Colloquium Papers and Authors

Presiding: W. Kalt and M.M. Kushad

The Role of Oxidative Stress and Antioxidants in Plant and Human Health: Introduction to the Colloquium

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The colloquium proceedings cover a wide range of topics related to oxidative stress/antioxidant protection and illustrate a merger among the fields of plant, food, nutritional, and medical sciences, which is unprecedented and exciting to the field of horticulture. In plant science alone, the importance of oxidative stress as the mechanistic basis of a variety of fruit and vegetable disorders is a fundamental breakthrough in both production and postharvest physiology. Understanding that oxidative stress is a "point of commonality" for several preharvest and postharvest disorders may result in new approaches in biochemical research to identify targets and potentially develop solutions for a variety of plant stresses. Studies at the whole plant, cellular, and organelle level are necessary to understand how factors such as environment, genetics, and cellular compartmentation may play a role in oxidative defense.

The preponderance of evidence documented in human nutrition and medical research substantiating a role for dietary antioxidants in health maintenance and disease prevention is an impetus for researchers in horticulture and food science to consider monitoring antioxidant compounds in fruits and vegetables. The chemical characteristics of antioxidants, including their solubility properties, regenerative ability, structure/activity relationships, and bioavailability, are important factors with respect to human health. The distinctive properties of each antioxidant group (e.g., tocopherols, carotenoids, flavonoids, and vitamin C) highlight the importance of a varied complement of antioxidants in the diet. The development of storage and processing technologies aimed at retaining the antioxidant complement of fruits and vegetables is an area of readily applicable research for those in horticulture and food science.

Although little is known from human nutrition research regarding the absolute amounts of various antioxidants required for maximum human health benefits, increasing the preharvest levels of dietary antioxidants in fruits and vegetables is an area of keen interest and presents an opportunity to agricultural scientists. Based on our current knowledge of the genetic variation in various antioxidants in plant foods, conventional breeding holds significant promise for developing genotypes with improved antioxidant content and composition. Direct genetic manipulation also has great potential as a tool to improve the nutritive quality of produce, particularly as we learn more about the biochemical pathways affecting the levels of various fruit and vegetable antioxidants.

Among the groups of antioxidant molecules, the flavonoids are somewhat distinctive because of their different roles in plants vs. humans. Carotenoids, tocopherols, and ascorbate are all recognized as playing a role as antioxidants in both plants and humans. However, flavonoids do not appear to function as antioxidants in plants, and instead serve various ecological roles, such as protectants, attractants, and repellents. It seems simply fortuitous that the flavonoids, which can make a substantial contribution to the human diet, may be beneficial to health because of their antioxidant characteristic.

To address the issues surrounding oxidative stress and antioxidant protection by addressing the entire continuum from plant production to human medicine seems logical and essential. These proceedings can be deemed a success if they raise the awareness of the significant role that horticultural research can play in optimizing and maintaining the nutritional quality of fruits and vegetables.

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