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Mineral Analysis of Some Local Cultivars of Melon (*Cucumis melo* L.)

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Abstract: Twenty six cultivars of which twenty four local and two introduced (Yellow canary and Lobnani) were evaluated. In order to study the physicochemical quality of melon, a mineral analysis was carried out. This analysis included sodium, potassium, phosphorus and calcium plus magnesium. Na and K were measured by photometer with flame, phosphorus was determined by spectrophotometer and Ca^{++} - Mg^{++} were proportioned by a proportioning colorimetric. The result showed that all cultivars exhibited the highest level for Na. K content was higher than 2% in 60% of cultivars. P content was higher than 0.1 % in 70 % of cultivars. Ca^{++} - Mg^{++} content was higher than 1 meq/l in 50% of cultivars. Analysis of variance and hierarchical classification, according to variations in mineral element between cultivars, were assured with *SPSS* 12.0. Analysis of variance confirmed significant differences ($p < 0:05$) between the different cultivar for every parameter.

Keywords: *Cucumis melo* L., Cultivar, Melon, Mineral elements

1. Introduction

Melon is one of the first horticultural crops to come to mind for cultivating in arid and semi-arid regions based on salinity concerns that are becoming or have become a problem (Navarro *et al.*, 1999). Despite melon is known for its tolerance to salinity. It has been reported that salt tolerance in melons is dependent on the cultivars with sensitive and tolerant cultivars existing (Shannon and Francois, 1978; Meiri *et al.*, 1982). The symptoms of salt damage in plant change varies among species. Salinity is a factor affecting the whole metabolism of the plant, as well as, its morphology and anatomy (Levitt, 1980). Some nutritional disturbances are expected under saline conditions, resulting in high ratios of Na/Ca and Na/K. In the presence of excess NaCl in medium, Na and Cl are accumulated in plant organs, and these saline ions can affect the uptake of other mineral elements through competitive interactions or by affecting membrane ion selectivity. This results in nutrient deficiencies in plants (Bohra and Döffling, 1993), growth inhibition (Franco *et al.*, 1993, 1997; Mendlinger and Fossen, 1993; Carvajal *et al.*, 1998), metabolic disturbances (Mavrogianopoulos *et al.*, 1999; del Amor *et al.*, 2000), yield and quality losses (Mendlinger, 1994; Meiri *et al.*, 1995; del Amor *et al.*, 2000).

2. Materials and Methods

2.1. Plants material

This study was performed using 24 local melon cultivars and 2 introduced cultivars: Yellow canary and Lobnani, collected from different areas of Tunisia (**Table1**).

2.2. Mineral analysis

To determine phosphorus, sodium, potassium and calcium plus magnesium concentrations in each plant, 1 g of grinded pulp was ashed for 4 h at 550 ˚C. After cooling, ash was mixed with 4 ml of distilled water and 1 ml of conc. HCl. The solution was brought to boil, then filtered and brought to 100 ml volume with distilled water. A Secomam spectrophotometer was used to determine the phosphorus concentration. A flame photometry was used to analyze the sodium and potassium concentration. Calcium - magnesium was determined for each cultivar using proportioning colorimetric. The element concentration was calculated according to the equation: % Na, % K and % P = (C × FD) / (100 × m), where C featured value (ppm), FD factor of dilution, and m mass (g). Finally, Ca - Mg was calculated using the equation: me (Ca^{2+} - Mg^{2+})/l = 5×(V1 - V0), where V1 was volume in ml of the graduated solution of EDTA used for the extract and V0 was volume in ml of the graduated solution of EDTA used for the dummy trial.

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2.3. Statistical analysis

A one-way variance analysis was done for each mineral descriptor and the means separated by performing a Duncan's MRT; results were considered significant at the $p<0.05$ level. A classification analysis according to mineral element variations between cultivars was assured with a hierarchical cluster using SPSS 12.0.

3. Results and Discussion

3.1. Pulp nutrients

K content was higher than 2% of the pulp weight in 61 (53%) of the studied cultivars and Na content higher than 0.2% in 38 (46%) of the cultivars and P content higher than 0.1% in 69 (23%) of cultivars. Ca plus Mg content was higher than 2 meq/l in 30 (76%) of cultivars. The differences between all cultivars was statistically different at the ($p<0.05$) level of significance (**Fig. 1**).

The results obtained from this study show that the different local cultivars contain a high concentration of Na^+. This increase of Na^+ was also observed at both introduced cultivars (Lob and J.C) which yielded Na^+ concentrations of 0.418% and 0.405%, respectively.

Table 1. Local melon cultivars studied with their origin.

Number of cultivar	Code of cultivar	Place of collection	Origin
1	M 3	Lbness Elgataya	Kébili
2	M 5	Lsteftimi	Kébili
3	M 6	Hniche	Kébili
4	M 9	Elrabta	Kébili
5	M 15	Elrabta	Kébili
6	M 16	Elrabta	Kébili
7	M 17	Elrabta	Kébili
8	M 18	Elmenchia, Souk Elahed	Kébili
9	M 19	Elmenchia, Souk Elahed	Kébili
10	M 20	Rabta	Kébili
11	M 24	Dgache	Tozeur
12	M 26	Elmenchia, Souk Elahed	Kébili
13	M 29	Rogba	Tataouine
14	M 31	Ferche	Tataouine
15	M 35		Gabes
16	M50	Eljazira souk Elahed	Kébili
17	M58	Ganouche	Gabès
18	M61	Bir Amir	Tataouine
19	M97	Oum Elsoumaa souk Elahed	Kébili
20	M116	Azmour Dar Alouch	Nabeul
21	M120	Galeet Elandalouss	Bizert
22	M122	Gar Elmelh	Bizert
23	M125	Hammet Tozeur	Tozeur
24	M135	Elrabta	Kébili

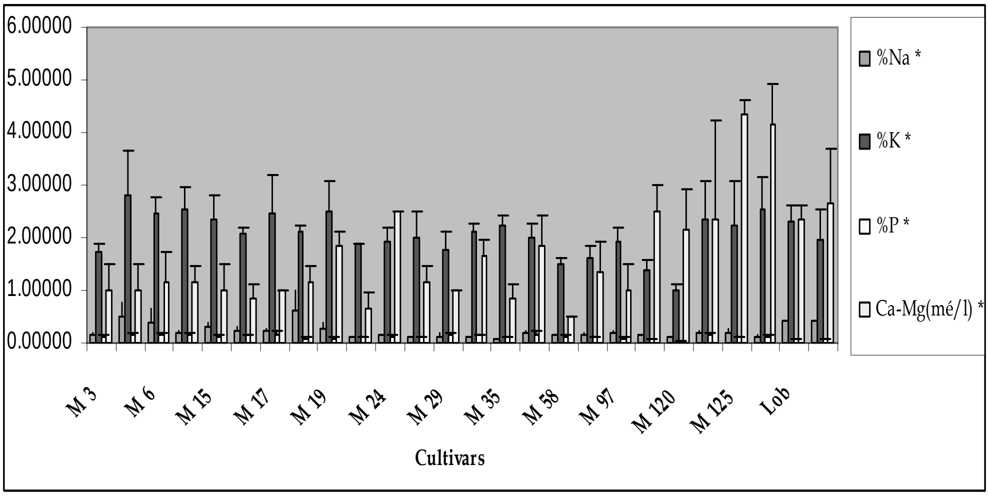

Fig. 1. Variation in Na, K, Ca-Mg and P contents for the different cultivars. Error bars represent standard deviation between three essays. * Significant variation (ANOVA).

Many studies have showed that the increase in salinity ratios is a result of salt accumulation in irrigated soils from both irrigation and groundwater sources (Cengiz *et al*., 2007). In fact, the high concentrations of Na^+ disturbs intracellular ion homeostasis which leads to membrane dysfunction, attenuation of metabolic activity, and secondary effects that cause growth inhibition thereby leading to cell death (Rus *et al*., 2001, 2004; Ashraf, 2004). The ability of plant cells to maintain sodium concentrations low in the cytosol is a vital process associated with the ability of plants to grow under high salt regimes (Blumwald, 2000; Ashraf and Harris, 2004). Sodium enters leaf cells and is then pumped into the vacuole before its concentrations are built up in the cytoplasm. The pumping of Na^+ into the vacuole is catalyzed by vacuolar Na^+/H^+ antiporter (Blumwald *et al*., 2000) and the plasma membrane Na^+ transporter AtHKT1 (Rus *et al*., 2004). However, Lacan and Durand (1996) proposed that under high Na^+ concentration, a Na^+/H^+ antiporter worked in reverse, to pump Na^+ into the cytosol.

Thus, overcoming salt stress is a main issue in arid and semi-arid areas to ensure agricultural sustainability and continued food production (Heuer, 2003).

3.2. Hierarchical classification

The hierarchical classification of the different cultivars, based on the set of the pulp contents of K, Na, P, and Ca-Mg, allows for the grouping of cultivars into four groups. The 1st group consists of cultivars M3, M29, M97, M26, M16, M35, M20, M61, M58, M15, M17, M6, M9, M5 and M18. This group is characterized by the higher concentrations of K, Na and an average level of P. The 2nd group includes cultivars M116 and M120 which are characterized by low concentrations of the majority of mineral elements analyzed, especially P. The 3rd group is consists of cultivars M19, M24, M31, M50, M122, Lob and J.C. These cultivars are distinguished, contrary to the second group, by the higher concentrations of P. The 4th group contains two cultivars M125 and M135 which are characterized by the higher concentrations of Ca-Mg (**Fig. 2**).

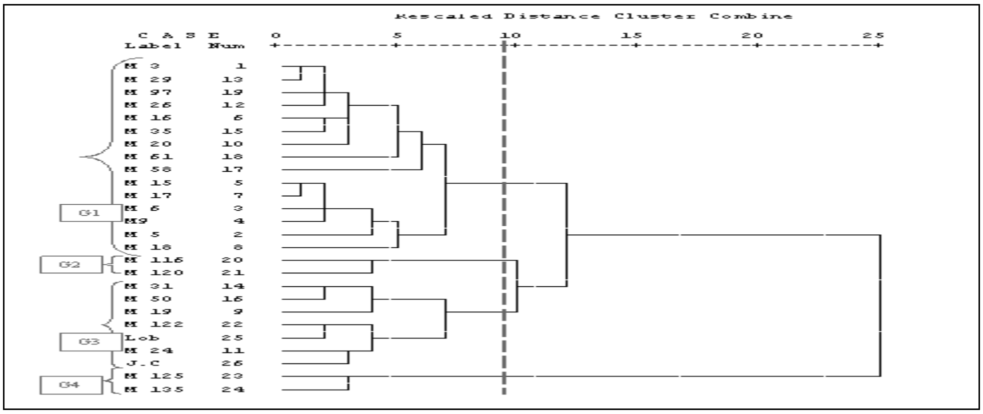

Fig. 2. Dendrogram of K, Na, P and Ca-Mg contents of the different cultivars: (G1) Group 1, (G2) Group 2, (G3) Group 3, (G4) Group 4.

4. Conclusions

Summarizing the results it could be clarified that the mineral elements studied and concenrtaions of elements determined is dependent on farming conditions and the quality ground and irrigation water. Indeed, it was noticed that variability in observations can be contributed to the geographical origin (place of culture) of different local cultivars studied.

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