Proceedings of the Colloquium

Recent Advances in Plant Responses to Stress: Bridging the Gap between Science and Technology

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Colloquium Papers and Authors

Presiding: Michael Wisniewski

Recent Advances in Plant Responses to Stress: Bridging the Gap between Science and Technology: Introduction to the Colloquium
Michael Wisniewski

Recent Advances in Plant Response to Mechanical Stress: Theory and Application
Cary A. Mitchell

Regulation of Plant Growth Responses to Low Soil Water Potentials
Robert E. Sharp

Low-temperature Stress Tolerance: The Role of Abscisic Acid, Sugars, and Heat-stable Proteins
L.V. Gusta, R.W. Wilen, and P. Fu

Theory and Application of Genetic Engineering for Stress Resistance and Avoidance
Steven E. Lindow

Role of Calcium in Plant Responses to Stresses: Linking Basic Research to the Solution of Practical Problems
Jiwan P. Palta

Recent Advances in Plant Responses to Stress: Bridging the Gap between Science and Technology: Introduction to the Colloquium

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In nature, all plants are exposed to environmental conditions and biotic influences that reduce their potential growth. The impact of nonoptimal growing conditions on plants is referred to as environmental and biotic stress. As a stress is imposed, plants usually exhibit a cascade of responses, occurring on different time scales, that involve biochemical and morphological adjustments leading to stress tolerance or avoidance (Mooney et al., 1991). Plant stress, because of its impact on growth and reproductive output, plays a significant role in limiting crop production. Consequently, considerable research has been devoted to understanding basic mechanisms underlying the response of plants to stress. As noted by Close and Bray (1993), it is especially challenging to identify the stress responses that might be exploited to improve plant production in limiting environments.

In the past two decades, the field of plant stress has become a major subdiscipline within plant biology, and many basic and applied research goals have been reached. This colloquium is intended to review recent advances in our basic knowledge of plant adaptation to stress and the efforts to develop specific management practices that either attempt to moderate detrimental stress responses or, alternatively, use stress to horticultural advantage. This colloquium is not intended to be a comprehensive review, but rather to highlight the accumulation of new knowledge in specific areas and the beneficial application of that knowledge in the real world.

As attitudes regarding government-supported research change and the need for fiscal responsibility increases, funding for plant research is becoming more difficult to obtain. As horticulturists, we are becoming more adept at communicating the economic importance of our research to agricultural production. That is why this colloquium has been subtitled, "Bridging the Gap Between Science and Technology." As scientists, we have to be concerned more than ever before about the application of our knowledge. Patents, technology transfer, research and development grants, biotechnology, all these terms are becoming an integral part of our professional vernacular. With this in mind, our contributors were asked, wherever possible, to indicate how our basic knowledge of plant stress has led to the development of new technology or management practices that maintain or increase agricultural production.

Cary Mitchell reviews recent advances in our understanding of how plants respond to mechanical stress (seismic and thigmic). Although an appreciation of the impact of this type of stress on plant growth and development has been slow to develop, Mitchell will clearly illustrate the commercial potential of regulating plant growth under greenhouse conditions in a beneficial manner via the use of physical pertubations. He will also address how the discovery of "touch genes" in plants has led to a more fundamental understanding of signal transduction in plants.

Robert Sharp discusses the response of plants to low soil water

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