Preface

The National Land and Water Resources Audit has estimated that by 2020, somewhere between 10% and 25% of currently arable land in Australia could be out of production, and the overall cost of dryland salinity may exceed AUS$1 billion by 2100 (http://www.deh.gov.au/soe/2001/fact-sheets/salinity.html). In addition, 67% of the agricultural area has potential for 'transient salinity' (Rengasamy, 2006), which may amount to $1330 million per annum in lost opportunities (Rengasamy, 2002). Even more severe are the economic consequences of drought stress. Over the last few years, Australia has experienced its worst drought in 100 years, which has shaved off up to 1% of Australia's economic growth, as well as resulted in over AUS$6 billion losses in crop and livestock production during 2006/2007 (ABARE, 2006).

The problem of salinity and drought goes well beyond the regional scale. On global scales, salinity is destroying at least 3 ha of arable land every minute (Zhu *et al.*, 2005). It is predicted that up to 30% of currently arable land may be lost within the next 25 years, and up to 50% by the year 2050 (Wang *et al.*, 2003). The global cost of irrigation-induced salinity is equivalent to an estimated US$11 billion per year (FAO, 2004). As for the drought, the very recent 2011 summer drought in Texas (USA) has already caused $5.2 billion in losses to agriculture (http://www.reuters.com/article/2011/08/17/us-drought-losses-texas-idUSTRE77G4RG20110817), making it the most destructive drought in the state's history. Of these, over $2.8 billion were related to lost crop production.

The above examples of drought and salinity stresses are only the tip of the iceberg. Other adverse environmental conditions such as waterlogging, temperature extremes, soil nutrient availability and biotic factors also have major detrimental effects on crop production around the globe. Given the fact that most of the suitable land has already been cultivated, meeting a projected target of a 50% increase in global food production by 2050 to match the projected population growth becomes a rather challenging task. Key to achieving this goal is a better understanding of the major physiological and molecular mechanisms facilitating plant tolerance to adverse environmental factors.

Recent progress in biology and rapid development of advanced biochemical and molecular techniques has resulted in the nearly exponential accumulation of our knowledge on specific genes under- or over-expressed in plants under a variety of stress conditions. The physiological roles of these genes, as well as the integration of collective responses of highly specialized plant cells and tissues into the overall adaptive response of the plant in its entirety, are understood much less. This book provides a timely update on the recent progress in our knowledge of all aspects of plant's perception, signalling and adaptation to a variety of environmental stresses such as drought, salinity, heat, cold, frost, soil pH extremes, Al and heavy metal toxicities, desiccation, waterlogging, UV, oxidative stress and pathogens. For the first time, all this information is collated under one cover, providing a comprehensive reference text for a broad range of researchers, from ecologists to plant physiologists to agronomists and plant breeders. We hope that the book will also be highly valuable to tertiary students in a variety of biology-related disciplines, as well as lecturers and post-graduate students in appropriate disciplines.

In conclusion, I would like to say my sincere thank you to all contributing authors for their great work and enthusiastic support of this project. I would also like to acknowledge the financial support from the Australian Research Council and Grain Research and Development Corporation for research on plant stress physiology in my laboratory.

Enjoy the reading!

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