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EVALUATION OF SOME CLONES SELECTED FROM LOCAL TARO UNDER NEWLY RECLAINED SANDY SOIL

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ABSTRACT

Two field experiments were carried out during the two successive summer growing seasons of 2004 and 2005 at South El-Tahrir Research Station, Horticulture Research Institute.

Comparative studies were carried out among eleven clones of taro which were selected from the local standard variety (Balady) in addition to it as a control. The results indicated that the two clones No.14 and 15 were the best ones. Also, the results showed that clone number 14 surpassed all the other selected clones, as well as the standard variety, in all the studied growth characters i.e. plant height, No. of leaves per plant, leaf area (cm^2), chlorophyll content, average of corm length (cm), average of corm diameter (cm), average fresh weight (kg/plant), total yield (kg/plot and ton/fed.) and some chemical composition, i.e., starch, Dry matter, potassium, phosphorous and nitrogen during the 1st and 2nd seasons of study.

Studying the correlation coefficients among vegetative growth and yield parameters, results showed that the vigorous growth response were positively correlated with yield increases of taro plants, this may lead to the recommendation of growing these two clones (No.14 and No.15) of taro under new reclaimed sandy soil.

Key words: Taro (*Colocasia esculenta* L.) clones, variety.

INTRODUCTION

The monocotyledonous family Araceae (the aroids) contains several plants which are cultivated and used for food in various parts of Tropics, especially, *Colocosia esculenta* (L.) schott (Taro, old cocoyam, eddo, dasheen).

The sexual hybridization is extremely difficult. This makes improvement of the crop through conventional breeding methods very difficult. Heavy reliance is therefore placed on selecting from naturally caused or artificially induced mutations. This is a partial solution to the problem. Several studies of genotypes on vegetative growth and yield components had been done by wills *et al.*, 1983. Also, Dwivedi and Sen, 2001 studied the growth characters, and corms yield of 15 improved local taro cultivars in West Bengal. They reported that some cultivars showed high weight of corms/ plant than others. Moreover, several studies found a wide range of variation in corm quality, in this respect [Ghosh and Hasan (1992), Goenaga and Chordon (1995), Roychowdhury (1995) and Paull *et al* (2000)].

Many attempts have been done under Egyptian conditions to achieve the goal of improving taro (Habashy and Radwan, 1997 and Awashi and Singh, 2000). Also, Salem *et al*, 2003 got higher yield and better quality by using clones number 21, 9 and 15 in Delta Egypt. The main objective of the present investigation was to study and evaluate some promising clones of taro characterized by high yield and good quality in comparison with local cultivar "Balady" under the newly reclaimed land conditions.

MATERIALS AND METHODS

This study was carried out at South El-Tahrir Research Station, Horticulture Research Institute. Behaira Governorate, during the two successive seasons of 2004 and 2005. A complete randomized block design with three replicates was adopted. Each replicate consisted of eleven clones, i.e. No.2, No.8, No.9, No.11, No.12, No.14, No.15, No.18, No.19, No.20 and No.21 compared with taro population of standard variety (Balady) were provided by the Department of potato and vegetatively propagated vegetables, Horticulture Research Institute. Each experimental unit of 20 m^2 consisted of one ridge. Each ridge was 20 m long and 1 m wide. Plants were set at 50 cm apart. The soil of the experimental field was sandy in texture with drip irrigation system. The chemical analysis of the soil was determined according to the method described by Jakson (1965) and is shown in Table (1).

Table (1): Chemical analysis of experimental soil.

Soil characteristics	Values
PH	7.9
Ec (dsm^{-1})	1.41
Mineral nutrients (mg/kg^{-1})	
N	11
P	12
K	55
Cations as mg/L	
Ca^{++}	10.8
Mg^{++}	6.3
Na^{+}	6.9
K^{+}	2.3
Organic matter (%)	**1.91**

Sets cut from mother corms were used as planting materials. The plants were fertilized at the rate of 300 kg of ammonium sulphate (20.5% N), 150 kg of calcium super phosphate (15.5% P_2O_5) and 200 kg potassium sulphate (48% K_2O) per feddan. The other cultural practices were followed normally as in taro cultivation in the destrict.

Samples of 10 plants from each experimental unit were taken at the age of 210 days from planting date and the following growth parameters were recorded: Plant height (cm), number of leaves/plant, average leaf area (cm^2) by using the leaf area meter (L-1.310).

At harvest time, (270 days after planting date) another 10 plants were also taken from each plot for measuring, average fresh weight of corms per plant (kg), average of corm length (cm), average of corm diameter (cm) which was measured by calipers, total yield of corms (kg/plot and ton/fed.), dry matter of corm (g/plant), chlorophyll content of leaf by using chlorophyll meter (SPAD-Sol), starch content of corms (g/corm) according to Somogyi (1952), protein content as nitrogen (g/corm) according to Koch and Mc-Meckin (1924) and converted to its equivalent protein content by multiplying with 6.25 as described by Pregl (1945), phosphorus by Toug & Meyer, 1939 and potassium by Brown & Lilliland, 1946. Samples of corms were dried at 70°C till constant weight then used for the chemical determinations and calculated on dry weight basis.

Statistical analysis:

All obtained data were statistically analyzed using a General Liner Model procedure of SAS Institute (1989). Fishers protected Least significant (LSD) at $P \leq 0.05$ was employed to separate the treatment means.

RUSULTS AND DISCUSSION

1- Plant growth parameters:

Plant height:

Data in Table (2) show that there were significant differences in the two successive seasons between the selected clones and the standard variety with regard to plant height. The results indicate that the clone No.14 produced the tallest plant height followed by the clones of No.15 and No.12, while, the shortest plants were produced by the standard variety (Balady). The plant height ranged from 79.67 cm (in the clone No.18) to 122.33 cm (in the clone No.14) and from 89.33 cm (in the clone No.11) to 141.33 cm (in the clone No.14), during the two seasons, respectively.

Number of leaves/plant:

As shown also in Table (2), significant differences were also obtained in mean number of leaves/plant among the clones in both seasons. Number of leaves per plant among the clones ranged from 5.77 to 4.47 in the first season and from 6.33 and 3.74 in the second season.

The highest value was obtained by clone No.11 followed by clone No.14 and No.12 in the first season. While in the second one, it was given by clone No.12 followed by clone No.14 and No.15. On the other hand, the lowest mean number of leaves per plant was obtained by clone No.21 followed by the standard variety in the first season while in the second one, it was shown by the standard variety followed by clone No. 11. These results are in harmony with these obtained by Dwived and Sen., (2001) and Heredia (1995).

Leaf area (cm^2):

As shown in Table (2), significant differences were obtained in leaf area per plant among the studied clones in both seasons. Clone No.14 showed superiority in leaf area per plant in both seasons as compared with all other clones including the control.

On the other hand, the lowest leaf area was recorded by cv. Balady during the first season and clone No.2, during the second one. These results are in agreement with those obtained by Goenaga (1995) and Roychowdhury (1995) who studied the leaf area development in taro and its relation ship with yield. They found that the greater leaf area was associated with higher DM production and contributed to better yield.

Leaf chlorophyll content:

Data in Table (2) show the mean values of the eleven studies clones for leaf chlorophyll content in the two seasons. The results indicate that the highest mean values of chlorophyll content were obtained by clone No.14 followed by clone No.15 in the first season. While, in the second one, the clone No.14 and clone No.12 produced the highest chlorophyll per leaf. Meanwhile, the lowest chlorophyll content per leaf was shown by clone No.2 in the first season and by the standard variety in the second one. Similar results were recorded by Wills *et al* (1983), Heredia (1995) and Awasrhi and Singh (2000).

Yield and its components:

Average of corm length:

Data presented in Table (3) clearly show that there were significant differences in average of corm length among the different evaluated clones and the standard cultivar (Balady). Clone No.14 surpassed all other clones in this trait followed by clones No.15 and then by No.12 during the two seasons.

Meanwhile, clone No.21, standard variety and clone No.18 produced the lowest corm length in this study. These results are in agreement with those obtained by Salem *et al* (2003).

Average of corm diameter:

Data of corm diameter are also shown in Table (3) from such data its clear that, clone No.14 and No.15 produced the highest significant values (10.43, 10.60) and (10.83 and 10.60) during the two seasons of 2004 and 2005 respectively. The average corm diameter in these clones ranged from 7.33cm (clone No.8) up to 10.60 cm (clone No.15) in the first season. While, the clone No.14 gave the highest value (10.83 cm) and the standard (cv. Balady) gave the lowest diameter (6.63 cm) during the second season.

Table (2): Vegetative growth characters of eleven taro clones and cv. Balady under selection during 2004 (1st) and 2005 (2nd) seasons.

Genotypes No.	Plant height (cm)		Number of leaves/plant		Leaf area (cm^2)		Chlorophyll content	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd
2	109.00	127.67	5.42	4.60	1181.0	1146.5	33.33	37.37
8	97.00	94.00	5.45	4.93	1438.3	1349.2	34.87	40.60
9	95.33	101.00	5.11	4.32	1267.8	1233.8	38.33	42.53
11	109.33	89.33	5.77	3.85	1557.0	1583.1	36.83	35.23
12	114.33	119.67	5.35	6.37	2173.2	2269.9	44.00	51.23
14	122.33	141.33	5.66	6.33	2585.0	2607.7	50.03	53.90
15	110.00	130.33	4.99	5.47	2278.8	2326.4	46.87	44.83
18	79.67	97.00	4.84	3.78	1449.1	1445.1	37.47	34.73
19	96.33	109.67	4.65	4.72	1933.3	1911.9	41.57	44.30
20	99.00	106.33	4.61	4.46	2183.1	1870.0	40.97	47.13
21	85.00	111.33	4.47	4.11	1849.1	1777.8	43.43	38.90
Balady cv.	84.67	102.67	4.50	3.74	1159.0	1164.0	40.33	31.97
L.S.D. at 5%	11.89	9.44	1.21	0.60	96.11	113.89	4.26	3.70

Table (3): Total yield and its components of taro clones and cv. Balady under evaluation during 2004 (1st) and 2005 (2nd) seasons.

Genotypes No.	Average of corm length (cm)		Average of corm diameter (cm)		Average fresh weight (kg/plant)		Average weight of corms (kg/plot)		Total yield (ton/fed)	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
2	9.07	10.00	9.27	9.23	0.87	0.88	35.70	35.92	7.14	7.35
8	10.67	9.83	8.50	7.73	0.82	0.63	34.00	26.60	6.98	5.32
9	9.67	9.80	8.90	7.47	0.68	0.79	28.22	32.75	5.65	6.26
11	9.80	9.73	7.83	7.77	0.47	0.64	22.47	23.72	4.57	4.76
12	12.37	12.07	9.50	9.67	0.97	0.80	40.23	41.30	8.09	8.30
14	13.63	13.63	10.43	10.83	1.47	1.23	59.72	59.00	11.94	11.80
15	13.40	13.30	10.60	10.60	1.33	1.28	55.57	49.83	11.34	9.97
18	8.17	8.80	7.33	7.53	0.42	0.77	24.30	21.15	4.86	4.23
19	9.57	10.37	8.00	8.10	0.80	0.87	32.53	39.77	6.54	7.96
20	11.27	10.53	8.60	7.73	0.75	0.98	31.02	44.67	6.20	8.85
21	8.40	7.63	7.47	7.30	0.58	0.70	23.50	28.39	4.70	5.68
Balady cv.	8.23	8.00	7.08	6.63	0.35	0.44	20.23	18.78	4.15	3.87
L.S.D. at 5%	1.57	1.78	1.04	0.90	0.19	0.43	7.60	6.52	0.74	0.65

Average fresh corm weight (kg/plant):

Data in Table (3) show the average fresh corm weight of the eleven clones under study and the cv. Balady in the two seasons. The results indicate that the highest mean values of corm fresh weight was obtained by clone No.14 followed by No.15 in the two seasons. On the other hand, the lowest value was obtained by the standard variety (Balady) during 2004 and 2005. Similar results were reported by Dwivedi and Sen, 2001, who studied the growth characters, yield allritntes and cormel yield of 15 improved local taro cultivars in West Bengal, some cultivars

showed high weight of corms/plant. Meanwhile, these results were not in agreement with those obtained by Salem *et al* (2003) of Delta region who indicated that clone 14 gave the lowest average fresh corm weight.

Average weight of corms (kg/plot):

Clones No.14 and No.15 showed comparable and consistent higher fresh weight of corms (kg/plot) than the other clones during 2004 and 2005 seasons as shown in Table 3. Clones No.14 yielded 66.12 and 68.17% higher than the standard (cv. Balady) during 2004 and 2005, respectively.

On the other side the lowest values were given by cv. Balady, clones No.11 and No.21 during the first season, and by cv. Balady, clone No.18 during the second one (Table 3).

Total yield of corms (Ton/fed.):

Regarding total yield of corms, results in Table (3) show that there was a clear significant difference between selected clones and standard variety (Balady). Total yield ranged from 11.94, 11.80 (in clone. 14) to 4.15, 3.87 ton/fed in the standard variety during 2004 and 2005, respectively. Moreover data in Table (3) also show that the maximum values of yield were always recorded by clones No.14, 15 and 12. Similar results were obtained by Singh and Okpul (2000) and Salem *et al* (2003) under delta region, found that the highest yield was recorded by the four selected clones No.21,9,15 and 20.

Protein, starch and dry matter content of corms:

Data in Table (4) show that in 2004 clone No.14 produced corms of higher protein, starch and dry matter content (g/plant) than other clones followed by clones No.15 and No.12, while the standard variety showed the lowest values. Differences among varieties for protein, starch and dry matter were significant. More or less, these results are in agreement with those reported by Wills *et al* (1983), Agbor and Rickard (1990), Goenaga and Chardon (1995), Habashy and Radwan, (1997), Singh and Okpul, (2000), Paull *et al.* (2000) and Salem *et al*, (2003).

Potassium, phosphorus and nitrogen content of corms (g/100g DW):

As shown also in Table (4) significant differences were obtained in potassium, phosphorus and nitrogen content in corms of the studied clones and the standard variety, in both seasons. Clones No.14 and 15 showed superiority in percentage of potassium, phosphorus and nitrogen content in both seasons. While, the selected clone No.18, as well as the standard variety (Balady), gave the lowest values. These results are not in agreement with these obtained by Goenaga and Chardon (1995) who reported that there were no significant differences between cultivars. However, cv. Lila absorbed significantly smaller amounts of N,P,K than cv. Balanca, suggesting that it had higher nutrient use efficiency.

Correlation coefficient among vegetative growth, chemical analysis and yield of taro:

As shown in Table (5), the present study documents a positive correlation among, some vegetative growth characters, chemical analysis and yield of taro, in both 2004 and 2005 seasons. It can be noticed that positive correlation was found between corms yield and number of leaves, leaf area (cm^2), chlorophyll content, plant height (cm). The significant positive association of leaf area with yield suggested that greater leaf area was associated with higher DM production and this contributed to better yield in the eddoes type colocasia.

Similar results were reported by Rouchowdhury (1995),Pandey *et al* (1996) and Chan-Litfu *et al* (1997).

Moreover, Dwivedi and Sen (1999) evaluated 30 genotypes of taro to study the correlation path analysis they found that the corms yield had positive and significant association with corm weight.

The results in Table (5) also indicate that there was a positive correlation between dry matter content and corms yield during both 2004 and 2005 seasons.

Table (4): Protein, Starch and Dry matter (g/plant), Nitrogen, phosphorus and Potassium percentage in eleven taro clones and Balady cv. under selection during 2004 (1st) and 2005 (2nd) seasons.

Genotypes No.	Protein (g/plant)		Starch (g/plant)		Dry matter (g/plant)		N (%)		P (%)		K (%)	
	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
2	18.60	18.94	101.56	102.63	187.58	189.67	0.70	0.72	0.26	0.27	2.60	2.67
8	17.40	13.50	96.17	76.21	176.03	138.83	0.67	0.54	0.25	0.19	2.55	1.80
9	14.47	16.64	77.67	89.24	145.15	169.36	0.54	0.64	0.24	0.27	2.10	2.49
11	9.64	10.30	52.16	54.32	96.70	105.46	0.37	0.41	0.15	0.15	1.45	1.56
12	21.95	21.69	126.62	127.16	219.77	217.34	0.79	0.82	0.30	0.29	3.16	2.86
14	34.66	32.76	222.28	207.49	353.37	328.08	1.24	1.12	0.50	0.49	4.95	4.66
15	30.31	32.69	167.60	180.89	301.72	297.55	1.18	1.17	0.42	0.40	4.53	4.20
18	8.57	9.96	51.58	63.67	85.73	100.38	0.34	0.39	0.12	0.14	1.23	1.42
19	17.77	20.68	116.87	134.28	181.18	207.59	0.66	0.78	0.26	0.34	2.59	2.99
20	16.60	21.37	103.90	135.39	167.25	216.38	0.56	0.75	0.24	0.31	2.50	3.16
21	12.41	13.33	70.64	76.18	124.77	134.93	0.52	0.57	0.19	0.24	1.87	2.16
Balady cv.	7.13	7.02	39.33	38.57	72.25	69.71	0.22	0.21	0.09	0.10	1.10	1.10
L.S.D. at 5%	4.48	4.96	24.18	30.32	42.73	45.80	0.16	0.16	0.07	0.66	0.62	0.78

Table (5): Correlation coefficient among vegetative growth characters, chemical analysis and yield of taro in eleven selected clones and Balady cultivar in 2004 and 2005 seasons.

Character	Season 2004						
	Dry matter	Corm diameter	Corm length	Chlorophyll content	Fresh weight (kg/plant)	Leaf area	No. of leaves
Corm length	0.215	0.743*					
Chlorophyll content	0.473	0.452	0.533*				
Dry matter		0.379	0.232	0.125			
Fresh weight (kg/plant)	0.190	0.865**	0.624*	0.594*			
Leaf area	0.331	0.566*	0.733*	0.872**	0.685*		
No. of leaves	0.772**	0.552*	0.571*	0.154	0.347	0.102	
Plant height	0.199	0.864**	0.659*	0.625*	0.988**	0.706*	0.339
Total yield (kg/plot)	0.508*	0.888**	0.723*	0.330	0.745*	0.506*	0.713*
	Season 2005						
Corm length	0.212	0.801**					
Chlorophyll content	0.325	0.606*	0.770*				
Dry matter		0.423	0.229	0.115			
Fresh weight (kg/plant)	0.209	0.642*	0.841**	0.646*			
Leaf area	0.326	0.559*	0.662*	0.813*	0.589*		
No. of leaves	0.100	0.839**	0.819*	0.888**		0.760*	
Plant height	0.064*	0.667*	0.748*	0.569*	0.796**	0.548*	0.680*
Total yield (kg/plot)	0.050	0.691*	0.892**	0.859**	0.910**	0.777**	0.790**

* Significant at 5% ** Significant at 1%.

CONCLUSION

It could be concluded that taro plant can be planted successfully under newly reclaimed soil conditions by drip irrigation system. This study showed that the two selected clones No.14 and No.15 are recommended for cultivation under the newly reclaimed soil conditions.

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تقييم بعض السلالات المنتخبة من القلقاس البلدي في الأراضي الرملية حديثة الاستصلاح

ظهره عبد المولى الشرقاوي
قسم بحوث البطاطس والمحاصيل خضرية التكاثر - معهد بحوث البساتين - مركز البحوث الزراعية - الجيزة - جمهورية مصر العربية

أجريت تجربتان حقليتان خلال موسمي ٢٠٠٤، ٢٠٠٥ بالمزرعة التجريبية لمحطة بحوث جنوب التحرير التابعة لمعهد بحوث البساتين حيث أجريت دراسة مقارنة أحد عشر سلالة تم انتخابها من الصنف البلدي بالإضافة إلى الصنف القياسي (البلدي) وقد أوضحت النتائج أن السلالات أرقام (١٤ و ١٥) كانت أفضل السلالات. وأن السلالة ١٤ هي السلالة المتفوقة على بقية السلالات المختبرة وكذلك على الصنف القياسي (البلدي) في جميع الصفات الخضرية المدروسة مثل (طول النبات- عدد الأوراق للنبات ومساحة الورقة ومحتوى الورقة من الكلوروفيل) وكذا المحصول الكلي ومكوناته مثل طول وقطر الكورمة والوزن الطازج لكورمات النبات والقطعة التجريبية وبعض الصفات القياسية الكيميائية خلال موسمي الزراعة ٢٠٠٤، ٢٠٠٥.

وبدراسة معامل التلازم (العلاقة) بين الصفات المختلفة للنمو الخضري والتحليل الكيميائي ومكونات المحصول تبين وجود علاقة إيجابية بين قوة النمو الناتجة والزيادة في المحصول .

لذا يمكن التوصية بإنتاج السلالتين ١٤ و ١٥ في الأراضي الرملية حديثة الاستصلاح .