This book is a unique attempt to simultaneously tackle theoretical and practical aspects in drought phenotyping, through both crop-specific and cross-cutting approaches. It has been written for—and will be of use to—practitioners and postgraduate students in plant science, who are grappling with the challenging task of evaluating germplasm performance under different water regimes.
In Part I, different methodologies are presented for accurately characterising environmental conditions, implementing trials, and capturing and analysing the information this generates, regardless of the crop. Part II presents the state-of-art in research on adaptation to drought, and recommends specific protocols to measure different traits in major food crops (focusing on particular cereals, legumes and clonal crops).

The book is part of the CGIAR Generation Challenge Programme’s efforts to disseminate crop research information, tools and protocols, for improving characterisation of environments and phenotyping conditions. The goal is to enhance expertise in testing locations, and to stimulate the development and use of traits related to drought tolerance, as well as innovative protocols for crop characterisation and breeding.

To ensure the widest dissemination, this book is published under the Creative Commons Attribution-NonCommercial-Share Alike 2.5 Mexico licence.


- Downloadable online at: www.generationcp.org/drought_phenotyping
- Also available in hard copy (limited edition) and on CD. To request a copy please send an e-mail to: books@generationcp.org
Contents

Part I. Plant phenotyping methodology

Phenotyping drought-stressed crops: key concepts, issues and approaches
   Roberto Tuberosa

Effective and efficient platforms for crop phenotype characterisation under drought
   Hugo Campos, Jacqueline E Heard, Miguel Ibañez, Michael H Luethy,
   Tom J Peters and David C Warner

Drought tolerance phenotyping in crops under contrasting target environments: procedures and practices
   Reinaldo L Gomide, Frederico OM Durães, Cleber M Guimarães, Camilo LT
   Andrade, Paulo EP Albuquerque, Edson A Bastos, João HM Viana, Luis F Stone,
   Orlando P Morais, Maria J Del Peloso, Paulo C Magalhães, Luiz Balbino Morgado
   and Antônio C Oliveira

Screening experimental designs for quantitative trait loci, association mapping, genotype-by-environment interaction, and other investigations
   Walter T Federer† and José Crossa

Plant response to environmental conditions: assessing potential production, water demand and negative effects of water deficit
   François Tardieu

The statistical analysis of multienvironment data: modelling genotype-by-environment interaction and its genetic basis
   Marcos Malosetti, Jean-Marcel Ribaut and Fred A van Eeuwijk

Analysis of metabolites for phenotyping
   Tim L Setter

Development of crop ontology for sharing crop phenotypic information
   Rosemary Shrestha, Guy F Davenport, Richard Bruskiewich and Elizabeth Arnaud

A selection of models to assist drought phenotyping
   Sam Geerts and Dirk Raes

Spatial analysis to support geographic targeting of genotypes to environments
   Glenn Hyman, Dave Hodson and Peter Jones
Part II. Application to specific crops

Cereals

Phenotyping rice for adaptation to drought
Ken S Fischer, Shu Fukai, Arvind Kumar, Hei Leung and Boonrat Jongdee

Phenotyping wheat for adaptation to drought
Philippe Monneveux, Ruilian Jing and SC Misra

Phenotyping maize for adaptation to drought
Jose Luis Araus, Ciro Sanchez and Gregory O Edmeades

Phenotyping sorghum for adaptation to drought

Phenotyping pearl millet for adaptation to drought
Vincent Vadez, Tom Hash, Francis R Bidingerg and Jana Kholova

Legumes

Phenotyping common beans for adaptation to drought
Stephen E Beebe, Idupulpulati M Rao, Matthew W Blair and Jorge A Acosta-Gallegos

Phenotyping chickpeas and pigeonpeas for adaptation to drought
HD Upadhyaya, J Kashiwagi, RK Varshney, PM Gaur, KB Saxena, L Krishnamurthy, CLL Gowda, RPS Pundir, SK Chaturvedi, PS Basu and IP Singh

Phenotyping cowpeas for adaptation to drought
Anthony E Hall

Phenotyping groundnuts for adaptation to drought
MS Sheshshayee, G Parsi Shashidhar, JN Madhura, R Beena, TG Prasad and M Udayakumar

Clonal crops

Phenotyping cassava for adaptation to drought
E Okogbenin, Tim L Setter, M Ferguson, R Mutegi, AC Alves, H Ceballos and M Fregene

Phenotyping sweet potatoes for adaptation to drought
Francisco Vilaró

Phenotyping bananas and plantains for adaptation to drought
Iyyakkutty Ravi and Subbaraya Uma