ₇	82.50	6.15	38.50	1.88
Sil. ₉	70.00	5.60	48.00	1.40
Sil. ₁₀	70.00	5.50	36.00	1.67
Sil. ₁₁	78.00	6.40	12.00	5.75
Sil. ₁₂	75.00	5.78	24.00	1.79
Sil. ₁₄	65.00	5.40	45.00	1.22
Sil. ₁₅	80.00	6.10	47.50	1.75
Sil. ₁₆	92.50	6.35	35.00	2.01
Sil. ₁₇	90.20	6.32	31.80	2.42
Sil. ₁₈	75.00	5.90	31.00	2.09
Sil. ₁₉	90.00	6.50	44.00	1.81
Sil. ₂₀	75.00	5.33	55.00	1.03
**Cont.	60.00	5.00	48.00	1.05

*Sil.: Silver.

**Cont: The common used variety (Balady).

B.1.2. Leaves number per plant (L. No./plant):

Data in Table (7) indicate that there were significant differences among the selected clones in this trait in both seasons of study. The highest L. No./plant in 2006/2007 season was produced by clone St.₄₄ and clone St.₃₆ (11 leaves/plant) while the lowest L. No./plant was produced by clone St.₃₁ (9). In 2007/2008 season, the highest L. No./plant was produced by clones St.₄₄, St.₃₈, St.₃₀, St.₁₆ and St.₈, which produced the same number of leaves per plant (9.00 leaves/plant), while the lowest number of leaves in this season was produced by clones St.₁, St.₃ and St.₃₁ (7.33 leaves/plant). There were no significant differences in the 2006/2007 season among clones St.₄₄, St.₃₆, St.₃₈, St.₁₆, St.₃₅, St.₃₀, St.₁₉, St.₁₄, St.₈ and St.₆ in L. No./plant, but clones St.₄₄ and St.₁ surpassed significantly clones St.₃, St.₂₇, St.₃₆, St.₂, control and St.₃₁ in this trait, but in 2007/2008 season, there were no significant differences among clones St.₄₄, St.₃₈, St.₈, St.₁₆, St.₃₀, St.₂₇, cont., St.₃₆ and St.₂, while clones St.₄₄, St.₃₈, St.₈, St.₁₆ and St.₃₀ surpassed significantly clones St.₁₉, St.₆, St.₁₄, St.₃₅, St.₁, St.₃ and St.₃₁. These results agree with those obtained by Osman and Abd El-Hamid (1990,1994), Soliman (1992), Gad El-Hak *et al.* (1996), Kasim and El-Ghadban

(2002) and Abd El-Hamid *et al.* (2006), who found significant differences between the selected clones and the standard variety.

B.1.3. Leaves fresh weight (L.F.W.) g.:

Data in Table (7) indicate that there were significant differences in L.F.W. of the selected clones in both seasons of study. The highest value of this trait in 2006/2007 season was obtained from clone St.₄₄ (143.67g.), while the lowest value of this trait was obtained from clone St.₁₆ (72.67). In 2007/2008 season clone St.₄₄ produced the highest value of L.F.W. (114.00g.) while the lowest L.F.W. was produced by cont. (34.67g.). In 2006/2007 season clone St.₄₄ surpassed significantly clones St.₃₈, cont., St.₂, St.₃₁, St.₁₉, St.₃, St.₃₀, St.₁₄, St.₁ and St.₁₆ in this trait, while in 2007/2008 season, there were no significant differences among clones St.₄₄, St.₃₈, St.₃₆, St.₂ and St.₂₇, but these clones surpassed significantly clones St.₈, St.₃₀, St.₃, St.₁, St.₆, St.₃₁, St.₁₆, St.₁₄ and cont. The presented results agree with those obtained by Osman and Abd El-Hamid (1990, 1994) and Kasim and El-Ghadban (2002).

B.1.4. Bulb fresh weight (B.F.W.) g.:

It is clear from data presented in Table (7), that there were significant diffe-

rences in B.F.W. of the selected clones in both seasons of study. In 2006/2007 season, the highest value of B.F.W. was produced by clone St.₄₄ (44.00g.), while the lowest value of B.F.W. in the same season was produced by clone St.₂ (21.00g.). The highest value of this trait in 2007/2008 season (79.00g.) was produced by clone St.₄₄, while the lowest value of this trait in the same season was produced by cont. (18.33g.). In 2006/2007 season there were significant differences in B.F.W. between clone St.₄₄ and all other selected clones with exception of clone St.₁₉. Also, there were significant differences in this trait between clone St.₆ and clones St.₃₁, St.₂₇, St.₁, cont. and St.₂. In 2007/2008 season clone St.₄₄ surpassed significantly all other selected clones followed by clone St.₃₆ which surpassed significantly all other selected clones, while all selected clones surpassed significantly the control in this trait. The obtained results agree with that obtained by Osman and Abd El-Hamid (1990,1994) and Kasim and El-Ghadban (2002).

B.1.5. Plant fresh weight (P.F.W.) g.:

Data illustrated in Table (7) indicate that there were significant differences among the selected clones in P.F.W. in both seasons of study. In 2006/2007 season clone St.₄₄ produced the highest value of P.F.W. (187.67g.), while the lowest value of P.F.W. in the same season was obtained from clone St.₁₆ (101.34). In 2007/2008 season, the highest value of P.F.W. (193.00g.) was produced by clone St.₄₄, while the lowest value of P.F.W. in the same season was produced by cont (53.00). In 2006/2007 season, there were no significant differences among clones St.₄₄, St.₆, St.₈ and St.₃₆, but St.₄₄ surpassed all other selected clones and control in this trait. In 2007/2008 season also clone St.₄₄ surpassed significantly all other selected clones and control in P.F.W. Also, all selected clones surpassed significantly control in P.F.W. in the same season. The obtained results agree with those obtained by Osman and Abd El-Hamid (1994), who recorded highly significant differences in P.F.W. due to clones.

B.1. 6. Neck diameter (N.D.) cm.:

Concerning N.D., it is clear from data in Table (7) that there were significant differences in N.D. of the selected clones in both seasons of study. In 2006/2007 season,

the highest N.D. was obtained by clones St.₃₅ and St.₄₄ (1.93cm.), while the lowest N.D. in the same season was produced by clone St.₁ (1.47cm.). The highest N.D. in 2007/2008 season was produced by clone St.₄₄ (1.87cm.) while the lowest N.D. in the same season was produced by clone St.₃₁ (1.13). It is clear from the same data of 2006/2007 season that N.D. of clone St.₁ was significantly lower than those of clones St.₃₅, St.₄₄, St.₂₇ and St.₃₆, while in 2007/2008 season there were no significant differences in N.D. between St.₄₄, St.₈, St.₁ and St.₂₇, but these clones surpassed significantly N.D. of clones St.₁₆, St.₆, St.₁₉, cont., St.₃₅, St.₃₆, St.₁₄ and St.₃₁. The obtained results are in harmony with those recorded by Osman and Abd El-Hamid (1994) and Kasim and El-Ghadban (2006) who found significant differences in N.D. of the selected clones.

B.1.7. Bulb diameter (B.D.) cm.:

Data in Table (7) indicate clearly that there were significant differences in B.D. of the selected clones in both seasons of study. The highest B.D. was produced by clone St.₄₄ (4.67cm.), while the lowest B.D. in the same season was obtained from clone St.₂ (3.3cm.). In 2007/2008 season the highest value of B.D. was produced by clone St.₃₈ (3.77cm.), while the lowest value of B.D. in the same season was produced by clone St.₁₆ (2.33cm.).

B.1. 8. Bulbing Ratio (B.R.):

Bulbing ratio (B.R.) is considered one of the points which are used to determine harvest date of garlic i.e. the lower value of B.R. the earlier harvest date.

Data presented in Table (7) indicate clearly that there were significant differences in B.R. of the selected clones in both seasons of study. In 2006/2007 season, the lowest value of B.R. was obtained from clone St.₁₄ (0.36), while the highest value of B.R. in the same season was obtained from clone St.₂₇ (0.54). The lowest value of B.R. in 2007/2008 season was produced by clone St.₃₆ (0.36), while the highest value of B.R. in the same season was obtained from clone St.₁ (0.61). In 2006/2007 season there were no significant differences in B.R. of the selected clones St.₂₇, St.₃₅, St.₂, cont and clone St.₃₆, but these clones produced significantly higher B.R. than that produced by St.₁₄. In 2007/2008 season there

were no significant differences in B.R. values of clones St.₁, St.₈, St.₆, St.₄₄, but B.R. values of these clones were significantly higher than those of clones St.₃₀, St.₃₁, St.₃₈, St.₃₅, St.₁₄, cont. and St.₃₆. The obtained results agree with those reported by Osman and Abd El-Hamid (1990), Kasim and El-Ghadban (2002) and Abd El-Hamid *et al.* (2006), who found significant differences among B.R. of the selected clones.

B.II. Fresh yield and bulb characteristics:

B.II.1. Fresh yield (F.Y.) ton/fed.:

Data in Table (8), indicate that there were significant differences in F.Y. of the selected clones in both seasons of study. In 2006/2007 season, the highest F.Y. was produced by clone St.₄₄ (17.87) ton/fed. followed by clones St.₃₆ (14.58), St.₃₅ (14.47) and St.₃₈ (14.06) ton/fed., while the lowest F.Y. value in this season was obtained by cont. (10.17) ton/fed. Clone St.₄₄ surpassed significantly all other selected clones while, clones St.₃₆, St.₃₅, and St.₃₈ surpassed significantly clones St.₂₇, St.₁₆, St.₁, St.₃₀, St.₁₄, St.₃₁, St.₂ and cont. In 2007/2008 season, the highest F.Y. was produced by clone St.₄₄ (14.23) ton/fed. followed by clones St.₃₆ (14.00), St.₃₈ (13.42) and St.₃₅ (12.48) ton/fed., while the lowest F.Y. value was obtained by cont. (8.91) ton/fed. There were no significant differences among clones St.₄₄, St.₃₆ and St.₃₈, but these clones surpassed significantly clones St.₆, St.₁₄, St.₃₀, St.₁₉, St.₈, St.₂₇, St.₂, St.₃₁, St.₁₆ and cont. The obtained results agree with that obtained by Osman and Abd El-Hamid (1990, 1994) who mentioned that these differences may be attributed to differences of superiority of the genetic pool of the clones and subsequently good utilization of nutrients and other growing factors.

B.II.2. Bulb characteristics:

B.II.2.1. Bulb weight (B.W.)g.:

Data in Table (8) indicate the differences in bulb fresh weight of the selected clones in the seasons of 2006/2007 and 2007/2008. These differences were significant in both seasons of study. Clone St.₄₄ produced the highest B.W. in both seasons of study. It produced bulb weight (117g.) followed by clones St.₃₆ (94.17g.), St.₃₈ (90.5g.) and St.₃₅

(90.0g.), while the lowest bulb weight was produced by the control (69.0g.) in 2006/2007 season. In 2007/2008 season the highest B.W. (91.67g.) was produced by clone St.₄₄ followed by clones St.₃₆ (91.33g.), St.₃₈ (88.83g.) and St.₃₅ (83.67g.), while the lowest bulb weight (58.33g.) was produced by the control. These results agree with those obtained by Osman and Abd El-Hamid 1994, Kasim and El-Ghadban, 2002 and Abd El-Hamid *et al.* (2006).

B.II.2.2. Bulb diameter (B.D.)cm.:

Concerning bulb diameter it is clear from data in Table (8) that there were significant differences in bulb diameter of the selected clones in both seasons of study. In 2006/2007 season, the highest B.D. was produced by clone St.₄₄ (7.12cm) followed by clones St.₃₆ (6.58), St.₃ and St.₈ (6.55), while the lowest bulb diameter was produced by clone St.₃₅ (5.20). In 2007/2008 season, the highest B.D. (6.50cm) was produced by clones St.₄₄ and St.₃ (6.50) followed by clone St.₂₇ (6.37), while the lowest B.D. was produced by clone St.₃₁ (5.28). These results agree with those obtained by Osman and Abd El-Hamid (1990,1994), Kasim and El-Ghadban (2002) and Abd El-Hamid *et al.* (2006).

B.II.2.3. Cloves number per bulb (C. No./bulb:

Data in Table (8) indicate that there were significant differences in cloves number per bulb of the selected clones in both seasons of study. In 2006/2007 season, the lowest cloves number per bulb (14.29) was produced by clone St.₄₄ followed by clones St.₁₄ (14.67) and St.₃₈ (15.00), while the highest number of cloves per bulb was produced by the cont. (19.50). In 2007/2008 season, the lowest number of cloves per bulb (12.67) was produced by clone St.₄₄ followed by clones St.₁₆ (15.67), St.₁₄ (15.90), St.₃₈ (16.47), while the highest cloves number per bulb was produced by clone St.₂ (19.50). These results agree with those obtained by Osman and Abd El-Hamid (1990,1994), Kasim and El-Ghadban (2002) and Abd El-Hamid *et al.* (2006) who mentioned that there were differences among clones and ecotypes of garlic .

Table (7): Vegetative growth of chines garlic (Sids-40) selected clones during 2006/2007 and 2007/2008 seasons.

Clone	Plant height		No. of leave (cm)		Leaves fresh weight (g)		Bulb fresh weight (g)		Plant fresh weight (g)		Neck diameter (cm)		Bulb diameter (cm)		Bulbing ratio	
	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/2008
*St. ₁	80.33	64.67	9.67	7.33	79.00	76.67	24.33	33.33	103.33	110.00	1.47	1.80	3.63	2.97	0.40	0.61
St. ₂	86.33	69.00	9.30	8.33	96.00	109.33	21.00	36.67	117.00	146.00	1.63	1.67	3.30	3.20	0.50	0.52
St. ₃	81.67	76.33	9.67	7.33	94.00	90.00	32.67	40.00	126.67	130.00	1.76	1.53	3.97	2.97	0.44	0.52
St. ₆	89.00	70.33	10.00	7.67	114.33	76.67	35.00	33.33	149.33	110.00	1.67	1.43	4.17	2.53	0.40	0.57
St. ₈	87.33	81.67	10.00	9.00	116.33	93.33	31.33	36.67	147.66	130.00	1.76	1.80	4.00	3.07	0.44	0.59
St. ₁₄	76.67	62.33	10.00	7.67	86.00	43.33	34.00	26.67	120.00	70.00	1.53	1.16	2.40	2.86	0.36	0.41
St. ₁₆	82.67	66.67	10.33	9.00	72.67	51.67	28.67	35.00	101.34	86.67	1.73	1.23	3.93	2.33	0.44	0.53
St. ₁₉	79.67	85.00	10.00	8.00	95.00	105.00	36.67	32.67	131.67	137.67	1.73	1.43	4.23	2.87	0.41	0.50
St. ₂₇	83.33	85.00	9.67	8.67	121.33	105.67	25.33	36.67	146.66	142.34	1.90	1.80	3.53	3.33	0.54	0.54
St. ₃₀	80.67	75.00	10.00	9.00	86.33	92.33	28.00	43.33	114.33	135.66	1.60	1.53	3.77	3.33	0.42	0.46
St. ₃₁	79.67	68.33	9.00	7.33	95.33	63.33	26.00	30.00	121.33	93.33	1.70	1.13	3.83	2.47	0.44	0.46
St. ₃₅	82.67	81.33	10.00	7.67	108.33	101.00	27.00	41.67	135.33	142.67	1.93	1.43	3.83	3.47	0.50	0.41
St. ₃₆	87.66	88.33	11.00	8.33	115.00	111.67	31.67	51.00	146.67	162.67	1.87	1.23	4.03	3.37	0.46	0.36
St. ₃₈	82.33	84.67	10.50	9.00	98.00	112.00	32.00	41.67	130.00	153.67	1.60	1.70	3.97	3.77	0.40	0.45
St. ₄₄	94.33	83.33	11.00	9.00	143.67	114.00	44.00	79.00	187.67	193.00	1.93	1.87	4.67	3.37	0.41	0.55
**Cont.	83.33	66.67	9.33	8.67	96.00	34.67	22.00	18.33	118.00	53.00	1.63	1.27	3.50	3.23	0.47	0.39
L.S.D. at 5%	6.54	7.05	1.17	0.72	38.77	8.78	8.38	7.57	44.98	15.18	0.34	0.23	0.56	0.39	0.08	0.07

*St.: Star.

**Cont: The common used variety (Sids-40).

Table (8): Fresh yield and its components of Chinese garlic (Sids-40) selected clones during 2006/2007 and 2007/2008 seasons.

Clone	Yield ton/fed		Bulb weight (g)		Bulb diameter (cm)		Cloves number per bulb		Clove/weight (g)	
	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08
*St. ₁	12.04	12.25	77.92	81.67	6.17	6.30	16.67	18.00	4.32	4.21
St. ₂	10.57	11.08	69.83	69.83	5.75	5.30	18.67	19.50	3.82	3.46
St. ₃	13.53	12.37	87.33	83.33	6.55	6.50	16.67	17.90	4.86	4.27
St. ₆	13.47	12.13	89.83	81.17	6.25	5.98	15.85	17.67	5.27	4.05
St. ₈	13.49	11.55	87.67	76.00	6.55	5.98	15.50	17.92	5.71	3.78
St. ₁₄	11.67	11.88	78.33	75.83	6.13	5.78	14.67	15.90	5.70	4.57
St. ₁₆	12.13	9.33	79.33	62.67	5.83	5.67	15.75	15.67	4.81	3.62
St. ₁₉	13.18	11.62	84.83	77.00	6.33	6.00	16.11	17.33	5.02	4.06
St. ₂₇	12.39	11.18	80.33	75.50	5.90	6.37	16.33	17.58	4.52	3.98
St. ₃₀	11.74	11.67	76.93	78.33	5.83	5.93	17.94	18.42	4.14	4.01
St. ₃₁	11.41	9.45	75.67	62.50	5.75	5.28	18.67	17.92	3.82	3.09
St. ₃₅	14.47	12.48	90.00	83.67	5.20	5.97	16.67	16.50	5.14	4.36
St. ₃₆	14.58	14.00	94.17	91.33	6.58	6.30	17.00	18.00	5.28	4.54
St. ₃₈	14.06	13.42	90.50	88.83	6.27	5.93	15.00	16.47	5.81	5.14
St. ₄₄	17.87	14.23	117.00	91.67	7.12	6.50	14.29	12.67	7.69	6.26
**Cont.	10.17	8.91	69.00	58.33	5.70	5.37	19.50	19.33	3.29	2.92
L.S.D. at 5%	1.55	1.21	8.24	6.18	0.54	0.41	2.77	2.77	0.89	0.66

*St.: Star.

**Cont: The common used variety (Sids-40).

B.II.2.4. Clove weight (C.W.)g.:

Concerning clove weight, data in the same Table indicate that there were significant differences among the selected clones in this trait. The highest clove weight, in 2006/2007 season was produced by clone St.₄₄ (7.69g.) followed by clones St.₃₈ (5.81g.), St.₈ (5.71g.) St.₁₄ (5.70g.) and St.₃₆ (5.28g), while, the lowest C.W. (3.29g.) was obtained from the cont. In 2007/2008 season the highest C.W. (6.26g.) was obtained by clone St.₄₄ followed by clones St.₃₈ (5.14), St.₁₄ (4.57g.), St.₃₆ (4.54g.) and St.₃₅ (4.36g), while the lowest C.W. (2.92g.) was produced by the cont. The variations among the selected clones in this trait agree with those obtained by Lee and Kim (1977), Osman and Abd El-Hamid (1990, 1994), Kasim and El-Ghadban (2002) and Abd El-Hamid *et al.* (2006).

B. In 2006/2007 and 2007/2008 seasons the following data were recorded on selected clones of white garlic i.e. Balady cv.

B.I. Vegetative growth:

B.I.1. Plant height (P.H) cm:

Data presented in Table (9) indicate that there were significant differences in P.H. values of the selected clones in both seasons of study. In 2006/2007 season the highest P.H.

value was produced by clone Sil.₁₇ (110.00), while the lowest value of P.H. in the same season was obtained from clone Sil.₁₁ (58.67). In this season, clone Sil.₁₇ surpassed significantly all other selected clones. On other hand, there were no significant differences among clones Sil.₁₆, Sil.₅, Sil.₁₅, Sil.₁₉ and Sil.₇, but these clones surpassed significantly clones Sil.₃, Sil.₁, Sil.₄, Sil.₁₂, Sil.₉, Sil.₁₈, cont., Sil.₁₀ and Sil.₁₁. In 2007/2008 season, the highest value of P.H. was obtained from clone Sil.₁₇ (104.67), while the lowest value of this trait in the same season was produced by clone Sil.₁₀ (55.67). There were no significant differences between clone Sil.₁₇ and clone Sil.₁₆, but these clones surpassed significantly all other selected clones. The obtained results agree with those found by Singh (1981), Osman and Abd El-Hamid (1990, 1994), Kasim and El-Ghadban (2002) and Abd El-Hamid *et al.* (2006).

B.I.2. Leaves number (L. No)/plant:

It is clear from data in Table (9), that the differences in L. No. per plant of the selected clones were significant in both seasons of study. In 2006/2007 season clone Sil.₁₇ produced the highest L. No. per plant

(10.00), while the lowest L. No./plant was produced by clones Sil.₁₀, Sil.₁₅ and Sil.₂₀ (7.00). Clones Sil.₅, Sil.₁₁, Sil.₁₇ and Sil.₁₈ surpassed significantly clones Sil.₁₀, Sil.₁₅ and Sil.₂₀. In 2007/2008 season, the highest L. No./plant was obtained from clone Sil.₁₇ (8.67), while the lowest value of L. No./plant was produced by clone Sil.₁₀ and control (5.67). There were no significant differences among clones Sil.₇, Sil.₁₁, Sil.₁₇ and Sil.₁₉, but these clones surpassed clones Sil.₃, Sil.₄, Sil.₅, Sil.₁₀, Sil.₁₂ and control in L. No./plant in this season. The obtained results agree with those obtained by Osman and Abd El-Hamid (1990,1994), Gad El-Hak *et al.* (1996), Kasim and El-Ghadban (2002) and Abd El-Hamid *et al.* (2006), who showed significant differences among the leaves number values of the selected clones.

B.I.3. Leaves fresh weight (L.F.W.) g.:

Data in Table (9) indicate that the differences in L.F.W. of the selected clones were significant in both seasons of study. The highest L.F.W. was produced by clone Sil.₅ (115.67g.), while the lowest value of L.F.W. was obtained from clone Sil.₁₀ (34.67g.). There were no significant differences in L.F.W. of clones Sil.₅, Sil.₁₇ and Sil.₇, but these clones surpassed significantly clones Sil.₁₆, Sil.₃, Sil.₁₁, Sil.₁₅, Sil.₁₅, Sil.₁₂, Sil.₉, Sil.₄, cont, Sil.₂₀ and Sil.₁₀. The highest value of L.F.W., in 2007/2008 season was produced by clone Sil.₁₇ (138.33g.), while the lowest value of L.F.W. in this season was obtained from the control (30.00). Sil.₁₇ surpassed significantly all other selected clones in L.F.W., while there were no significant differences among clones Sil.₁₆, Sil.₁₉, Sil.₁₄ and Sil.₁₁ in L.F.W., but these clones surpassed significantly clones Sil.₁₅, Sil.₁₂, Sil.₃, Sil.₄, Sil.₁₀ and cont. in this trait.

B.I.4. Bulb fresh weight (B.F.W.) g.:

There were significant differences in B.F.W. of the selected clones in both seasons of study as shown in Table (9). The highest value of B.F.W. in 2006/2007 season was produced by clone Sil.₁₇ (30.00g.), while the lowest value of B.F.W. in the same season was obtained from clones Sil.₁₀ (7.67g.) and cont. (11.67). Sil.₁₇ surpassed significantly all

other selected clones in this trait, while, there were no significant differences among clones Sil.₁₈, Sil.₁₉, Sil.₁₁, Sil.₅ and Sil.₇, but these clones surpassed significantly clones Sil.₄, Sil.₉, cont., and Sil.₁₀. In 2007/2008 season, the highest value of B.F.W. was produced by clone Sil.₁₇ (46.67), while the lowest value of B.F.W. in the same season was obtained from the cont. (16.00). Sil.₁₇ surpassed significantly all other selected clones in this trait, while there were no significant differences in B.F.W. of clones Sil.₁₆, Sil.₉, Sil.₁₄, Sil.₁₁ but these clones surpassed significantly clones Sil.₁₂, Sil.₄, Sil.₁₀ and cont. The obtained results agree with that obtained by Osman and Abd El-Hamid (1990, 1994), Kasim and El-Ghadban (2002) and Abd El-Hamid *et al.* (2006).

B.I.5. Plant fresh weight (P.F.W.) g.:

Data presented in Table (9), show that there were significant differences in P.F.W. of the selected clones in both seasons of study. The highest P.F.W. in 2006/2007 season was produced by clone Sil.₁₇ (141g.), while the lowest value of P.F.W. in the same season was obtained by clone Sil.₁₀ (42.34g.). It is clear from these data that, there were no significant differences between clones Sil.₁₇ and Sil.₅, in P.F.W. but clone Sil.₁₇ surpassed significantly all other selected clones. In 2007/2008 season, the highest value of P.F.W. was produced from clone Sil.₁₇ (185.00g.), while the lowest value of P.F.W. in the same season was obtained from cont. (46g.). The obtained data of this season indicate that clone Sil.₁₇ surpassed significantly all other selected clones in this trait. Also, there were no significant differences in P.F.W. of clones Sil.₁₆, Sil.₁₄, Sil.₁₉, Sil.₁₁, Sil.₇, Sil.₁₅ and Sil.₂₀ but there were significant differences in P.F.W. of these clones and P.F.W. of clones Sil.₃, Sil.₁₂, Sil.₄, Sil.₁₀ and cont.

B.I.6. Neck diameter (N.D.) cm:

Data in Table (9) indicate that there were significant differences in N.D. values of the selected clones in both seasons of study. In 2006/2007 season clone Sil.₁₁ produced the highest N.D. (1.97cm.), while the lowest N.D. in the same season was obtained from clone Sil.₁₀ (1.10). N.D. of clones Sil.₁₁ and Sil.₅

surpassed significantly those of clones Sil.₁₂, Sil.₃, Sil.₁, Sil.₄, Sil.₉, Sil.₁₇, Sil.₁₅, cont., Sil.₂₀ and Sil.₁₀. In 2007/2008 season, the highest value of N.D. was produced by clone Sil.₁₇ (2.13cm.), while the lowest value of this trait in the same season was obtained from the cont. and Sil.₄ (0.87). The obtained results agree with those obtained by Osman and Abd El-Hamid (1994) and Kasim and El-Ghadban (2003), who found that there were significant differences among the selected clones in this trait.

B.I.7. Bulb diameter (B.D.) cm:

Data in Table (9) illustrate that, there were significant differences in B.D. values of the selected clones in both seasons of study. In 2006/2007 season, clone Sil.₅ produced the highest B.D. value (3.5cm.), while the lowest value of this trait in the same season was obtained from clone Sil.₁₀ (2.00cm.). The highest value of B.D. in 2007/2008 season was obtained from clone Sil.₁₇ (3.5cm.), while the lowest value of this trait in the same season was obtained from the cont. (1.57cm.). It is clear from the data of 2006/2007 season that there were no significant differences among the B.D. values of clones Sil.₅, Sil.₁₉. But these clone surpassed significantly clones Sil.₁₂, Sil.₁, Sil.₁₅, cont., Sil.₉, Sil.₄, Sil.₁₇, Sil.₁₈, Sil.₂₀ and Sil.₁₀. While, in the 2007/2008 season, clone Sil.₁₇ surpassed significantly all other selected clones in this trait.

B.I.8. Bulbing Ratio (B.R.):

Data of B.R. as shown in Table (9) indicate that there were significant differences among the selected clones in both seasons of study. The highest value of this trait in 2006/2007 season was produced by clone Sil.₁₈ (0.71), while the lowest value of B.R. in the same season was obtained from Sil.₁₉ (0.52) B.R. of clone Sil.₁₈ surpassed significantly B.R. of all clones in that trait. It is known that the lower B.R. value, the earlier the harvesting date. In the 2007/2008 season, the highest value of B.R. was produced from clone Sil.₁₈ (0.68), while the lowest value of B.R. in 2007/2008 season, was obtained from clone Sil.₁₀ (0.53). It is clear from the data that there were no significant differences in B.R. of clones Sil.₁₈, Sil.₁, Sil.₂₀, Sil.₅, Sil.₁₂, Sil.₁₆ but these

clones produced significantly higher B.R. than that of clone Sil.₁₀. The obtained results agree with that reported by Osman and Abd El-Hamid (1990), Kasim and El-Ghadban (2002) and Abd El-Hamid *et al.* (2006), who found significant variations among the selected clones in bulbing ratio character.

B.II. Fresh yield and bulb quality:

B.II.1. Fresh yield (F.Y.) in ton/fed.:

It is clear from data in Table (10), that there were significant differences in F.Y. of the selected clones in both seasons of study.

The highest value of F.Y. in 2006/2007 season was produced by clone Sil.₁₆ (16.10 ton/fed) followed by clones Sil.₁₇ (15.41), Sil.₁₅ (15.25) and Sil.₁₉ (14.98), while the lowest value of F.Y. in the same season was produced by cont. (8.75). Clones Sil.₁₆, Sil.₁₇, Sil.₁₅ and Sil.₁₉ surpassed significantly all the selected clones except clones Sil.₇, and Sil.₉. In 2007/2008 season, the highest value of F.Y. was produced by clone Sil.₁₆ (19.88) followed by clones Sil.₁₅ (19.69), Sil.₁₇ (18.11) and Sil.₁₉ (17.92), while the lowest F.Y. value in the same season was obtained by cont. (9.33). There were no significant differences between F.Y. of clones Sil.₁₆ and Sil.₁₅ or between F.Y. of clones Sil.₁₇ and Sil.₁₉ but these clones surpassed significantly all other selected clones in this trait. These results agreed with those obtained by Ahmed and Hoque (1988) and Osman and Abd El-Hamid (1994), who reported that the presence of significant differences due to the differences in source potentials and sink capacities among the tested genotypes.

B.II.2. Bulb quality:

B.II.2.1. Bulb weight (B.W.) g.:

It is clear from Table (10) that there were significant differences in B.W. of the selected clones in both seasons of study. In 2006/2007 season, the highest B.W. value was produced by clone Sil.₁₆ (100g.) followed by clones Sil.₁₅ (95.00), Sil.₁₇ (93.33) and Sil.₁₉ (92.00), while the lowest value of B.W. was obtained by cont. (52.50). It is clear that clones Sil.₁₆ and Sil.₁₅ surpassed significantly clones Sil.₂₀, Sil.₁₂, Sil.₁₄, Sil.₅, Sil.₁₀, Sil.₁₁, Sil.₃, Sil.₁₈, Sil.₁, Sil.₄ and cont. In the 2007/

2008 season, the highest B.W. value was produced by clone Sil.₁₆ (135.83g.) followed by clones Sil.₁₅ (134.17), Sil.₁₇ (122.00) and Sil.₁₉ (120.83), while the lowest value of B.W. in the same season was obtained by the cont. (56.17). It is clear also, that clones Sil.₁₆, Sil.₁₅, Sil.₁₇ and Sil.₁₉ surpassed all other selected clones. The obtained results agree with those obtained by Osman and Abd El-Hamid (1990,1994), Kasim and El-Ghadban (2002) and Abd El-Hamid *et al.* (2006) they found significant variation in B.W. values of the selected clones.

B.II.2.2. Bulb diameter (B.D.) cm:

Data in Table (10) indicate that there were significant differences in B.D. values of the selected clones in both seasons of study. The highest B.D. value in the 2006/2007 was produced by clone Sil.₁₆ (6.90cm.) followed by clones Sil.₁₄ and Sil.₁₇ (6.53), while the lowest value of this trait in the same season was obtained by cont. (5.25). There were no significant differences among clones Sil.₁₆, Sil.₁₄ and Sil.₁₇, while these clones, surpassed significantly clones Sil.₁₀, Sil.₉, Sil.₅, Sil.₁₈, Sil.₁₅, Sil.₂₀, Sil.₃, Sil.₁, Sil.₄ and cont.

In the 2007/2008 season, the highest value of B.D. was produced by clone Sil.₁₆ (7.17cm.) followed by clones Sil.₁₇ (7.10) and Sil.₁₅ (6.98), while the lowest value of this trait in the same season was obtained by clone Sil.₁ (5.13). There were no significant differences between B.D. of clones Sil.₁₆ and Sil.₁₇, but these clones surpassed significantly B.D. of all other clones except clones Sil.₁₅ and Sil.₁₉ in this trait. The obtained results agree with those obtained by Osman and Abd El-Hamid (1990, 1994), Kasim and El-Ghadban (2002) and Abd El-Hamid *et al.* (2006).

B.II.2.3. Cloves number per bulb (C. No./bulb):

Data in Table (10) indicate that there were significant differences in cloves number per bulb of the selected clones in both seasons of study. It is well known that the lower C. No./bulb, the better bulb quality. In 2006/2007 season, the lowest C. No./bulb was produced by clone Sil.₁₁ (10.17) followed by clones Sil.₁₈ (30.33), Sil.₁₂ (31.97) and Sil.₁₇ (32.67), while, the highest C. No./bulb was obtained

from the cont. (53.50). It is clear that clone Sil.₁₁ produced the lowest C. No./bulb and the differences were highly significant. In 2007/2008 season, the lowest C. No./bulb was produced by clones Sil.₁₁ (11.33) followed by clones Sil.₁₂ (27.50), Sil.₁₈ (29.33), Sil.₁₄ (30.67) and Sil.₁₇ (32.33), while the highest C. No./plant was obtained by the cont. (54.33). Cont. surpassed significantly all other selected clones with exception clone Sil.₁₅, while the lowest C. No. was obtained from clone Sil.₁₁ with significant differences compared with other selected clones. The obtained results agree with those obtained by Osman and Abd El-Hamid (1990,1994) who reported that decreasing C. No./plant may be attributed to genetic advancing. Also, Abd El-Hamid *et al.* (2006), reported similar results and mentioned that the lower cloves number per bulb is a very important character for increase of garlic export potentials.

B.II.2.4. Clove weight (C.W.) g.:

Data in Table (10) indicate clearly that, there were significant differences in C.W. values of the selected clones in both seasons of study. The highest value of C.W. in the 2006/2007 was obtained by clone Sil.₁₁ (6.11g) followed by clones Sil.₁₇ (2.57) and Sil.₁₂ (2.44), while the lowest C.W. was obtained from clone Sil.₄ (1.02) followed by cont. (1.03). It is clear that clone Sil.₄ and control produced the lowest C.W., while clone Sil.₁₁ surpassed all other selected clones in this trait.

In the 2007/2008, clone Sil.₁₁ produced the highest C.W. followed by clones Sil.₁₂ (2.93) and Sil.₁₇ (2.91), while the lowest C.W. in the same season was obtained by cont. (0.93). The cont. produced the lowest value of C.W., while clone Sil.₁₁ surpassed significantly all other selected clones. The obtained results agree with that obtained by Osman and Abd El-Hamid (1990,1994), Kasim and El-Ghadban (2002) and Abd El-Hamid *et al.* (2006).

B.III Chemical composition of the bulb

It is clear from results presented in Table (11) in the season of 2007/2008, that the clone Sil.₁₀ was pioneer in N content as it

recorded 3.956% compared to clone Sil.₅ which was the poorest in N content as it recorded 2.178%. The rest of the selected clones were graded from the lowest to the highest as follows: Sil.₁₉, St.₄₄, Sil.₁₇, Sil.₁₂, Sil.₇, St.₃₆, Sil.₁₈, Sil.₁₁ and Sil.₄ as they recorded 2.179, 2.211, 2.410, 2.430, 2.500, 2.711, 2.958, 3.591 and 3.829%, respectively.

Concerning phosphorus content (%), results reveals that clone Sil.₁₀ showed the highest content of phosphorus (0.652%). On the contrary, clone Sil.₁₂ had the lowest content as it recorded only 0.217% phosphorus. Other clones graded in the following descending order: Sil.₁₁ (0.617%), Sil.₄ (0.539%), Sil.₁₇ (0.492%), St.₄₄ (0.425%), Sil.₁₉ (0.407%), St.₃₆ (0.405%), Sil.₁₈ (0.380), Sil.₇ (0.356%) and Sil.₅ (0.246%).

Taking K content (%) into consideration, clone Sil.₁₈ possessed the highest content of K as it recorded 0.907%, while clone Sil.₇ had the lowest content of K recording 0.707%. Other selected clones had moderate values of K as they recorded 0.736, 0.779, 0.798, 0.818, 0.833, 0.834, 0.850, 0.850 and 0.882%, respectively for clones Sil.₁₁, Sil.₁₀, Sil.₁₇, St.₃₆, Sil.₁₂, St.₄₄, Sil.₅, Sil.₁₉ and Sil.₄.

As for Ca content (%), results revealed that the highest content of Ca was

shown by clone Sil.₁₁ (0.264%), however clone St.₄₄ recorded the lowest Ca content (0.106%). The other selected clones were found to be in the following ascending order as follows: Sil.₇, Sil.₁₀, Sil.₅, Sil.₁₇, St.₃₆, Sil.₄, Sil.₁₂, Sil.₁₈ and Sil.₁₉ as they recorded 0.127, 0.147, 0.150, 0.151, 0.172, 0.174, 0.175, 0.190 and 0.196, respectively.

Data in Table (11) reveals that clone Sil.₁₇ was superior in Na content (%) as it recorded (7.302%). On the contrary, clone Sil.₅ recorded the lowest Na content (2.486%) compared with other selected clones. This was followed by clones St.₃₆, Sil.₁₁, Sil.₇, Sil.₁₂, St.₄₄, Sil.₁₉, Sil.₁₈, Sil.₁₀ and Sil.₄ as they recorded 2.924, 2.924, 3.143, 3.143, 3.362, 3.581, 3.799, 3.799 and 4.237%, respectively.

In concern with protein content (%), results revealed that the protein content showed the same trend as N content.

Data in Table (11) demonstrated that clone Sil.₁₀ had the highest content of total carbohydrate content (18.823%), followed by clones Sil.₁₈ (18.095%), St.₄₄ (14.589%), then Sil.₄ (14.533%), St.₃₆ (13.607%), Sil.₁₉ (12.879%), Sil.₇ (10.818%), Sil.₅ (8.686%), Sil.₁₇ (7.562%), Sil.₁₂ (6.440%). While clone Sil.₁₁ possessed the lowest total carbohydrate content along with the whole studied clones (6.396%).

CONCLUSION

Significant differences were found among the different selected clones. Some clones showed high degree of superiority in certain characteristics compared to other selected clones and with the standard cv. This study show some promising clones for both local consumption and exportation as follow:

A. Purple clones selected from Chinese garlic cv. Sids-40:

Clone St.₄₄ is characterized by highest plant height, number of leaves/plant, highest fresh weight of leaves, bulbs and plants, also highest total yield (ton/fed.) as well as highest bulb weight, diameter and clove weight, furthermore low number of cloves. Clone St.₃₆ was found to have high plant weight and total

yield, high bulb and clove weight and bulb diameter. In addition, its cloves contain high percentage of nitrogen, potassium and protein compared with the other clones. Clone St.₃₈ was characterized by high total yield, high bulb weight and low number of cloves per bulb.

B. White clones selected from Balady cv.:

Clone Sil.₁₇ was characterized by highest plant height, highest number of leaves per plant as well as highest leaves, bulb and plant fresh weight during the vegetative growth, also it was found that it had the highest total yield (ton/fed) and highest weight of bulb besides high bulb diameter and high clove weight also low number of cloves per bulb.

Table (9): Vegetative growth of the selected Balady garlic clones during 2006/2007 and 2007/2008 seasons.

Clone	Plant height (cm)		No. of leaves/plant		Leaves fresh weight (g)		Bulb fresh weight (g)		Plant fresh weight (g)		Neck diameter (cm)		Bulb diameter (cm)		Bulbing ratio	
	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08
*Sil ₁	80.00	66.50	7.33	7.00	73.00	50.00	14.00	22.50	87.00	72.50	1.57	1.35	2.80	2.05	0.56	0.66
Sil ₃	81.67	69.33	7.67	6.33	81.33	40.00	16.33	23.33	97.66	63.33	1.60	1.10	2.90	1.77	0.55	0.62
Sil ₄	80.00	59.00	8.67	6.00	66.00	31.67	13.00	18.33	79.00	50.00	1.53	0.87	2.60	1.60	0.59	0.54
Sil ₅	96.00	71.67	9.00	6.33	115.67	55.00	18.00	25.00	133.67	80.00	1.93	1.50	3.50	2.40	0.55	0.63
Sil ₇	90.67	80.00	8.00	8.00	101.00	65.00	18.00	35.00	119.00	100.00	1.80	1.50	3.07	2.50	0.59	0.60
Sil ₉	78.00	82.50	7.33	7.00	69.00	60.00	13.00	30.00	82.00	90.00	1.53	1.35	2.47	2.20	0.62	0.62
Sil ₁₀	68.67	55.67	7.00	5.67	34.67	31.67	7.67	16.33	42.34	48.00	1.10	0.93	2.00	1.77	0.55	0.53
Sil ₁₁	58.67	58.33	9.33	8.00	79.00	73.33	20.67	30.00	99.67	103.33	1.97	1.53	3.10	2.47	0.64	0.61
Sil ₁₂	79.33	71.67	7.67	6.00	72.00	46.67	14.33	21.67	86.33	68.34	1.65	1.47	2.83	2.37	0.58	0.63
Sil ₁₄	87.00	88.33	8.00	7.33	89.00	76.67	17.00	30.00	106.00	106.67	1.77	1.63	3.03	2.87	0.58	0.57
Sil ₁₅	95.00	88.33	7.00	6.67	76.33	68.33	14.33	26.67	90.66	95.00	1.50	1.37	2.53	2.33	0.59	0.59
Sil ₁₆	98.00	100.33	8.00	7.33	83.00	93.33	16.00	30.33	99.00	123.66	1.75	1.60	3.00	2.53	0.58	0.63
Sil ₁₇	110.00	104.67	10.00	8.67	111.00	138.33	30.00	46.67	141.00	185.00	1.50	2.13	2.40	3.50	0.63	0.61
Sil ₁₈	77.00	79.50	9.00	7.50	92.00	105.00	22.00	25.00	114.00	130.00	1.70	1.60	2.40	2.35	0.71	0.68
Sil ₁₉	92.00	83.33	8.00	8.33	91.33	80.00	21.67	26.67	113.00	106.67	1.70	1.47	3.27	2.53	0.52	0.58
Sil ₂₀	85.00	85.00	7.00	7.33	60.00	66.67	25.00	28.33	85.00	95.00	1.30	1.47	2.20	2.30	0.59	0.64
**Cont.	76.67	60.67	7.33	5.67	63.00	30.00	11.67	16.00	74.67	46.00	1.47	0.87	2.50	1.57	0.59	0.55
L.S.D. at 5%	6.55	6.41	1.78	1.39	16.16	21.36	4.97	8.30	19.93	28.01	0.27	0.40	0.42	0.53	0.07	0.09

*Sil.: Silver.

**Cont: The common used variety (Balady).

Table (10): Fresh yield and its components of the selected Balady garlic clones during 2006/2007 and 2007/2008 seasons.

Clone	Yield ton/fed		Bulb weight (g)		Bulb diameter (cm)		Cloves number per bulb		Cloves weight (g)	
	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08	2006/07	2007/08
*Sil. ₁	10.97	11.620	68.67	74.17	5.67	5.13	38.00	42.17	1.49	1.56
Sil. ₃	12.89	11.71	80.17	72.67	5.90	5.57	38.83	37.33	1.67	1.68
Sil. ₄	9.80	9.66	57.17	58.67	5.50	5.67	51.33	47.33	1.02	1.18
Sil. ₅	12.76	13.02	83.92	87.22	6.10	5.89	36.17	35.17	1.98	1.77
Sil. ₇	13.71	13.91	89.47	90.83	6.18	5.92	40.00	38.17	1.86	1.92
Sil. ₉	13.67	14.19	89.00	92.67	6.12	6.17	36.33	44.00	1.94	1.92
Sil. ₁₀	12.60	12.37	83.00	82.50	6.13	5.93	44.50	40.11	1.63	1.89
Sil. ₁₁	12.76	13.07	81.33	86.50	6.22	5.80	10.17	11.33	6.11	6.11
Sil. ₁₂	13.18	13.25	86.92	87.50	6.31	6.05	31.97	27.50	2.44	2.93
Sil. ₁₄	13.11	12.97	85.17	82.17	6.53	5.40	36.67	30.67	2.27	1.91
Sil. ₁₅	15.25	19.69	95.00	134.17	5.97	6.98	47.83	51.33	1.47	1.50
Sil. ₁₆	16.10	19.88	100.00	135.83	6.90	7.17	46.17	44.83	2.03	2.00
Sil. ₁₇	15.41	18.11	93.33	122.00	6.53	7.10	32.67	32.33	2.57	2.91
Sil. ₁₈	11.25	11.34	73.33	75.67	5.97	6.17	30.33	29.33	2.17	2.33
Sil. ₁₉	14.98	17.92	92.00	120.83	6.47	6.52	41.67	45.67	1.93	1.94
Sil. ₂₀	13.39	13.23	87.50	89.17	5.95	5.90	46.00	38.67	1.73	1.78
**Cont.	8.75	9.33	52.50	56.17	5.25	5.37	53.50	54.33	1.03	0.93
L.S.D. at 5%	1.33	1.43	6.40	9.19	0.39	0.84	5.55	5.09	0.46	0.73

*Sil.: Silver

**Cont: The common used variety (Balady)

Table (11): Chemical composition of the cloves (g/100g d.wt.) of the selected garlic clones in the season 2007/2008

Garlic strain	N (%)	P (%)	K (%)	Ca (%)	Na (%)	Total protein (%)	Total carbohydrate (%)
St. ₃₆	2.711	0.405	0.818	0.172	2.924	16.944	13.607
St. ₄₄	2.211	0.425	0.834	0.106	3.362	13.819	14.589
Sil. ₄	3.829	0.539	0.882	0.174	4.237	23.931	14.533
Sil. ₅	2.178	0.246	0.850	0.150	2.486	13.613	13.613
Sil. ₇	2.500	0.356	0.707	0.127	3.143	15.625	10.818
Sil. ₁₀	3.956	0.652	0.779	0.147	3.799	24.725	18.823
Sil. ₁₁	3.591	0.617	0.736	0.264	2.924	22.444	6.396
Sil. ₁₂	2.430	0.217	0.833	0.175	3.143	15.188	6.440
Sil. ₁₇	2.410	0.492	0.798	0.151	7.302	15.063	7.562
Sil. ₁₈	2.958	0.380	0.907	0.190	3.799	18.488	18.095
Sil. ₁₉	2.179	0.407	0.850	0.196	3.581	13.619	12.879

These clones were selected for the purpose of chemical analysis because of the observed differences in some of the studied characteristics

Clones Sil.₁₆ and Sil.₁₅ were superior in total yield, bulb weight, also clone Sil.₁₉ was found to have high total yield, high bulb weight, in addition its cloves contained high percentage of potassium.

Clones Sil.₁₁, Sil.₁₂, Sil.₁₈ were found to have high total yield and high bulb weight compared to the standard cv. but they were found to be characterized by lowest cloves number per bulb, as well as superior in clove

weight, also cloves of clone Sil.₁₁ contained high percentage of nitrogen, phosphorus and protein as well as highest percentage of calcium, while cloves of clone Sil.₁₈ contained high percentage of nitrogen, protein and carbohydrate, as well as the highest percentage of potassium.

These clones should be evaluated in the future at different locations and planting dates before releasing them as new cultivars.

REFERENCES

- Abd El-hamid A.M.; El-Banna, E.N. and El-morsy, A.H.A. (2006): Evaluation of new promising garlic clones through selection program of Sids-40 variety. *J. Agric. Sci., Mansoura Univ.*, 31 (8):5227-5224, 2006.
- Ahmed, N.U. and Hoque, M.M. (1988): Studies on the performance of some indigenous and exotic garlic germplasma in Bangladesh. *Bangladesh Agric. Res., Inst., Jodeipur, Bangaladis. (C.F. Hort. Abst. 88, 74623).*
- Al-Zahim, H.; Newbury, J. and Ford-Lloyd, B.V. (1997): Classification of genetic variation in garlic (*Allium sativum* L.), revealed by RAPD. *Hortscience*, 32: 1102-1104.
- Dubois, M.; Smith, F.; Giues, K.A.; Hamilton, J.K. and Rebers, P.A. (1956): Colorimetric method for determination of sugars and related substances. *Annal. Chem.*, 28 (3): 350-356.
- Gad El-Hak, S.H.; El-Sharbaky S.A.; Abdel-Rahem, A.T. and Tony, H.S. (1996): Studies on vegetative growth and yield components of some garlic genotypes under El-Minia environmental conditions. *Fourth Arabic Conf., Minia, Egypt.*
- Hassan, M.A. and Osman, A.Z. (1990): Evaluation of cultivar and seed size in garlic. *Minia J. Agric. Res. Dev. (12): 1033-1044.*
- Jackson, N.L. (1958): *Soil chemical Analysis. Constable. Ltd. Co., London* pp. 498.
- Kasim, A.T.M. and El-Ghadban, E.A.E. (2002): New promising clones selected from some garlic "*Allium sativum* L." Cultivars. *Annals of Agric. Sci. Moshtohor, Vol. 40 (4): 2205-2218.*
- Lammerink, J. (1988): Better garlic yield though selection and seed clove grading. *Newzealand Commercial Grower*, 43:16-17.
- Lee, W.S. and Kim, Y.G. (1977): Agronomic characteristics and correlation in ecotypes of garlic. *J. Korean Soc. Hort. Sci.* 18 (1):36.
- Maksoud, M.A.; Beheid, M.A.; Foda, S.A.; Taha, S.M. and Abdel-Aziz, M. (1984): Complementary study on the evaluation of some garlic cultivars.
- Menzes, S.J.E.D (1979): The active bank of garlic germplasma. *Bancos actives de germplasma, 22-25 de maiode. (C.F. Plant bread. Abst. 52, P-1).*
- Novak, F.T.; Havel, L. and Dolezei, J. (1987): *Allium* in hand book of plant. Cell culture, Vol.4, pp.419-456.
- Osman A.Z; and Abd El-hamid, A.M. (1990): Evaluation of eighteen ecotypes of egyptian garlic Minia *J. Agric. Res. & Dev. 12 (3): 1625-1640.*
- Osman A.Z; Abd El-hamid, A.M. (1994): New clones of Chinese garlic cultivars via individual plan selection. *Minia J. Agric. Res & Dev. 16 (4):577-596.*
- Pregl, E. (1945): *Quantitative organic micro-analysis 4th Ed. Chundchiril, London.*
- Piper, C.S. (1950): *Soil and plant Analysis. Inter. Sci., Pulb, New York, pp. 368.*
- Plummer, D.T. (1971): *An introduction to practical biochem. Published by Mc Graw Hill Book Company (U.K.) Limited.*
- Singh, R.P. (1981): Genetic evaluation and path analysis in garlic. *Madrid Agric. J. (68):618-622 (C.F. Plant breed. Abst. 53:918).*
- Snedecor, G.W. and Cochran, W.G. (1980): *Statistical methods 7th Edn, Iowa Stat. Univ. press, Anes, Iowa, U.S.A.*
- Soliman, M.M. (1992): Responses of some strains from Chinese garlic to evaluation under local conditions. *Ann. Agric. Sci., Ain Shams Univ., Egypt (37): 217-220.*

Volk, G.M.; Henk, A.D. and Richards, C.M. clones as detected using AFLP methods. J. Amr. Soc. Sci. 129 (4): 559-569. (2004): Genetic diversity among US. Garlic

انتخاب وتقييم بعض سلالات الثوم البلدي والصيني

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أجري هذا البحث بمزرعة بحوث الخضر بقها ومعهد بحوث البساتين خلال خمسة مواسم هي ٢٠٠٤/٢٠٠٣، ٢٠٠٥/٢٠٠٤، ٢٠٠٦/٢٠٠٥، ٢٠٠٧/٢٠٠٦، ٢٠٠٧/٢٠٠٦، ٢٠٠٨/٢٠٠٧ بغرض انتخاب وتقييم سلالات جديدة منتخبة من الصنفين المحليين المزروعين بمصر مثل الصنف الصيني (سدس ٤٠) ذو القشرة البنفسجي، والصنف البلدي ذو القشرة البيضاء. تم تجميعها من عدة مواقع مختلفة في مصر. وذلك بهدف تحسين محصول الثوم المصري ونوعيته للحصول على سلالات ذات صفات جيدة للاستهلاك المحلي والتصدير وأيضاً دراسة التركيب الكيماوي في فصوص السلالات المنتخبة.

وجدت اختلافات معنوية بين السلالات المنتخبة بالنسبة للنمو الخضري، والمحصول، صفات رؤوس الثوم (وزن- قطر رأس الثوم، وعدد الفصوص- وزن الفص) والمحتوى الكيماوي للفصوص (نيتروجين- فوسفور- بوتاسيوم- كالسيوم- صوديوم- بروتين- كربوهيدرات). وقد أظهرت بعض السلالات تفوق في صفات معينة مقارنة بالسلالات المنتخبة الأخرى كالتالي:

أ- السلالات المنتخبة من الصنف الصيني البنفسجي (سدس ٤٠):

أعطت السلالات St.38، St.36، St.35، St.44 أعلى إنتاجية في المحصول الكلي للفدان، أيضاً أعلى وزن لرأس الثوم، وتميزت السلالات St.14، St.38، St.44 بأقل عدد من الفصوص في رأس الثوم بالإضافة إلى أعلى وزن للفص.

ب- السلالات البيضاء المنتخبة من الصنف البلدي:

١- السلالات Sil.16، Sil.15، Sil.17، Sil.19 أنتجت أعلى محصول كلي/فدان وأعلى وزن للرأس.
٢- السلالات Sil.11، Sil.12، Sil.18، Sil.17 أعطت أقل عدد من الفصوص في الرأس بينما أعلى وزن للفص أنتجته السلالات Sil.11، Sil.12، Sil.17.

ج- المحتوى الكيماوي في الفصوص:

١- بالنسبة للسلالات البنفسجية المنتخبة وجد أن السلالة St.36 كانت متفوقة في نسبة النتروجين والكالسيوم والبروتين. مقارنة بالسلالة St.44 بينما السلالة St.44 احتوت على بوتاسيوم وصوديوم وكربوهيدرات أعلى منه في السلالة St.36.

٢- بالنسبة للسلالات البيضاء المنتخبة وجد أن السلالات Sil.10، Sil.4، Sil.18 احتوت على أعلى نسبة من النتروجين والبروتين وتميزت السلالة Sil.10 أيضاً باحتوائها على أعلى نسبة من الفوسفور والكربوهيدرات ولكن أعلى نسبة للبوتاسيوم وجدت في السلالات Sil.18، Sil.4، Sil.5 بينما السلالات Sil.11، Sil.19، Sil.18 كانت متفوقة في محتواها من الكالسيوم بينما السلالات Sil.17، Sil.4 أنتجت أعلى نسبة من محتوى الصوديوم.

يلاحظ أن الاختلافات السابقة من السلالات المنتخبة المختلفة سوف يكون لها قيمة كبيرة في برامج تربية الثوم لإنتاج سلالات جديدة من الثوم متميز بالمحصول العالي والصفات الجيدة للأسواق المحلية والخارجية