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NEW STRAINS OF COWPEA (*Vigna unguculata* L.WALP.).

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ABSTRACT

This research was carried out at El-Baramoon Horticulture Research Farm, Dakahlia Governorate, Egypt, during the summer seasons for five years. Seven cowpea genotypes, including 6 selected lines and Cream 7 cultivar were grown in randomized complete blocks design with three replications. These inbred lines obtained from Cream 7 cultivar after five generations of inbreeding and selection and were evaluated. The differences among means of most tested lines appeared significance and all the selection lines were superiors than check cultivar for the total yield trait of cowpea. The results indicated that the strains S3, S2 and S6, respectively were superiors than check cultivar (Cream 7) for the qualitative and quantitative traits of cowpea crop. The results revealed that the pure line selection method within Cream 7 cultivar proved to be effective in separating new promising white lines superior of yield and quality. A correlation study indicated that the existence of high positive correlations between total yield and each of number of pods per plant, pod filling, dry weight per plant and 100 seed weight. On the other hand, all the studied traits except pod length and pod width were positively correlated with total yield at the two seasons of study.

Finally, it must be concluded that such new selected superior lines S3, S2 and S6 respectively had superior for the qualitative and quantitative characters, in addition, their adaptability for Egyptian conditions. So, it could be utilized commercially as new promising cultivars or in breeding programs to be utilized from some promising traits.

INTRODUCTION

Cowpea is one of the most ancient crops known to man. The nutritional value of cowpea lies in their high protein content which is 20 – 25 % and is double the protein values of most cereals (Dovlo *et al.*, 1984). In addition to it is excellent source of proteins, cowpea contains carbohydrates, vitamins and minerals as well as of dietary fibers, while the fat quantity is low and cholesterol content zero (Sales and Rodrigues, 1988).

Breeding studies of cowpea were carried out by many breeders such as, Ajibade and Morakinyo (2000), Badiane *et al.* (2004), Anthony (2004), Souza *et al.* (2007) and Abdel-Ati *et al*. (2013). According to Queiroz (2001), genetic improvement programs in the last decade gave rise to a significant increase in cowpea yield by the development of cultivars that meet consumers expectations. The wide genetic variability in the species made this possible.

Correlation coefficient 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. Studies on correlations with cowpea (Bezerra *et al*., 2001 and Lopese *et al.*, 2001) have tried to interpret the results and obtain support to work out adequate improvement strategies. This study aimed to evaluate and compare six cowpea pure lines that they released from Cream 7 cultivar through pure line selection method.

MATERIALS AND METHODS

Pure line selection program, continued for five years at el-Baramoon Horticulture Research Farm, Dakahlia Governorate, Egypt. Six different lines were developed through selection individual plants among the original population of Cream 7 cultivar depend on growth, yield and quality. The program was as follows: a) Selection of nemours individual plants. b) Growing of selected plants separately in single rows to select among rows. c) Evaluation of the best six inbred lines.

Evaluation work was made at the same farm to evaluate these selected lines during the two successive summer seasons 2012 and 2013, comparing with the local variety (Cream 7). Randomized complete blocks design with three replications was used. Each plot consisted of three rows, 4.5 m long, 70 cm wide, so the plot area was 9.45 m^2. Cowpea seeds were planted on April 6^{th} in both seasons, three seeds were sown per hill at 30 cm spacing and after germination seedlings were thinned at two seedlings. Normal cultural practices of irrigation and pest control were followed wherever they were necessary.

Data recorded were:

1-Plant height (cm).
2-Number of branches per plant.
3-Plant dry weight (gm).
4-Pod length (cm).
5-Pod width (mm).
6-Number of seeds per pod.
7-Pod filling % (PF) determined according to Remison (1978) as following formula.

$$\text{Pod filling \%} = \frac{\text{No of seeds/pod}}{\text{Pod length (cm)}} \times 100$$

8-Number of pods per plant.
9-Hundred seeds weight, in gram recorded after harvesting.
10- Total yield of dry seeds, in Kg/feddan recorded after harvesting.

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 season, illustrated the presence of significant differences among most of tested lines means for most traits as well as the original population as a check cultivar (Cream 7). These results indicated that the selection within Cream 7 cowpea cultivar proved to be effective in separating new lines by pure line selection program used. The data presented in Tables (1 and 2) were summarized as follows:

Plant height:

The tallest line in the first and second season was line S1 (88.33 and 89.00 cm) followed by the lines S6, S2 and S3, respectively. Most new lines were significantly taller plants than the check cultivar.

Number of branches per plants:

The highest number of branches was given by the lines S1, S2 and S6 in the first and second seasons respectively, and significantly exceeded the check cultivar (Cream 7).

Plant dry weight:

The biggest plant dry weight was given by the lines S2, S4 and S3 in the two seasons, and significantly exceeded the check cultivar.

Pod length:

The tallest pod in the two seasons was given by the check cultivar (Cream 7), followed by the lines S4, S3 and S2 in the two seasons respectively.

Pod width:

The biggest pod width was given by the line S5. While the smallest pod width was given by the line S4 in the two seasons of study.

Number of seeds per pod:

The highest number of seeds per pod was given by the lines S2, S3, S4 and check cultivar respectively in the two seasons. While the lowest number of seeds was given by the line S1.

Pod filling percentage:

The highest pod filling percentage was obtained from the lines S2, S3, S5 and S4, while the lowest record was given by the lines S1 and S6 followed by the check cultivar, respectively.

Number of pods per plant:

The highest number of pods was obtained from the lines S3, S2, S6 and S1 in the two seasons respectively, while the lowest number of pods was obtained from the lines S4 and S5 followed by the check cultivar.

Weight of 100 seeds:

The highest record for the weight of 100 seeds in the first season was obtained from the lines S3 and S6, while the lowest record was given by the lines S4 and S5, followed by the check cultivar. In the second season the highest record was obtained from the lines S3 and S6, while the lowest record was given by the lines S1, S5 and S2 followed by the check cultivar respectively.

Total dry seed yield:

Data presented in this study as shown in Tables (1 and 2) revealed that the maximum total yield per feddan was obtained from the lines S3, S2 and S6 in the two seasons of study, respectively. It was obvious from the same data that the six lines were superiors with respect to the total dry seed yield comparing with the check cultivar (Cream 7).

A correlation study was carried out to determine the relationship between yield and other nine traits. Data presented in Table (3) cleared that the existence of high positive correlation between total yield and each of number of pods per plant, pod filling, dry weight per plant and 100 seed weight. On the other hand, all the studied traits except pod length and pod width were positively correlated with total yield at the two seasons of study. The number of pods per plant is therefore a trait that can be considered in the indirect selection for higher yield in segregating cowpea populations. These results are consistent with those of Souza *et al.* (2007) recommended that

selection for more pods per plant may achieve a higher grain yield in cowpea, Jindal and Gupta (1984), Oliveira *et al.* (2003), Singh and Mehndiratta (1969) who evaluated cowpea and Ribeiro *et al.* (2001) who worked with common bean, suggesting that the number of pods per plant can actually be used as selection criterion for higher grain yield in cowpea. Generally, all the six white lines were superiors than the check cultivar (Cream 7) for the total yield and quality (white colour compared with yellowish white colour of check cultivar). Finally, it must be concluded that such new selected superior lines S3, S2 and S6 respectively appeared to be diet strains and had superior for the qualitative and quantitative characters, in addition, their adaptability for Egyptian conditions so, it could be utilized commercially as new promising cultivars or in breeding programs to be utilized from some promising traits.

Table 3: Correlation coefficient values of yield and 9 traits of cowpea strains as well as the check cultivar during the seasons of 2012 and 2013.

Traits	Total yield / fed.	
	2012	2013
Plant height	0.50	0.52
No. of branches	0.64	0.66
Dry weigh/plant	0.79*	0.63
Pod length	- 0.40	-0.40
Pod width	- 0.21	-0.21
No. of seeds/pod	0.25	0.22
Pod filling	0.82*	0.71
No. of pods/plant	0.94**	0.93**
100 seed weight	0.67*	0.65

****,* Significant at 1 and 5 % probability, respectively by the T test.**

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سلالات جديدة من اللوبيا.

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تم انتخاب ستة سلالات جديدة من صنف اللوبيا كريم ٧ والذى لوحظ أنه يشتمل على خلط وراثى بين نباتاته وذلك من خلال برنامج تربية استمر لمدة ٥ سنوات فى المزرعة البحثية بالبرامون بمحافظة الدقهلية – وتم تقييم هذه السلالات فى الموسم الصيفى عامى ٢٠١٢ و ٢٠١٣ بنفس المزرعة للمقارنة بينهم وبين الصنف الأصلى كريم ٧ . وقد أوضحت النتائج أن السلالات المختبرة أظهرت اختلافات احصائية فيما بينها لمعظم الصفات المدروسة والمتعلقة بالمحصول والجودة وهى ارتفاع النبات – عدد الأفرع للنبات – الوزن الجاف للنبات – طول القرن – عرض القرن – عدد البذور فى القرن – نسبة الامتلاء % - عدد القرون على النبات – وزن ١٠٠ بذرة جافة و الإنتاج الكلى للبذور الجافة بالفدان وقد تفوقت جميع السلالات المنتخبة S1، S2 ، S3 ، S4 ، S5 و S6 على صنف المقارنة الأصلى كريم ٧ فى صفة الإنتاج الكلى للفدان.

وقد أظهرت السلالات أرقام S3 ، S2 و S6 على الترتيب معنوية عالية لمعظم الصفات المدروسة بالنسبة لصنف المقارنة (كريم ٧) مما يدل على فاعلية الانتخاب فى هذا الصنف التجارى والمستخدم فى الزراعة المحلية منذ فترة طويلة مما ترتب عليه وجود اختلافات مظهرية ووراثية بسبب الطفرات والخلط الميكانيكى والوراثى. ويوجد ارتباط قوى موجب بين الإنتاج الكلى وصفة كل من عدد القرون على النبات – نسبة الامتلاء والوزن الجاف للنبات ووزن ١٠٠ بذرة جافة.

وفى النهاية نوصى بإكثار السلالات S3، S2 و S6 وهى سلالات متفوقة وواعدة تحت الظروف المصرية من ناحية الإنتاج والجودة حيث أنها سلالات بذورها بيضاء اللون وصفات الطهى جيدة.

Table 1: Comparison among the means of traits of the 6 cowpea pure lines and original cultivar as a check in the summer season of 2012.

Lines	plant height (cm)	No.of branches /plant	Plant dry weight (g)	Pod length (cm)	Pod width (mm)	No. of seeds/pod	Pod filling%	No. of pods/plant	100 seed weight (g)	Dry seed yield (Kg/fed).
S1	88.33 a	6.00 a	58.95 c	14.67 c	7.83 ab	10.67 c	73.48 cd	52.00 b	11.98 c	1313.33 c
S2	81.33 ab	6.00 a	77.20 a	16.67 b	7.67 ab	14.33 a	86.34 a	54.67 b	12.02 c	1483.33 b
S3	75.33 bc	5.67 ab	66.19 b	16.67 b	7.70 ab	14.00 a	84.49 ab	68.00 a	14.28 a	1583.33 a
S4	69.67 cd	4.00 d	67.22 b	17.00 b	6.50 c	13.67 ab	80.45 ab	41.00 c	11.87 c	1300.00 c
S5	73.00 c	5.67 ab	58.33 c	15.67 bc	8.63 a	11.33 c	81.11 ab	40.67 c	11.87 c	1303.33 c
S6	85.67 a	6.00 a	51.80 d	14. 67 c	7.63 b	11.67 bc	79.36 bc	54.00 b	13.07 b	1408.33 b
Check cultivar	62.00 d	4.00 b	48.00 d	19.33 a	8.27 ab	13.67 ab	70.79 d	31.33 d	11.81 c	1133.33 d

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

Table 2: Comparison among the means of traits of the 6 cowpea pure lines and original cultivar as a check in the summer season of 2013.

Lines	Plant height (cm)	No.of branches /plant	Plant dry weight (g)	Pod length (cm)	Pod width (mm)	No. of seeds/pod	Pod filling %	No. of pods/plant	100 seed weight (g)	Dry seed yield (Kg/fed).
S1	89.00 a	6.33 a	58.92 c	15.67 c	7.73 b	11.33 d	72.36 b	51.00 b	11.33 e	1316.67 d
S2	82.00 bc	6.33 a	77.00 a	17.00 bc	7.63 b	14.66 a	86.59 a	53.67 b	11.73 cd	1486.67 b
S3	77.00 cd	6.33 a	66.14 b	17.33 b	7.63 b	14.33 ab	82.87 ab	67.00 a	14.47 a	1586.67 a
S4	71.00 d	4.66 b	67.00 b	17.33 b	6.56 c	14.00 ab	80.83 ab	39.67 c	12.10 c	1303.33 d
S5	74.33 d	6.33 a	56.00 cd	16.33 bc	8.60 a	13.00 bc	79.78 ab	40.67 c	11.70 de	1306.67 d
S6	86.67 ab	6.66 a	51.67 de	15. 67 c	7.73 b	12.00 cd	76.67 ab	53.00 b	13.29 b	1411.67 c
Check cultivar	63.33 e	4.66 b	48.33 e	19.33 a	8.20 ab	14.00 ab	72.64 b	32.00 c	11.92 cd	1136.67 e

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