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IMPROVEMENT OF SWEET POTATO NURSERIES FOR INCREASING YIELD (QUANTITY AND QUALITY) IN EGYPT

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ABSTRACT

Two experiments were conducted during 1995 and 1996 seasons, to evaluate the propagation methodsof Sweet potato. Sweet potato seedlings of cvs. Mabrouka and Abees were used from : a) nursery (traditional method), b) seedling of trays (new method). The results in the two years revealed that using seedlings from trays gave the highest yield (ton/fed.) for two tested cultivars (Mabrouka and Abees). Seedlings obtained directly from the nursery showed many disadvantages. But, seedlings obtained from trays may be considered a new direction for increasing the yield of sweet potato for local consumption and also for exportation.

INTRODUCTION

Sweet potato is among the most important vegetable crops. The traditional propagative method is by cuttings which are produced by tuber roots. About 525 m² left from previous crops to be used to cultivate one feddan (4200 m²). Thus occupying the land for one year. Therefore, a new method was suggested. In this respect, transplants raised in plastic trays under plastic house conditions can be an appropriate alternative (Monoz, 1994; Bulter *et al.*, 1997; Kong *et al.*, 1998 and Nzima and Banga, 1999). The cultivation was carried out under plastic house conditions to prevent virus diseases and also to prevent disadvantages of occupying the land for one year. The new propagation method was investigated by using the two varieties Mabrouka and Abees.

MATERIALS AND METHODS

Two experiments were carried out in Farm of the International Potato Center (CIP) at Kafr El-Zayat, Gharbia Governorate, during the two seasons of 1995 and 1996. Two propagation methods (cuttings of old plants and transplants raised in seedling trays) were investigated by using two sweet potato varieties, *i.e.* Mabrouka and Abees.

The new method for transplants production was carried out as follows :

a- Plastic greenhouse (one kerat, *i.e.* 175 m²).

b- Benches. c- Plastic trays (65 cm length, 40 cm width) each contains 260 holes (one transplant/hole)

Cuttings were obtained from old nursery and planted in the trays in Feb. (100 plates/fed.). Also, one kerat (175 m²) gave number of transplants enough to cultivate 1000 trays. Therefore, it is possible to cultivate 10 fed. from a nursery of 175 m².

Preparing soil mixture:

The soil mixture contained sand + normal soil + peatmoss at the rate of 1 : 2 : 1 in valume. Ammonium sulphate (20 % N) and superphosphate (P_2O_5) were added to the final weight of the soil mixture at the rate of 10 % for each compound.

The cuttings were cut 10-12 cm in length and cultivated in plate trays, then irrigated every other days. After 45 days, the transplants reached about 20-25 cm with good root system and healthy terminal were ready for planting. Transplants were collected in April to transfer to permanent land. Transplants obtained by this new method of propagation were compared with cuttings obtained through the traditional method from old nursery plantations. Varieties of Mabrouka and Abees were used. A split-plot design was used with 3 replicates. The varieties occupied the main plots and the propagation methods were distributed in the sub-plots. The sub-plot area was 6.75 m^2 consisted of 3 rows, 75 cm apart and 3 meters in length. The harvesting time was in the first week of October, for both seasons.

Data recorded:

1- Leaf area per plant, m^2.
2- Total yield (kg/plot).
3- Marketable yield (kg/plot) after discarding all unmarketable thin or injured roots.
4- Dry matter content of roots was determined by oven drying samples at 70°C to constant weight.
5- Starch and total sugars in tuber roots were determined in g/100 g dry weight, according to A.O.A.C. (1970).

Statistical analysis :

All data obtained during both seasons of every experiment were subjected to statistical analysis according to Snedecor and Cochran (1972).

RESULTS AND DISCUSSION

a- Leaf area/plant (cm^2):

Data in Table (1) clearly showed that transplants obtained from seedling trays resulted in significantly higher leaf area per plant compared with the traditional propagation method (cuttings directly from nurseries) in both two years of study. Varieties were not significantly affected in two seasons. The interaction between varieties and propagation method had no significant effects also on plant leaf area in both seasons. The percentages increase in leaf area due to the use of transplants from trays and the cutting method were amounted to 34.3 % and 35.6 % for Mabrouka variety in 1995 and 1996 seasons, respectively. These increases may be due to the fact that the transplants from seeding trays formed good shoot and root system at planting time. In contrast, growing plants by using traditional method (cutting directly from nursery) needed to about 21 days in this respect. The respective figures for Abees variety were 24.9 % and 36.4 % in 1995 and

1996 seasons, respectively. Bonte *et al.* (2000) studied the influence of black polyethylene tunnel cover (BTC) on quantity and quality of sweet potato cv. Beauregard and Jewell transplants in plant beds in Louisiana and North Carolina. They found that the use of BTC increased production of Beauregard transplants from 63 % to 73 % in comparison with the bare ground control. Also, Lewthwaite (1999) reported that sweet potato transplants held in air allow root initiation suffered less transplant shock than those planted directly into the field, this technique involved little additional effort. In this respect also, Tateish and Murase (2000) used a new transplant production system that produced high quality sweet potato plug seedlings. They found also that it is a plant factory designed to produce massive amount of virus-free seedlings.

Table (1): Effect of propagation method (cuttings and transplants) on leaf area/plant (cm^2) for two varieties (Mabrouka and Abees) in 1995 and 1996 years.

	1995			1996		
Varieties Treatments	**Mabrouka**	**Abees**	**Mean**	**Mabrouka**	**Abees**	**Mean**
Cuttings from nurseries	0.553	0.490	0.522	0.573	0.507	0.540
Transplants from trays	0.743	0.652	0.698	0.777	0.693	0.735
Mean	0.648	0.622	-	0.675	0.600	-
L.S.D. at 5 % for :						
Varieties (V)		**N.S.**		**N.S.**		
Treatments (T)		**0.160**		**0.088**		
Intercation (V x T)		**N.S.**		**N.S.**		

b- Marketable yield (kg/plot):

Data presented in Table (2) indicated that the use of transplants from trays resulted in significantly higher marketable yield compared to the traditional propagation method in both the two years.

Varieties were not significantly affected in both seasons. The interaction between varieties and propagation method was not significant in 1995 season, while, it was significant in 1996 season. The Abees variety responded to the beneficial effect of the new method of propagation in both years. The percentages increase in marketable yield due to the use of the transplants from trays over traditional cuttings method were 22 % and 18 % in 1995 and 1996 seasons, respectively. The respective percentages for Abees variety were 23.4 and 22.1 % in 1995 and 1996 seasons, respectively. These increases may be due to increase plant leaf area (Table, 1) and hence relative growth rate of plants. These results coincide with those of Kong *et al.* (1998).

Table (2) : Effect of propagation method (cuttings and transplants) on the marketable yield of sweet potato (kg/plot) by using two sources of obtaining seedlings (field and trays) in 1995 and 1996 seasons.

	1995			1996		
Varieties Treatments	Mabrouka	Abees	Mean	Mabrouka	Abees	Mean
Cuttings from field	8.17	7.83	8.00	7.83	7.67	7.75
Transplants from trays	10.00	9.67	9.84	9.30	9.37	9.34
Mean	9.09	8.75	-	8.57	8.52	-
L.S.D. at 5 % for :						
Varieties (V)		N.S.		N.S.		
Treatments (T)		0.91		1.14		
Intercation (V x T)		N.S.		1.61		

c- Total yield (kg/plot):

Data presented in Table (3) showed that the use of transplants from trays produced significantly higher total yield (kg/plot) compared with the use of cuttings directly from the nursery in both seasons. The means of varieties were not significantly affected in both seasons. The interaction between varieties and propagation treatments did not reflect significant variation in total yield in both seasons. The percentages increase in total yield were 21.9 % and 15.5 % for Mabrouka variety in 1995 and 1996 seasons, respectively. the respective figures for Abees variety were 26.7 % and 17.3 % in 1995 and 1996 seasons, respectively. The increase in total yield may be due to the increase in leaf area per plant (Table, 1) which was markedly increased by the use of transplant raised in seedling trays compared with the traditional propagation method (cuttings directly from the field). This in turn, may be improved net assimilation rate, therefore, increased dry matter diverted to the tuber roots and hence increased total yield. These results are in agreement with those obtained by Hall (1993) who tested two cvs. (Georgia Jet and Red Jewel) obtained by pulled and nursery bed with or without the shoot apex removed. He found that Georgia-Jet produced the highest marketable yield when cut with no shoot apex (58.1 t/ha) compared with the yield of U.S. no. 1

Table (3) : Effect of propagation method (cuttings and transplants) on the the total yield of sweet potato (kg/plot) by using seedlings from field and trays in 1995 and 1996 seasons.

	1995			1996		
Varieties Treatments	Mabrouka	Abees	Mean	Mabrouka	Abees	Mean
Cuttings from field	9.37	10.00	9.69	9.97	9.77	9.87
Transplants from trays	11.43	12.67	12.05	11.50	11.46	11.48
Mean	10.40	11.33	-	10.74	10.62	-
L.S.D. at 5 % for :						
Varieties (V)		N.S.		N.S.		
Treatments (T)		1.22		1.18		
Intercation (V x T)		N.S.		N.S.		

(5.9 cm in diam. and 7.5-23.0 cm long) being (17.9 t/ha). While, Red Jewel produced (32.7 t/ha) marketable yield when cut with no shoot apex compared with (23.3 t/ha) being U.S. no. 1. Also, Bonte *et al.* (2000) studied the influence of black polyethylene tunnel cover BTC on quantity and quality of sweet potato cvs., Beauregard and Jewel transplants. They found that transplant quality was expressed as yield of storage root in repeated trials that extended throughout the normal growing season.

d- Dry matter percentage in roots and chemical analysis :

*** Dry matter:**

Data presented in Table (4) indicated that the dry matter percentage in sweet potato roots was not affected by the two propagation methods used for both varieties in the two years of the study. Also, tested varieties and the interaction had no marked effects on dry matter of tuber roots in both seasons. Similar results were reported by Monoz (1994).

Table (4) : Chemical analysis for some tuber root of sweet potato by sing two sources of seedlings obtained from (field and trays) in two seasons (1995 and 1996).

	1995						1996					
Varieties	Mabrouka			Abees			Mabrouka			Abees		
Treatments	Dry matter (D.M.)	Starch	Total sugar	Dry matter (D.M.)	Starch	Total sugar	Dry matter (D.M.)	Starch	Total sugar	Dry matter (D.M.)	Starch	Total sugar
Cuttingsfrom field	23.3	21.31	1.72	18.10	15.70	1.75	22.9	21.11	1.65	19.20	15.66	1.81
Transplants from trays	28.9	21.01	1.63	17.95	15.12	1.69	23.4	20.90	1.69	19.95	15.80	1.92
Mean	26.1	21.16	1.675	18.025	15.41	1.72	23.15	21.005	1.67	19.575	15.73	1.865

L.S.D. at 5 % for :		
Varieties (V)	N.S.	N.S.
Treatments (T)	N.S.	N.S.
Interaction (V x T)	N.S.	N.S.

*** Chemical analysis:**

Data in Table (4) showed that starch and total sugars (g/100 g dry weight) were not affected by the propagation method for both varieties in the two years. However, Villagarcia *et al.* (1998) reported that cuttings of sweet potato (*Ipomea batatas*) genotypes of two cvs., Jewel and MD 810 were transplanted into pots filled with sand and kept in growth Chamber for 72 days. At 30, 44, 58 and 72 days after transplanting, leaves, stems plus petiole, fibrous roots and storage root were different for total N, soluble sugars and starch. The differences were found also between the tested two cultivars, but were not significant in both seasons. In the same trend also, there were no significant interactions between tested varieties and propagation method on chemical constituents in tuber roots for both seasons. These results are in harmony with those of Bulter *et al.* (1997).

CONCLUSION

It could be concluded that using the transplants raised from seedling trays as a new method of propagation of sweet potato would result in increasing leaf area/plant as well as marketable and total yield of tuber roots. By using this new method, the area need for the nursery beds can be reduce from 525 m^2 to only 80 m^2 to produce enough seedlings for planting one feddan. Besides, it could be saving the time required to obtain growing plants which is normally 21 days in the traditional method (cutting directly from nursery) in order to form good root system in the permanent field. Moreover, using transplants from seedling trays formed already good shoot and root system at planting time.

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تحسين مشاتل البطاطا لزيادة المحصول كمـــاً ونوعاً

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أجريت التجارب لمدة سنتين ١٩٩٥، ١٩٩٦ لإختبار طريقتين للحصـــول علـــى شتلات البطاطا إما بالحصول عليها من المشتل مباشرة (الطريقة العاديـــة) أو الحصـــول على الشتلات التى زرعت بالصوانى البلاستيك لمدة ٤٥ يوما.

وجد أن زراعة شتلات البطاطا المتحصل عليها من الصوانى على مدى ســـنتى الدراسة أعطت محصولا كليا أعلى فى الصنفين اللذان تم إختبارهما وهما مبروكة وأبيس حيث زاد المحصول بصورة معنوية فى طريقة الصوانى عنه فى طريقة الحصول علـــى الشتلات من الحقل، حيث أن إستخدام هذه الطريقة أدى إلى توفير الوقت لزراعة الأرض وسهولة الزراعة والحصول على محصول عالى فى الكمية والجودة ممـــا يشـــجع علـــى التصدير أو الإستهلاك المحلى.