P-034: Antioxidants in tomatoes are influenced by potassium fertilization

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Tomato (*Solanum lycopersicum* L.) fruit contain several health beneficial antioxidants [1]. Their contents can be greatly influenced by abiotic factors such as light, temperature, or the nutritional status [2]. The macronutrient potassium (K) is essential for several physiological functions in plants, e. g. translocation of assimilates, activation of enzymes, maintenance of turgescence, and stomata regulation.

The aim of the study was to investigate the impact of increasing K fertilization on the antioxidants ascorbic acid, phenolic compounds, carotenoids, and tocopherols in tomatoes. Three cocktail tomato cultivars (Primavera, Resi, and Yellow Submarine) raised in an outdoor pot experiment were treated with five rising K doses in the first study year 2014. In 2015, Primavera and Resi were selected for a subsequent experiment using the lowest and highest K doses. In this experiment, the lipophilic antioxidants were additionally measured in three different tomato ripening stages.

Increasing levels of K fertilization distinctly affected the contents of antioxidants in cocktail tomatoes (Table 1). However, most of the effects were not consistent across all three cultivars and the two study years. In 2014, K fertilization level positively correlated ($p \leq 0.05$ or 0.01) with ascorbic acid and γ-tocopherol in Resi and with *p*-coumaric acid in Primavera, while significant negative correlations were observed for narigenin and ß-carotene in Primavera and for β-tocopherol and δ-tocopherol in Yellow Submarine. In contrast, significant positive correlations between K fertilization level and ascorbic acid, *p*-coumaric acid and caffeic acid were demonstrated for both, Primavera and Resi, in 2015. As opposed to 2014, the tocopherols in Resi and Primavera negatively correlated with increasing K fertilization. The only antioxidant that consistently showed positive correlations with increasing K doses across cultivars and study years was *p*-coumaric acid.

In summary, the content of plant antioxidants in cocktail tomatoes cultivated outdoors can be positively or negatively affected by K fertilization. However, other abiotic factors, such as variation in light and temperature may impact or even inverse those effects [3,4].

Table 1: Pearson correlation between the concentration of fruit K and antioxidants.

	Primavera 2014	Resi 2014	Yellow Submarine 2014	Primavera 2015	Resi 2015
ascorbic acid	0.028	0.477*	-0.081	0,978**	0,904**
p-coumaric acid	0.666**	0.375	0.309	0,923**	0,979**
caffeic acid	-0.221	0.392	0.039	0,769*	0,829*
ferulic acid	-0.326	0.293	-0.226	0.326	0.471
sinapinic acid	0.014	-0.067	-0.129	-0.039	-0.395
quercetin	0.198	0.048	0.295	-0.606	0.259
narigenin	-0.489*	-0.220	-0.291	-0.700	-0.174
ß-carotene	-0.686**	0.255	0.060	0.357	0,513*
lycopene	-0.307	-0.229		0.187	0.135
α-tocopherol		0.198	-0.351		-0,596**
β-tocopherol		0.030	-0.488*		-0.271
γ-tocopherol	0.313	0.696**	-0.411	-0,553**	-0,601**
δ-tocopherol	0.006	0.195	-0.479*	-0,778**	

*The correlation was significant at the level of p≤0.05 (2-sided) and with two** at the level of p≤0.01 (2-sided). The number of observations was ≥ 8 and if there is no value the concentration of the antioxidant was below the detection limit. The correlation for ß-carotene, lycopene, α-, β-, γ-, and δ-tocopherol in 2015 was performed with all ripening stages.

References

[1] PERVEEN, R., SULERIA, H. A. R. and F. M ANJUM, et al., 2015: Critical Reviews in Food Science and Nutrition, **55**, 919–929.

[2] GAUTIER, H., DIAKOU-VERDIN, V., and C. BÉNARD, et al., 2008: Journal of Agricultural and Food Chemistry, **56**, 1241–1250.

[3] EHRET, D.L., USHER, K., and T. HELMER, et al., 2013: Journal of Agricultural and Food Chemistry, **61**, 1138–1145.

[4] BALLIU, A., and V. IBRO, 2000: II Balkan Symposium on Vegetables and Potatoes, **579**, 385–388.