UV Light Adds Flavor to Out-of-Season Greenhouse Tomatoes

By Alex Berezow — September 19, 2016

Credit: Shutterstock [1]

For various reasons, fruits and vegetables grown out-of-season don't taste as good as ones grown in-season. Food aficionados are known especially to turn their nose up at greenhouse tomatoes.

A team of researchers led by Michael Dzakovich from Purdue University wanted to determine if it was possible to enhance the flavor of these tomatoes. Because of less sunlight and the UV-blocking properties of glass, they hypothesized that tomatoes grown out-of-season in greenhouses did not receive adequate ultraviolet light. UV light (specifically UV-B radiation), which stresses plants, triggers metabolic reactions that may alter the flavor and nutritional value of fruit.

To test their hypothesis, the authors grew tomatoes in a greenhouse with or without UV light supplementation. (Tomatoes without UV light served as the "control" group.) They also grew "outdoor" tomatoes in the summertime. Then, they asked a panel of volunteers to taste and rate the tomatoes on a scale from 1 to 9 on qualities such as aroma, sweetness, and overall experience. (See chart.)

treatment	sample size	color	aroma	sweetness	acidity	aftertaste	texture	overall approval
hedonic								
control	$n = 39$	7.05 ± 0.21a	5.82 ± 0.21b*	5.18 ± 0.25a	5.59 ± 0.25b	5.56 ± 0.23a*	5.56 ± 0.26a	5.67 ± 0.26b*
UV-A	$n = 39$	7.0 ± 0.24a	7.05 ± 0.23a	5.67 ± 0.23a	6.31 ± 0.24a	6.02 ± 0.24a	6.28 ± 0.26a	6.49 ± 0.2a
UV-A+B	$n = 39$	7.08 ± 0.21a	6.08 ± 0.22b*	5.41 ± 0.25a	5.82 ± 0.25ab	5.56 ± 0.23a*	5.92 ± 0.31a	5.87 ± 0.24ab
outdoor	$n = 54$	7.43 ± 0.17	6.87 ± 0.19	5.83 ± 0.26	6.2 ± 0.25	6.74 ± 0.2	6.26 ± 0.3	6.61 ± 0.22

For simplicity, let's focus on "overall approval" (highlighted in pink). Outdoor tomatoes were given the highest preference rating of 6.61. Taste testers gave the lowest score to the control tomatoes (5.67). Compared to outdoor tomatoes, this difference was statistically significant. In other words,

there was a real, noticeable difference between outdoor and control tomatoes.

Tasters gave tomatoes supplemented with UV-A light the second highest preference score (6.49), which was almost as high as the outdoor tomatoes. The difference (6.61 vs. 6.49) was not statistically significant, meaning the tasters couldn't tell the difference between them. The tomatoes supplemented with UV-A and UV-B light were not rated as well as those supplemented with UV-A light alone. The molecular reasons for this are unclear, but it is likely that UV-A and UV-B radiation trigger different kinds of metabolic pathways.

Disappointingly, the authors did not find evidence that UV light supplementation enhances the nutritional value of greenhouse tomatoes. But at least they taste better.

Source [2]: Michael P. Dzakovich, Mario G. Ferruzzi, and Cary A. Mitchell. "Manipulating Sensory and Phytochemical Profiles of Greenhouse Tomatoes Using Environmentally Relevant Doses of Ultraviolet Radiation." *J. Agric. Food Chem.*, 64 (36): 6801–6808. Published: 26-August-2016. DOI: 10.1021/acs.jafc.6b02983
