Characterization of Mineral Nutrients in National Plant Germplasm System (NPGS) Tomato Varieties

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❖TOMATO (*Solanum lycopersicum* L.) fruit quality and yield are highly dependent on adequate uptake of nutrients. Potassium, magnesium and calcium are essential elements that influence fruit quality traits such as color, uniformity of ripening, hollow fruit, fruit shape, firmness, and acidity. Sodium is not an essential element for tomato and can detrimentally compete with absorption of potassium and calcium. Daily intakes of potassium, magnesium and calcium in human diets are typically below healthful levels, while sodium intake is often excessive. The objective of this study was to compare 52 diverse commercially important varieties of tomato for concentrations of potassium, magnesium, calcium and sodium in fruits.

❖ Materials and Methods

Fifty-two commercial cultivars and important breeding lines during the mid to late 20th century were chosen from the National Plant Germplasm (NPGS) collection (Fig. 1). The tomatoes were produced in replicated plots in Geneva, NY during two field seasons. Multiple fruits per plot were harvested vine-ripe, homogenized, shipped frozen to the Western Regional Research Center and assayed for concentrations of potassium, magnesium, calcium and sodium. Multivariate statistical analysis was performed using SAS ver. 9.4 (Cary, NC, USA).

❖ Results and Interpretation

- **Analysis of Variance (ANOVA)** showed significant differences among the 52 varieties for all four traits, i.e., cation concentrations (df = 51, p < 0.0001 to 0.0034) and no significant differences between years for any trait (df = 1, p = 0.3432 to 0.6770).

- **Pearson's correlation** was highly significantly for potassium and magnesium (r = 0.64, p < 0.0001). No other correlations between pairs of traits were observed.

- **Cluster analysis** showed processing types clustered together more closely than fresh consumption types (Fig. 1).

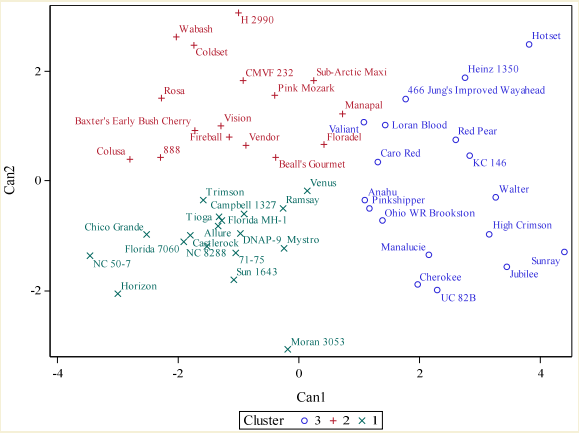

Fig. 1. Cluster analysis of 52 tomato accessions based on cation profiles. The statistical method identifies an initial predefined number of clusters and then applies an algorithm that minimizes the sum of squared distances from the cluster means.

- **Factor analysis** showed a strong interrelationship between potassium and magnesium that was independent of calcium and sodium (Fig 2).

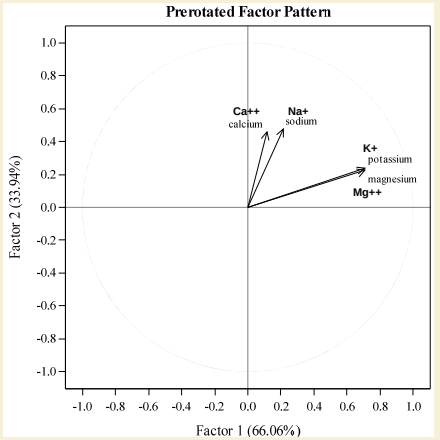

Fig. 2. Factor analysis of four cation traits for 52 tomato accessions grown in replicated plots in two environments (n = 208).

❖ **Conclusion** Results supported a genetic basis for potassium, magnesium, calcium and sodium concentrations that was consistent across environments. Results will provide insight for development of cultivars with favorable cation profiles in terms of human health and fruit quality.

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