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Desiccation-Tolerance of Plant Tissues: A Mechanistic Overview*

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I. INTRODUCTION

The loss of water from plant cells is an important environmental stress that has a major impact on the area of land available for cultivation. Over 35% of the world's land surface is considered to be arid or semiarid, experiencing precipitation that is inadequate for most horticultural uses. Ramanathan (1988) has argued, based on predictions of global environmental changes, that developing crops that are more tolerant to water deficits while maintaining productivity will become a critical requirement in the near future. Understanding how plant cells tolerate water loss is a vital prerequisite for developing strategies that can impact horticultural and agricultural crop productivity and survival under conditions of decreasing water availability. Much work has been accomplished in this area with the main emphasis on those genes that are expressed during the response of plants to water stress. From this work, our knowledge of stress tolerance has improved immensely but with little success in augmenting the development of breeding programs for increasing drought tolerance of horticultural crops. The approach is restricted in that most crops have a limited capacity for drought tolerance and thus the genetic information necessary for expanding their drought-tolerance may not be present or exploitable. In addition, the response to drought may not be directed at tolerance of the stress directly. In contrast, more may be gained by understanding how stress-tolerant plants or plant structures accomplish tolerance and which genes from these sources contribute directly to this phenotype. In keeping with this philosophy, understanding how plants cells tolerate the severest of water deficits, viz. desiccation, will offer novel perspectives and new insights into water stress-tolerance mechanisms. Native plants that can tolerate desiccation of their vegetative tissues are a potential