Soil Quality from Long-term Organic Management Nearly Doubles Flavonoids in Organic Tomatoes

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For more than ten years, scientists at U.C. Davis in California have conducted a Long-Term Research on Agricultural Systems project (LTRAS). The impacts of conventional and organic management on tomato production and tomato nutrient concentrations have been a major focus of this effort.

On June 23, 2007, the American Chemical Society's Journal of Food and Agricultural Chemistry published compelling results from the LTRAS (Mitchell et al., 2007). The team found that the level of quercitin, the most common flavonoid in the human diet and the major flavonoid in tomatoes, increased 79 percent as a result of organic management, and kaempferol levels rose 97 percent.

In addition, and significantly, the longer a field was managed organically, the bigger the margin in flavonoid levels between organic and conventional plots. The level of quercitin in the organic plots increased about 5 milligrams per gram of dried tomato per year, with the largest increases coming after seven years of organic management. In the conventional plots, quercitin levels increased only 2 mg/gram per year. This finding supports the need for a three-year transition period before a field is eligible to grow certified organic crops, and also helps explain the relatively smaller percentage increases in antioxidant levels typically found in university studies that entail just a few years of organic management.

The team points out that a number of factors can trigger the biosynthetic pathway in plants that produces flavonoids - nutrient deficiency, pest attack, wounding, pathogens, and UV radiation (sunlight).

This study is unique because of its long duration and the careful accounting of production and nutrient inputs and nitrogen availability. The scientists focused on the long-run impacts of well-defined, typical organic and conventional cropping systems using the same tomato cultivar, rather than the impacts of individual practices and inputs. Tomatoes yields did not vary significantly between the conventional and organic plots, although the variation in yields was lower in the organic plots. The ability of soils under organic management to take in and store water more effectively than conventionally managed soils likely accounts for this finding.

Another unique aspect of this study is the ability to link changes in the nutrient content of tomatoes to the impacts of organic management on soil quality. The authors report significantly higher soil organic matter (SOM) levels in the organic plots. SOM levels rose through 1998 in the LTRAS, and reached a steady-state in 1998-1999, at which point the team reduced dramatically the applications of compost. The reduction in total nitrogen applied to the organic system did not reduce yields, and was accompanied by increased flavonoid levels. The authors concluded that -

"Flavonoid content in tomatoes seems to be related to available N. Plants with limited N accumulate more flavonoids than those that are well-supplied....overfertilization (conventional or organic) might reduce the health benefits from tomatoes"

This study provides powerful, new evidence in support of a nutrient "dilution effect" triggered by high levels of nitrogen and rapid plant growth, especially in the absence of pest pressure.

Source: "Ten-Year Comparison of the Influences of Organic and Conventional Crop Management Practices on the Content of Flavonoids in Tomatoes"

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