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Improvement of Egyptian Loofahs (*Luffa egyptica* L.) Using Recurrent Selection

El -Gendy, A. S.A.
Department of Vegetable Breeding Research, Horticultural Research Institute, Agriculture Research Centre, Egypt

ABSTRACT

Field experiments were conducted at Mootoubs, Kafr Elsheikh, Egypt during four successive seasons of 2012, 2013, 2014 and 2015. Commercial seed lots in the terms of original population denoted in (C0) were cultivated at first season and self-pollination was done. Cultivation on May,15 was done with plant spacing of 4X6 m^2. The selection was performed on the plants of Co , recurrent 1 denote in (C1), recurrent2 denoted in (C2) and recurrent3 denoted in (C3) of luffa were also sown, and transplanted on May 15, 2013, 2014 and 2015 seasons at private farm at Of about 150 plants were selected for good plant characteristics. Seeds with the original population C0 and other recurrent populations were sown into a randomized complete blocks design with four replications, Each replicate for each population was represented by 50-70 plants 4 * 6m. The main results could be summarized as follows; The different recurrent selection cycles had apparent significant effect and marked improvement for all studied characters. Fruit diameters, fruit length, stem length, harvest numbers, Marketable fruit, number of ears per fruit and number of seeds per fruit were gradually increased as recurrent progressed from C0 to C3 recurrent selection. The yields of loofahs involving average yield a time or yield fed^{-1} were only improved significantly when plants were selected for three times (C3). Number of fruits $plant^{-1}$ and early yield kg fed^{-1} were clearly decreased as recurrent selection progressed in the terms of advanced recurrent selection. From going discussion, it could be concluded that the simple recurrent selection had high affinity to improve morphological characteristics rather than yield. Yield improvement need more cycle of selection for getting more improvement since the C3 showed reasonable improvement in yield of loofahs.

Keywords: Loofahs, Morphological traits improvement, Recurrent selection

INTRODUCTION

Loofahs are of two types; the angled loofah (ridge gourd) and the smooth loofah (smooth gourd) immature loofah fruits used as vegetables and mature used for fiber. Loofah is a good source of carbohydrates, vitamin C and minerals, the fiber used for industrials. For genetic improvement and development of new varieties, population improvement-especially mass selection and recurrent selection can be used. pedigree selection is being used (Zhang 1989). Also, Zhang (1989) produced new improved luffa by recurrent selection showed long fruit and high yield/plant (50 kg/plant). Bosland and Votava (1999), Cardi (2002), Herman (2004) and El-Gendy and Ramadan (2008) reported that improve the desirable characteristics of balady hot pepper cultivar by the method of simple recurrent selection. It is evident that the phenotypic recurrent selection was found to be more effective in improving balady hot pepper for mentioned measured characteristics. Furthermore, Gruneberg *et al*. (2005), Acquaah (2007) and Chiona (2009) improved other vegetable crop such as cucumber and sweet potato using simple recurrent selection. It was found that recurrent selection methods gave significant increase in number of fruits, average of fruit weight, fruit diameters and capsaicin percentage in selected population than those obtained by the original population of balady hot pepper. El Gendy and Arfa (2014) reported that it is evident that the phenotypic recurrent selection was found to be more effective in improving local varieties of sweet potato. Zhang *et al*. (2007) stated that shape fruit of loofahs or other similar vegetable can be improved by breeding and selection such as simple recurrent selection. The study was amid to improve quality and yield of Egyptian loofahs by using recurrent selection.

MATERIALS AND METHODS

The current experiment was carried out at Mootoubs, Kafr Elsheikh, Egypt during four successive seasons of 2012, 2013, 2014 and 2015. Commercial seed lots in the terms of original population denoted in (C0) were cultivated at first season and self-pollination was done. Seedling of loofahs plants were transplanted at 35 days seedling age. Cultivation on May,15 was done with plant spacing of 4 * 6 m^2. The selection was performed on the plants of Co , recurrent 1 denote in (C1), recurrent2 denoted in (C2) and recurrent3 denoted in (C3) of luffa were sown, and transplanted on May 15, 2012 at private farm, 150 plants were selected for good plant characteristics. Selfied seeds of the 150 plants (S1) were sown and transplanted separately for crop production .At maturity, selection for the previous traits was undertaken within and between the S1 lines, only 50 plants were saved for intercrossing to produce the first cycle seeds (C1)

Seeds with the original population C0 and other recurrent populations were sown into a randomized complete blocks design with four replications Each replicate for each population was represented by 50-70 plants 4 * 6m.

Data were taken for the fruit diameter, fruit length, number of fruits (ears), stem length (cm), early yield kg fed^{-1}, Number of harvests, average of yield harvests fruits, yield fed^{-1}, marketable fruits, number of ears and number of fruits ear^{-1}. The improvement rate in the terms of increase (- or+ %) was estimated for each traits with each recurrent selection.

The obtained data were statistically analyzed according to Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Referred to Table 1 the selection generation from C0 up to C3 on fruit diameter; the data indicated that C0

had the lowest value of fruit diameter. While, the highest fruit diameter was produced by C3 as compared with the other selective generations. It was observed that there are gradually increment from C0 up to C3. The improvement percentages were 21%, 29% and 65% for C1, C2 and C3, respectively. For fruit length, the improvement rate was high since, it reached to 61.53% with the third recurrent progeny as in Table 1. The current results are in a good conformity with those reported by Zhang (1989), Acquaah (2007), Zhang *et al*. (2007), El-Gendy and Ramadan (2008), Chiona (2009) and El Gendy and Arfa (2014).

Table 1. The mean performance of loofahs fruit diameter and fruit length as affected by different recurrent selection.

RC P	Fruit diameter(cm)	Increase %(-or+)	Fruit length (cm)	Increase %(-or+)
C0	41.00	----	65.00	
C1	50.00	21	71.66	9.29
C2	53.33	29	80.00	23.1
C3	68.33	65	105.00	61.53
LSD at 0.05	26.88	-	32.47	-

Data in Table 2 indicated that the fruits number of the selective generations insignificantly differed from one to another. Also, the recurrent selection had significant negatively effect on fruit numbers. The recurrent 1 progeny (C1) had the highest values of number of fruits, while the lowest number of fruits were given by C2 without significant difference with C3. The recurrent selection of C2 and C3 did not approach any improvement in numbers of fruit. The latter couple recurrent selection negatively decreased the number of fruits. Only, the recurrent selection (C1) slightly increased the number of fruits without any significant deference with obtained by C0. Stem length was significantly affected by recurrent selection. There is continues significant increase in stem length with advanced different recurrent selection progeny performing. The recurrent selection (C3) gave the longest stem followed by recurrent selection (C2) without significant differences between them. On the other hand, the recurrent selection (Co) produced the shortest stem length without significant differences with those produced by recurrent selection C1. Also, it was observed that both of C1 and C2 were comparable regarding stem length. The increasing percentages were 7.0, 27.0, and 50% for C1, C2 and C3, respectively. Similar findings were reported by Zhang (1989), Acquaah(2007), Zhang *et al*. (2007), El-Gendy and Ramadan (2008), Chiona (2009) and El Gendy and Arfa (2014).

Table 2. Number of fruits and stem length of loofahs as affected by different recurrent selection.

RC P	Number of fruits	Increase% (-or, +)	Stem length (cm)	Increase% (-or+)
C0	14.33	----	8.66	---
C1	14.66	2	9.33	7.0
C2	10.66	-25	11.00	27
C3	11.33	-20	13.00	50
LSD at 0.05	3.1	-	3.21	-

Data in Table 3 gives information about early yield and number of harvests of the four selective generations. It cleared that no significant differences among recurrent selection progeny. On the other side, the highest early yield was given with the C0 and C1 selective generations since they possess the same values. Interestingly, the last two recurrent selections of C2 and C3 produced the lowest early yield since, they had the same values of early yield without any improvement. There is clear reduction in early yield with both of C2 and C3 progeny that was -8% for each. The number of harvest was significantly affected by recurrent selection. There is significant increase in number of harvest with advanced different recurrent selection progeny performing for C2 and C3 only. The recurrent selection of C1 did not show any increase or improve in harvest number since it gave the same value of C0. The recurrent selection (C2) gave the highest number of harvest followed by recurrent selection (C3) without significant differences. On the other hand, the recurrent selection (Co) produced the lowest values of harvest numbers without significant differences with those produced by recurrent selection C1. Also it was observed that both of C2 and C3 were comparable regarding number of harvest. The increasing percentages were 0, 18 and 14% for C1, C2 and C3, respectively. Similar findings were reported by Zhang (1989), Acquaah (2007), Zhang *et al*. (2007) , El-Gendy and Ramadan (2008), Chiona (2009) and El Gendy and Arfa (2014).

Table 3. The mean performance of loofahs of early yield and number of harvests as affected by different recurrent selection

RCP	Early yield kg (fed^{-1})	Increase% (-or+)	Number of harvests	Increase% (-or+)
C0	111.66		9.00	----
C1	111.66	0	9.00	----
C2	101.66	-8	10.66	18.0
C3	101.66	-8	10.33	14.0
LSD at 0.05	NS		1.00	

Data in Table 4 showed the finding related to the effect of recurrent selection on both of average of yield kg harvest fruits and yield kg fed. It was observed that only the recurrent selection of C3 gave significant improvement and its increase rate was 11%. The other two recurrent progeny (C1 and C2) did not show any significant average yield harvest fruit^{-1} . The total yield fed showed the same pattern of average yield harvest fruits^{-1}, but C3 recorded significant higher yield with increase percentage of 3%. The recurrent selection C2 and C3 were comparable regarding yield fed^{-1}. Also it was noted that both of C0 and C1 had the same values of yield fed^{-1} . Similar findings are claimed by Zhang (1989), Acquaah (2007), Zhang *et al*. (2007) , El-Gendy and Ramadan (2008), Chiona (2009) and El Gendy and Arfa (2014).

Table 4. The average of yield and yield of loofahs as affected by different recurrent selection.

RC P	Average of yield (kg harvests fruits)	Increase% (-or+)	Yield (kg fed^{-1})	Increase% (-or+)
C0	335.00	----	3730.00	----
C1	336.66	+4.0	3730.33	----
C2	336.66	+4.0	3800.00	+1
C3	373.33	-11.0	3850.00	+3
LSD at 0.05	20		110.00	

Data in Table 5 presented the marketable fruit, number of ears fruit^{-1} and number of seed fruit^{-1} of the recurrent selection cycles .The cycle of recurrent selection had significant effect on above mentioned traits. The data showed that C3 had the highest values of the abovementioned characteristics, while the C0 proved the lowest values of them. Furthermore, there are gradually increments in those traits from C0 up to C3. The improvement rates were very high in marketable fruit since, it reached up to 125% at C3 and they were 62 and 104% for both of C1 and C2, respectively. With respect to number of ears fruit^{-1}, the improvement was 50% with C3, while their values were 22 and 30% for C1 and C2, respectively. Obviously, the improvement of seed number fruit-1 reached to high score , 190% with C3. At the same time the improvement rates of C1 and C2 were 19 and 70 for C1 and C2, respectively. There are several scientists such as Zhang (1989), Acquaah (2007), Zhang *et al*. (2007, El-Gendy and Ramadan (2008), Chiona (2009), and El Gendy and Arfa (2014) did completely agrees with the current results.

Table 5. The mean performance of loofahs Marketable fruit, number of ears fruit^{-1} and number of seeds fruit as affected by different recurrent selection

RC P	Marketable fruit	Increase% (-or+)	No of ears fruit^{-1}	Increase% (-or+)	No. of seeds fruit^{-1}	Increase% (-or+)
C0	40.00	----	3.33	----	293.33	----
C1	65.00	62	3.66	22	350.00	19
C2	81.66	104	4.33	30	500.00	70
C3	90.00	125	5.00	50	800.00	190
LSD at 0.05	18.41		2.32		150.60	

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تحسين انتاجية اللوف المصري باستخدام الانتخاب التكراري البسيط

عبدالمنعم سيداحمد الجندي

قسم بحوث تربيه الخضروات – معهد بحوث البساتين – مركز البحوث الزراعيه – مصر.

اقيمت التجارب الحقليه في مركز مطوبس –محافظه كفر الشيخ و ذلك خلال المواسم الصيفيه ٢٠١٢و ٢٠١٣و ٢٠١٤ و ٢٠١٥م. جمعت البذور التجاريه استخدمت كجيل انتخابي C0 بالموسم الاول ثم تم انتخاب بعض النباتات و اجري عليها التلقيح الذاتي مع انتخاب نباتات لزراعتها في الاجيال التكراريه الاول و الثاني و الثالث و هي (C1, C2 and C3) وتمت الزراعه باستخدام شتلات علي عمر ٣٥ يوم في ١٥ مايو من كل عام علي مسافات ٤* ٦ متر مع استخدم تصميم القطاعات الكامله العشوائيه ذوثلاث مكررات. تم قياس صفات المحصول و خصائص ثمره اللوف علي ١٥٠ نبات . وكانت اهم النتتائج على النحو التالى: كان للانتخاب التكراي تاثير ايجابي و معنوي في تحسين انتاجيه و جودة اللوف الناتج. اظهر كل من قطر الثمره و طولها وطول الساق و عدد الثمار التي يمكن تسويقها ذات الجوده العاليه وعدد الكيزان بالثمرة استجابه معنويه و زياده مضطرده مع تقدم اجيال الانتخاب التكراري من الدورة الاولي و حتي الثالثه ولوحظ ان المحصول ومتوسط المحصول تحسن فقط في حاله الدورة الثالثه وعلي النقيض وجد ان عدد الثمار / النبات و محصول اول جمعه قل مع تقدم دورات الانتخاب التكراي. عليه يمكن التوجيه بان الانتخاب التكراري امكنه تحسين الصفات المورفولوجيه بصورة معنويه اكثر مما حدث مع المحصول وفقط تم تحسين المحصول في دوره الانتخاب التكراري الثالثه و ربما يحتاج المحصول الي اجيال اخري للحصول علي التحسن بدرجه عالية.