

THE CORRELATIONS BETWEEN TOTAL ANTIOXIDANT CAPACITY AND TOTAL POLYPHENOLS CONTENT ESTABLISHED FOR TOMATOES

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Summary

Tomatoes (*Lycopersicum esculentum*) are the most popular garden vegetable crop in world [6]. Tomatoes have been reported to be an important source of antioxidants such as lycopene, phenolics, and vitamin C in human diet [1], and have been linked with reduced risk of prostate and various other forms of cancer, as well as heart diseases [2].

The aim of the study was to determine the total antioxidant capacity and total polyphenol content and to establish some correlations between this parameters in two summer-autumn tomatoes varieties (Campbell 1327 and Ace Royal), cultivated in field condition, in west area country. The analyses were performed on control soil samples (without extra fertilization substances) and soil sampled after differentiated NPK fertilization in variable dozes: N₃₀P₃₀K₃₀, N₄₅P₄₅K₄₅, N₆₀P₆₀K₆₀, N₁₂₀P₆₀K₆₀.

The total antioxidant capacity was studied using FRAP method and the total polyphenol content by Folin-Ciocalteu method.

Materials and methods

Reagents and equipment: Were used chemicals and reagents from Merck; deionized water. Absorption determination for FRAP and total polyphenol content was using Spectrophotometer UV-VIS SPECORD 205 by Analytik Jena.

Samples preparation: All tomatoes samples were collected on august. For each sample it was made the alcoholic extraction: 10 g of each sample were mixed with 10 mL ethanol solution (50%), and after 30 minutes were filtered. Ethanol extracts were diluted than 1/10 with ethanol solution (50%).

Determination of total antioxidant capacity (TAC) by FRAP method: FRAP method depend upon the reduction of ferric tripyridyltriazine complex to the ferrous tripyridyltriazine by a reductant at low pH. This ferrous tripyridyltriazine complex has an intensive blue color and can be monitored at 593 nm [3]. Reagents: acetate buffer, 300mM/L, pH 3.6 (3.1g sodium acetate 3H₂O and 16 mL conc.; acetic acid per 1L of buffer solution); 10 mM/L TPTZ (2, 4, 6-tripyridyl-s-triazine) in 40 mM/L HCl; 20 mM/L FeCl₃6H₂O in distilled water. FRAP working

solution: 25 mL acetate buffer, 2.5 mL TPTZ solution and 2.5 mL FeCl₃ solution. The working solution must be always freshly prepared. Aqueous solution of known Fe (II) concentration was used for calibration, in a range of 0.1-0.8 mM/L. For the preparation of calibration curve 0.5 mL aliquot of 0.1, 0.2, 0.4, 0.6, 0.8 μM/mL aqueous Fe(II) as Mohr salts solution (1mM) were mixed with 2.5 mL FRAP working solution; FRAP reagent was used as blank. The absorption was read after 10 min. at 25 °C and 593 nm. All determinations were repeated for three times. Total antioxidant capacity in tomatoes in Fe (II) equivalents was calculated. Correlation coefficient (r^2) for calibration curve was 0.9677 [5].

Determination of phenolic compounds: It was used the following reagents: 2.0 M Folin-Ciocalteu phenol reagent, gallic acid and anhydrous carbonate. The content of total polyphenolic compounds in tomatoes ethanol extracts diluted 1/10 was determined by Folin-Ciocalteu method (1927) [4]. For the preparation of calibration curve 0.5 mL aliquot of 0.2, 0.4, 0.8 and 1.2 μM/mL aqueous gallic acid solution were mixed with 2.5 mL Folin-Ciocalteu reagent (diluted ten-fold) and 2.0 mL sodium carbonate (7.5%). The absorption was read after 2 h at 20°C, at 750 nm. All determinations were repeated for three times. Total content of polyphenols in tomatoes in gallic acid equivalents (GAE) was calculated. Correlation coefficient (r^2) for calibration curve was 0.9986 [5].

Statistical analysis: The results were analyzed using students t-Test for two populations by Origin 6 program and MVSP program – Principal Coordinates Analyze PCA.

Results and discussions

The total antioxidant capacity by FRAP method and polyphenol contents are presented in table 1.

Table 1
Total antioxidant capacity by FRAP method and polyphenol contents in tomatoes

Tomatoes varieties	Fertilization dozes	Antioxidant capacity [μMFe/100g fresh matter]	Polyphenols [μMgallic acid/100g fresh matter]
Campbell 1327	Control	310	100.4
	N ₃₀ P ₃₀ K ₃₀ .	290	75.6
	N ₄₅ P ₄₅ K ₄₅ .	368	102.0
	N ₆₀ P ₆₀ K ₆₀ .	476	136.0
	N ₁₂₀ P ₆₀ K ₆₀ .	326	95.8
Ace Royal	Control	376	109.8
	N ₃₀ P ₃₀ K ₃₀ .	376	107.6
	N ₄₅ P ₄₅ K ₄₅ .	322	117.8
	N ₆₀ P ₆₀ K ₆₀ .	350	113.6

	N ₁₂₀ P ₆₀ K ₆₀ .	340	96.6
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SOI 1	SOI 2	Data	Mean	Variance	N
310	376	SOI1	354	5474	5
290	376	SOI2	352.8	549.2	5
368	322				
476	350				
326	340				

t = -0.03457
p = 0.97327

At the 0.05 level,
the two means are NOT significantly different.

SOI 1= Campbell 1327; SOI 2= Ace Royal

Fig.1. t-Test for two populations for antioxidant results

SOI 1	SOI 2	Data	Mean	Variance	N
100.4	109.8	SOI1	101.96	473.488	5
75.6	107.6	SOI2	109.08	63.732	5
102.0	117.8				
136.0	113.6				
95.8	96.6				

t = 0.68689
p = 0.51157

At the 0.05 level,
the two means are NOT significantly different.

SOI 1= Campbell 1327; SOI 2= Ace Royal

Fig.2. t-Test for two populations for polyphenols results

The t-Test for two populations of tomatoes *Campbell 1327* and *Ace Royal* is showing that the differences between the means for the two types of tomatoes varieties are not significant for both determinations (figure 1 and figure 2). The statistical analysis was performed with Origin 6 program.

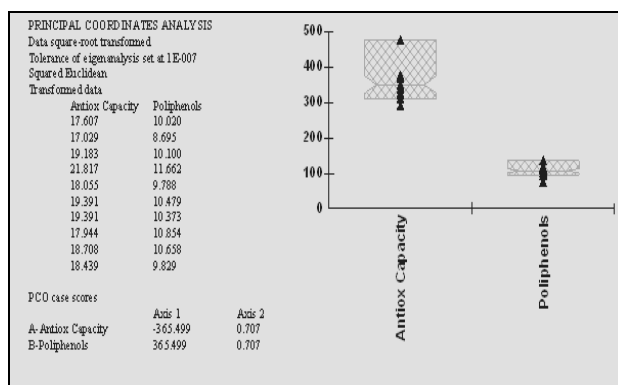


Fig.3. PCA analysis for total antioxidant capacity and polyphenol content in tomatoes varieties

Conclusions

PCA is showing that $N_{60}P_{60}K_{60}$ fertilization doses is giving us the highest values for both studied parameters in *Campbell 1327* tomatoes assortment were the transformed data corresponding to TAC and GAE are 21.817 $\mu\text{MFe}/100\text{g}$ fresh matter for antioxidant capacity (TAC) and 11.662 $\mu\text{Mgallic acid}/100\text{g}$ fresh matter for polyphenols content (GAE). In *Ace Royal* tomatoes assortment the transformed data corresponding to TAC and GAE are 19.391 $\mu\text{MFe}/100\text{g}$ fresh matter for antioxidant capacity (TAC) and 10.479 $\mu\text{Mgallic acid}/100\text{g}$ fresh matters for polyphenols content (GAE), values wich correspond to the control samples.

Using a differentiated NPK content of fertilizations the influence on antioxidant capacity and polyphenols is different from a variety of tomatoes to another.

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