Comparison of Tomato Genotypes Grown Under Conventional and Organic Production System for Nutrient Composition

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Abstract

There is a growing interest in the quality of fruits and vegetables produced under conventional and organic production system. While some of the reports on subjective comparison of quality of fruits and vegetables produced under conventional and organic systems are already available, we were interested to determine the genotypic differences under conventional and organic production system for nutrient composition in tomato. For that, we grew three genotypes of tomato with three replications under organic and conventional production system at Mountain Research Station, Waynesville, NC. Nutrient analysis was performed from vegetative (leaf) and reproductive (fruit) parts at three different stages. Results indicated that conventional system was significantly ($p<0.05$) better than organic system for almost all nutrient availability except Magnesium and Sulfur. No genotypic differences were found for nutrients availability from vegetative stage to reproductive stage, indicating that either the number of genotypes in the study was too small to draw the conclusion, or that all genotypes show the similar pattern for nutrient uptake and utilization under conventional and organic production system. This information may be useful to address the questions related to these two production systems with respect to nutrient utilization.

Key words: conventional, organic, nutrient, tomato, uptake and utilization

Introduction

Organic agriculture is one of the fastest growing industries in the US reaching its annual sale of about $35 billion (http://nifa.usda.gov/topic/organic-agriculture). It has not only economic but also environmental benefits that are being observed directly by organic growers. Organic food production supports increased biodiversity, enhanced nutrient cycling, and less chemical runoff to our waterways (BADGLEY et al., 2007; PIMENTEL et al., 2005). Based on recent statistics, consumer demand for organic food continues to increase.

It is widely claimed that tomatoes grown under organic conditions are of better nutrition. There is also a growing trend of buying organic products because of this perception of the general public. However, there is currently no data to support this claim. Tomato quality is a combination of several factors including genotype, production method, harvest stage, and post-harvest handling. An integrative study investigating all factors would be interesting to determine the role of individual component in the quality of tomato fruit. In this study, we were interested to determine the genotypic differences for nutrient composition of fruits under conventional and organic production conditions.

Materials and Methods

In order to achieve the above objective, we grew three tomato genotypes-- Mountain Merit (NC0694), NC085 and NC089-- under Conventional and Organic conditions with three replications. Leaf and fruit samples were taken from vegetative and reproductive growth stages at three different time intervals to monitor the nutrient levels under both production systems. Samples were analyzed for major and micro-nutrients. Analysis of variance was performed to determine the differences between the genotypes and production systems for nutrient composition.

Results and Discussion

There was a significant ($p<0.05$) difference between conventional and organic production systems for nutrient composition of tomato fruits. Levels of most of the major nutrients were found to be higher under conventional system (Fig. 1 and 2).

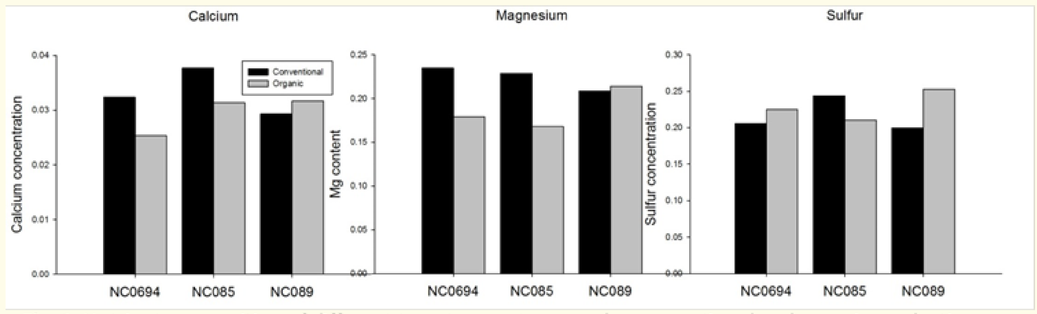

Fig. 1. Nutrient composition of different tomato genotypes under conventional and organic production.

However, NC089 had higher levels of calcium and sulfur under organic conditions (Fig. 1). We also evaluated the partitioning of nutrients between vegetative (leaf) and reproductive (fruit) tissues. There was a significant difference between leaf and fruit for boron, calcium, magnesium, potash, and sulfur (data not shown). There was a significant ($P<0.05$) interaction between genotypes for calcium, magnesium, and sulfur (Fig. 1). These nutrients are constituents of the compounds that determine the quality of the tomato. Although we did not determine the quality compounds, it has been shown in other studies that the quality components were not better under organic conditions despite general expectations (HALLMANN, 2012; ILIC et al., 2014).

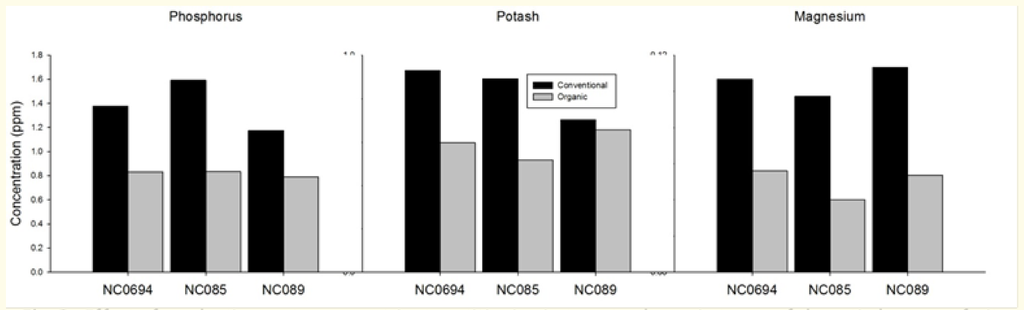

Fig. 2. Effect of production system on nutrient partitioning in tomato shown in terms of the ratio between fruit and leaf tissues for phosphorus, potassium, and manganese.

Some studies have shown higher levels of bioactive compounds in tomato fruits produced under organic conditions. However, findings are inconsistent. Higher levels of basic constituents in conventional production systems in all genotypes indicated that there may not be an opportunity to improve the trait by genotypic approach, although the number of genotypes included in the study was only three, which is extremely low to come to any conclusion.

In most of the fruit quality analysis other traits including total soluble solids, organic acids, and lycopene are also reported (LECOMTE et al., 2004; PANTHEE et al., 2013; RUIZ et al., 2005; RUIZ et al., 2006). In the present study, we have not performed those analyses, which makes the reporting incomplete.

Conclusion

There was no genotypic difference for nutrient composition in fruits of tomato, although the number of genotypes included in the study was very small. Contrary to general perception, nutrient composition from conventional production system was better than organic system. This indicated that we may not have evidence to claim that organic products are better than conventional products.

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