

## **NEW STRAINS OF EL-BALADY PEPPER**

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### **ABSTRACT**

This study was carried out at El-Baramoon Horticultural Research Farm, Dakahlia governorate, Egypt during the summer seasons for four years. Eleven sweet pepper genotypes, including 10 selected lines and the original cultivar (El-Balady pepper) were grown in randomized complete blocks design with three replications. These inbred lines obtained from El-Balady sweet pepper cultivar after four generations of inbreeding and selection and were evaluated. The differences among means of most tested lines appeared significance. The results indicated that all the strains, particularly strains 6, 3, 4 and 7, respectively were superior than check cultivar for the qualitative and quantitative traits of pepper crop. The results revealed that the selection pure line within El-Balady sweet pepper cultivar proved to be effective in separating new promising lines superior of yield and quality. A correlation study indicated that the existence of high positive correlation between total yield per plot and number of fruits per plant.

Finally, it must be concluded that such new selected superior lines 6, 3, 4 and 7 appeared to be diet strains and had a superior for the qualitative and quantitative characters, in addition, their adaptability for Egyptian conditions. So, it could be utilized commercially as a new promising cultivars or in breeding programs to be utilized from some promising traits.

### **INTRODUCTION**

Pepper (*Capsicum annuum* L.) is one of the most common and popular vegetable crops in Egypt, as well as, in many other countries. It is used fresh, cooked, canned, pickled and ground. Small fruits can be used for decorative purpose (Thompson and Kelly, 1957). It is known to be rich in ascorbic acid and contains middle quantity of vitamin A. Local sweet pepper cultivar (El-Balady) showed recently a lot of variability in various growth and yield characteristics. So, the improvement of pepper production through breeding methods, such as pure line selection and mass selection or introducing high yielding line considered of national interest.

Fruits number per plant is an important character influence the pepper yield. Malash and Khalil (1988) noticed that highly significant differences were found between 9 pepper cultivars regarding fruits number / plant. Also, Konzuwa (1997) found that significant differences were noticed among 24 pepper genotypes regarding number of fruits per plant. The varietal differences in this trait were also stated by Khalil *et al.* (1988), Das *et al.* (1990), Khalil (1992) and Rani and Singh (1996).

Concerning average fruit weight, many investigators reported significant differences among pepper cultivars. Among them were Khalil *et al.* (1988), Konzuwa (1997) and Zaky (1995).

Total yield is the most important character in pepper production. Several studies on total yield of pepper showed varietal significant differences. Aliyu and Dlarewaju (1994) evaluated over 200 local selections of pepper cvs and found significant differences in total yield. Varietal

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variations in pepper yield were also reported by Gaafar (1993), Ahmed *et al.* (1994), Rani and Singh (1996), Konsuwa (1997), Singh and Singh (1998) and Farag (2000).

Dobrzanska and Michalik (1986) measured early yield as the weight of fruits harvested till the first 1/3 of the harvesting period.

Malash and Khalil (1988) found significant differences among pepper cultivars and fruit diameter value ranged from 1.03 to 4.39 cm. Similar results were reported by Arich *et al.* (1995) and Konsuwa (1997).

Regarding fruit length, Malash and Khalil (1988) found highly significant differences among 9 pepper cultivars. The cultivar El-Balady gave fruits with length of 4.52 cm, while the cultivar New Comer gave fruits with length of 9.89 cm.

The shape index values are useful in differentiating between long cone cvs and oval ones, the high value denotes long cone, where low value denotes oval cone (Abou El-Hassan *et al.*, 1986). They added that most sweet cvs had low values of shape index indicating to be oval shaped. Zaky (1955) showed that fruit shape index was 1.40 in Pip cv (blocky shape) and 1.90 in cv Fimentao (elongated fruit shape), the differences between those two cvs were significant.

Fruit flesh thickness in pepper significantly differed among cultivars. Abou El-Hassan *et al.* (1986) reported that hot cultivars were thinner than sweet cvs, varietal differences in this trait were also observed by Zaky (1995).

Correlation coefficients were known to be used to estimate the relationship between various pairs of traits and whether the trait was more effective or correlated with yield. This study was undertaken in an attempt to evaluate and compare ten pepper pure lines that they released from El-Balady sweet pepper cultivar through pure line selection method.

## **MATERIALS AND METHODS**

Pure line selection program continued for four years at El-Baramoon Horticultural Research Farm, Dakahlia Governorate, Egypt. Ten different lines were developed through selection individual plants among the original population of El-Balady cultivar depend on yield and quality. The program of pure line selection was; selection of numerous individual plants, growing of selected plants separately in single rows and select among rows, and after year evaluation of the best ten inbred lines was conducted.

Evaluation work was made at the same farm to evaluate these selected lines during the two successive summer seasons 2001 and 2002.

Comparing with the original population (El-Balady). Randomized complete blocks design with three replications was used. Each plot consisted of three rows, 4.5 m long and 70 cm apart, so the plot area was 9.45 m<sup>2</sup>, and the seedlings (20 cm height) were transplanted at 30 cm spacing on March 10<sup>th</sup>, in both seasons. The seeds were grown 60 days earlier.

Normal cultural practices of irrigation, fertilization and pest control were followed wherever they were necessary.

The samples of yield and yield component were taken when the fruits reached to the green harvest stage, by random choosing.

Data recorded were fruit number per plant, fruit weight, total yield per plant, early yield per plot, total yield per plot, fruit diameter, fruit length, fruit shape index and flesh thickness.

All recorded data were subjected to statistical analysis, for each year separately, as illustrated by Al-Rawi and Khalf-Allah (1980). Differences among means were compared using Duncan's Multiple Range Test (Duncan, 1955).

## RESULTS AND DISCUSSION

Analysis of variance data presented in Table (1) for the first season and Table (2) for the second one, illustrated the presence of significant differences among all tested lines means as well as the original population as a check. These results indicated that the selection within El-Balady sweet pepper cultivar proved to be effective in separating new lines by pure line program used. It was concluded that there was enough scope for improvement the quantitative and qualitative characters in pepper by simple breeding method, pure line selection (Gaafar, 1993; Rani and Singh, 1996; Konсуwa, 1997 and Singh and Singh, 1998).

The data presented in Tables (1 and 2) were summarized as follows:-

**Table 1: Comparison among the means of traits of the 10 pepper pure lines and original cultivar as a check in the summer season 2001.**

Lines	Fruits number / plant	Fruit weight (gm)	Total yield / plant (kg)	Early yield / plot (kg)	Total yield / plot (kg)	Fruit diameter (cm)	Fruit length (cm)	Fruit shape index	Fresh thickness
1	37.0 e	30.0 ab	1.11 d	2.60 c	7.8 e	4.0 a	5.8 b	1.44 b	0.27 cde
2	30.0 fg	23.0 de	0.69 e	1.60 e	4.8 h	3.6 abc	5.2 bc	1.46 b	0.37 abcd
3	100 a	20.0 e	2.0 a	4.20 a	12.6 a	3.1 bc	8.5 a	2.98 a	0.23 de
4	70.0 c	21.0 e	1.47 c	3.90 a	11.7 b	3.3 abc	4.7 bc	1.44 b	0.17 e
5	78.0 b	23.0 de	1.80 ab	3.00 b	9.0 d	3.4 abc	5.2 bc	1.58 b	0.37 bcd
6	60.0 d	27.0 bc	1.62 bc	4.20 a	12.6 a	2.9 c	4.7 bc	1.62 b	0.53 a
7	60.0 d	30.0 ab	1.80 ab	3.30 b	9.9 c	4.2 a	4.8 bc	1.16 b	0.43 abc
8	34.0 efg	31.0 a	1.04 d	3.10 b	9.3 d	3.9 ab	4.8 bc	1.23 b	0.33 bcde
9	35.0 ef	26.0 cd	0.91 d	2.10 d	6.3 g	3.6 abc	5.6 bc	1.55 b	0.47 ab
10	29.0 g	31.0 a	0.90 d	2.40 cd	7.2 f	3.6 abc	5.4 bc	1.53 b	0.33 bcde
Check cultivar	21.0 h	20.0 e	0.42 f	0.8- f	3.6 i	3.0 c	4.5 c	1.52 b	0.27 cde

Means having the same letter in the same column do not significantly differ using Duncan's Multiple Range Test at 5% probability..

### 1. Fruits number / plant:

The average number of fruits per plant of 10 sweet pepper lines under study ranged from 29.0, and 30.7 (in line 10) to 100, and 105 (in line 3) in the two seasons of study. All these lines significantly exceeded the check cultivar. These results agreed with the reported data by Khalil *et al.* (1988), Das *et al.* (1990), Khalil (1992), Rani and Singh (1996) and Konсуwa (1997).

**Table 2: Comparison among the means of traits of the 10 pepper pure lines and original cultivar as a check in the summer season 2002.**

Lines	Fruits number / plant	Fruit weight (gm)	Total yield / plant (kg)	Early yield / plot (kg)	Total yield / plot (kg)	Fruit diameter (cm)	Fruit length (cm)	Fruit shape index	Fresh thickness
1	39.0 e	31.7 a	1.24 d	2.73 e	8.20 e	4.1 ab	5.9 b	1.45 b	0.27 ef
2	31.7 fg	24.3 cd	0.77 e	1.67 g	5.03 h	3.7 abcd	5.3 bcd	1.46 b	0.40 bcd
3	105.0 a	21.0 d	2.20 a	4.40 a	13.23 a	3.1 d	8.7 a	2.88 a	0.23 f
4	73.7 c	22.0 d	1.62 c	4.10 b	12.30 b	3.4 bcd	4.8 cd	1.43 b	0.17 f
5	82.0 b	24.3 cd	2.00 ab	3.17 d	9.47 d	3.5 bcd	5.3 bcd	1.57 b	0.40 bcd
6	63.0 d	28.7 ab	1.81 bc	4.40 a	13.23 a	3.0 d	4.8 cd	1.62 b	0.57 a
7	63.0 d	31.7 a	1.99 ab	3.47 c	10.40 c	4.3 a	4.9 bcd	1.16 b	0.47 abc
8	36.0 efg	29.3 ab	1.06 d	3.27 cd	9.77 d	3.9 abc	4.9 cd	1.24 b	0.37 bcde
9	37.0 ef	27.3 bc	1.01 de	2.20 f	6.63 g	3.7 abcd	5.7 bc	1.54 b	0.50 ab
10	30.7 g	32.7 a	1.00 de	2.53 e	7.57 f	3.6 abcd	5.5 bcd	1.52 b	0.37 cde
Check cultivar	22.0 h	21.0 d	0.46 f	0.83 h	3.77 i	3.3 cd	4.6 d	1.41 b	0.27 def

Means having the same letter in the same column do not significantly differ using Duncan's Multiple Range Test at 5% probability.

#### 2. Average fruit weight:

The highest average fruit weight was obtained from the lines 8, 10, 7, 1 and 6. While, the lowest average fruit weight was obtained from the lines 9, 2, 5, 4 and 3 followed by the check cultivar in the two seasons of study, respectively. Herein, it could be suggested that such lines of the highest fruit weight might be activity accumulated and translocated more bioassimilates into their fruits, as well as activity of setting more fruits compared with check cultivar. These results are in line with Khalil *et al.* (1988), Das *et al.* (1990), Khalil (1992), Rani and Singh (1996) and Konsuwa (1997).

#### 3. Total yield per plant:

Data of this trait clearly showed that there were significant differences in total yield among the studied pepper genotypes. The maximum total yield per plant was obtained from the lines 3, 5, 7, 6 and 4. While, the minimum total yield per plant was obtained from the lines 1, 8, 9, 10 and 2 in the two seasons of study, respectively. All these lines were superior than check cultivar. It was clear from the same data that such superiority in yield of these lines could be due to the high fruit number per plant and average fruit weight. This reflected physiological and genetical superiority. These results agreed with the reported data by Gaafar (1993), Ahmed *et al.* (1994), Rani and Singh (1996), Konsuwa (1997), Singh and Singh (1998) and Farag (2000).

#### 4. Early yield per plot:

The weight of fruits harvested till the first 1/3 of the harvesting period is considered the early yield / plot. It is clear from the data that the maximum early yield per plot was obtained from the lines 6, 3, 4, 7 and 8 compared to check cultivar. While the minimum early yield per plot was obtained from the lines 5, 1, 10, 9 and 2 in the two seasons of study, respectively. All these lines were superior than check cultivar. These results are in line with the data obtained by Dobrzanska and Michalik (1986).

#### **5. Total yield per plot:**

Data presented in this study revealed that the maximum total yield per plot was given by the lines 6, 3, 4, 7 and 8. While, the minimum total yield per plot was given by the lines 5, 1, 10, 9 and 2 in the two seasons. All these lines were superior than check cultivar. It was obvious from the data that such superiority in total yield per plot of these lines could be due to the superiority in total yield per plant. These results agreed with the reported data by Zaky (1995), Konsuwa (1997) and Farag (2000).

#### **6. Fruit diameter:**

The biggest fruit diameter was given by the lines 7, 1, 8, 9 and 2 in the two seasons. While, the smallest fruit diameter was given by the lines 10, 5, 4 and 3 followed by the check cultivar then line 6 in the first season. While in the second season, check cultivar, line 3 and line 6 were given the smallest fruit diameter. These findings are in agreement with those obtained by Malash and Khalil (1988), Arich *et al.* (1995) and Konsuwa (1997).

#### **7. Fruit length:**

The tallest fruit in the two seasons was given by the lines 3, 1, 9, 10, 2 and 5, respectively. While the shortest fruit was given by the lines 7, 8, 4, 6 and later check cultivar. Generally, fruit length ranged from 4.5 and 4.6 (in check cultivar) to 8.5 and 8.7 cm (in line 3). The remaining cultivars were in between in this respect. These results are in line with Malash and Khalil (1988).

#### **8. Fruit shape index:**

Line 3 (2.88 and 2.98) showed the highest values of shape index in both seasons. While the other 9 lines and check cultivar were not significant differences in both seasons also. The shape index values are useful in differentiating between long cone cvs and oval ones, the high value denotes long cone, where low value denotes oval cone (Abou El-Hassan *et al.*, 1986). It is clear from the data that line 3 had elongated fruit shape, while the other 9 lines and check cultivar had blocky shape (Zaky, 1995).

#### **9. Flesh thickness:**

Average flesh thickness ranged from 0.17 and 0.17 cm (in line 4) to 0.53 and 0.57 cm (in line 6). However, the maximum flesh thickness value of fruit was shown by the lines 6, 9, 7, 5, 2, 10 and 8. They significantly exceeded the control (check cultivar) in this respect in both seasons. It is obvious that all hot cvs generally gave thinner fruits than those given by the sweet cultivars (Abou El-Hassan *et al.*, 1986; Zaky, 1995 and Farag, 2000).

#### **Correlation coefficients:**

A correlation study was carried out to determine the relationship between yield and six other traits. Data presented in Table (3) cleared that the existence of high positive correlation between total yield and number of fruits per plant. On the other hand, all the studied traits, except fruit diameter

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and flesh thickness were positively correlated with total yield at the two seasons of study.

**Table 3: Correlation coefficient values of yield and 6 traits of pepper strains, as well as the check cultivar during the seasons 2001 and 2002.**

Traits	Total yield / plot	
	2001	2002
Fruits number / plant	0.81	0.81
Fruit weigh	0.02	0.01
Fruit diameter	-0.12	-0.19
Fruit length	0.30	0.30
Fruit shape index	0.29	0.36
Flesh thickness	-0.01	-0.02

Generally, all the ten lines were superior than check cultivar for the qualitative and quantitative characters for sweet pepper crop. Attention must be given to the new high yielding lines 3, 4, 6 and 7, which had different characters for the different purposes for the grower and consumer. For example, the lines 3 and 4 had low flesh thickness fruit, so it may be used in cooked and pickled. While, the lines 6 and 7 had high flesh thickness fruit, so it may be used in fresh market.

Finally, it must be concluded that such new selected superior lines 6, 3, 4 and 7 appeared to be diet strains and had a superior for the qualitative and quantitative characters, in addition, their adaptability for Egyptian conditions. So, it could be utilized commercially as a new promising cultivars or in breeding programs to be utilized from some promising traits.

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## سلالات جديدة من الفلفل البلدى

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تم إنتخاب ١٠ سلالات جديدة من الصنف البلدى للفلفل الحلو والذى لوحظ أنه يشتمل على خلط وراثى بين نباتاته وذلك من خلال برنامج تربية إستمر لمدة ٤ سنوات فى المزرعة البحثية بالبرامون بمحافظة الدقهلية وتم تقييم هذه السلالات فى الموسم الصيفى عام ٢٠٠١ ، ٢٠٠٢ بنفس المزرعة للمقارنة بينهم وبين الصنف البلدى الأصىلى . وقد أوضحت النتائج أن السلالات المختبرة أظهرت إختلافات إحصائية فيما بينها لمعظم الصفات المدروسة والمتعلقة بالمحصول والجودة وهى عدد الثمار للنبات - متوسط وزن الثمرة - الإنتاج الكلى للنبات - الإنتاج المبكر للقطعة التجريبية - الإنتاج الكلى للقطعة التجريبية - قطر الثمرة - طول الثمرة - دليل شكل الثمرة وسمك لحم الثمرة .

وقد أظهرت السلالات رقم ٦ ، ٣ ، ٤ ، ٧ على الترتيب معنوية عالية لكل الصفات المدروسة بالنسبة لصنف المقارنة (الصنف البلدى الأصىلى) مما يدل على فاعلية الإنتخاب فى هذا الصنف التجارى والمستخدم فى الزراعة المحلية منذ فترة طويلة مما ترتب عليه وجود إختلافات مظهرية ووراثية بسبب الطفرات والخلط الميكانيكى والوراثى . ويوجد إرتباط قوى موجب بين الإنتاج الكلى للقطعة التجريبية وعدد الثمار للنبات ، ويوجد أيضا إرتباط موجب بين الإنتاج الكلى للقطعة التجريبية وصفة كل من متوسط وزن الثمرة - طول الثمرة ودليل شكل الثمرة . كما يوجد إرتباط سالب بين الإنتاج الكلى للقطعة التجريبية وصفة كل من قطر الثمرة وسمك لحم الثمرة .

وفى النهاية نوصى بإكثار السلالتين أرقام ٣ ، ٤ وذلك لغرض الطهى والتخليل حيث أن سمك اللحم قليل ، وكذلك السلالتين ٦ ، ٧ لغرض الإستهلاك الطازج أو حسب ذوق المستهلك حيث أن سمك اللحم كبير وهى سلالات متفوقة وواعدة تحت الظروف المصرية .