
Preface

In 2007, we edited *Handbook of Plant Nutrition*, a compendium of knowledge at that time on the mineral nutrition of plants. This handbook was inspired by Homer D. Chapman's 1965 book, *Diagnostic Criteria for Plants and Soils*, and had contributions from eminent plant and soil scientists from around the world. Its purpose was to provide a current source of information on the nutritional requirements of world crops, and it covered the uptake and assimilation of elements essential or beneficial for plant growth, the availability of these elements to plants, fertilizers used to enhance the supply of the elements, and diagnostic testing of plants and soils to determine when they are in short supply. Each element considered was given its own chapter, with macronutrients being covered in more detail than micronutrients and beneficial elements.

Since the publication of the first edition, there have been advances in many aspects of plant nutrition, so a second edition is now timely. The second edition seeks to outline recent advances but also to put these advances into the context of our historical understanding of the importance of nutrient and beneficial elements to plants. This action means that inevitably some repetition of ideas that appeared in the first edition will occur, but repetition has been minimized in a variety of ways.

First, most of the chapters are written by different experts, or a group of experts, from those who contributed to the first edition. This change does not reflect on the outstanding contributions made by those earlier authors, some of whom have contributed chapters on different elements in this second edition, but merely gives a stimulus to cover each element in a different manner. Different workers inevitably have different interests in their research and expressions of their knowledge, and these interests and expressions are reflected in the way in which they have written about a particular element.

Second, the chapter sections have been modified to reflect current interests within plant nutrition. For example, the chapters in the second edition have more extensive coverage of the relationship between plant genetics and the accumulation and use of nutrients by plants, but most chapters contain less on the discovery of essentiality or beneficial action, as in most instances this information is covered well in the first edition. The first edition had extensive tables showing elemental composition of different plants and different plant parts. To avoid repetition, such tables are not nearly as extensive in the second edition and concentrate on the summarization of values reported from the period of time between the publications of the two editions. A final difference is that more knowledge about the importance of lanthanides in plant nutrition has become available since the first edition, so these elements are featured in a new chapter in the second edition.

Chapters on the different mineral elements follow the general pattern of a description of the determination of essentiality (or beneficial effects of the element), uptake and assimilation, physiological responses of plants to the element, genetics of its acquisition by plants, concentrations of the element and its derivatives and metabolites in plants, interaction of the element with uptake of other elements, diagnosis of concentrations of the element in plants, forms and concentrations of the element in soils and its availability to plants, and soil tests and fertilizers used to supply the element. These vary slightly depending on whether elements are assimilated, or function unchanged in plants; whether they are macronutrients, micronutrients, or beneficial elements; whether or not we use fertilizers to improve their supply; and whether we know about genetic differences in their plant requirements. There is a color insert of some of the images of plants showing deficiencies or toxicities of different nutrients that appear in black and white in the chapters, some images of sub-cellular structures, and also some of the diagrams. In addition, there is an introduction in which the editors discuss world population growth, trends in the use of inorganic fertilizers, developments in improving the efficiency of fertilizer use, the ionic composition of plants and its manipulation,

and techniques used in plant nutrition research. The conclusion notes key points discussed in the chapters. This new handbook describes interactions between the elements in plants and highlights areas of rapid change in the study of plant nutrition and in the application of our knowledge.

The editors are grateful to the authors of the chapters in both editions for their detailed and informative coverage of topics in plant nutrition. With the world population, and the number of mouths to feed, increasing rapidly, with pollution from agricultural wastes still an environmental problem in many parts of the world, and with great interest in lowering the energy requirements of agriculture (and the greenhouse gas emissions associated with this), we hope that the second edition will provide a useful stimulus to people working to overcome these problems.

It is with sadness that we note the death of one of the contributors, Dr. Nand Kumar Fageria, during the final stages of preparation of this book. Dr. Fageria, a former senior soil scientist at Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA) in Brazil, was a leading contributor to work on plant nutrition, with more than 200 publications to his name, including some well-known books on crop nutrition. His chapter on potassium in this book is a detailed and informative account of current ideas on the role of this element in plant nutrition, although in truth he could have also contributed outstanding chapters on many other elements required by plants. We also note the passing of Professor Volker Römheld, who jointly contributed the chapter on iron, and Professor Konrad Mengel, who contributed the chapter on potassium to the first edition. Professor Römheld was professor of plant nutrition at Hohenheim University, and published extensively on acquisition, uptake, and physiology of micronutrients in plants. Professor Mengel was professor of plant nutrition at the Justus Liebig University, Giessen, and not only was an expert on the potassium nutrition of plants but also had a broad interest across the whole of plant nutrition. This interest was put to good use in *Principles of Plant Nutrition* (K. Mengel and E.A. Kirkby), which ran to five editions and was a stimulating introduction to the subject for many students worldwide.

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