
Contents

Section I

Introduction	1
---------------------------	----------

Chapter 1 Introduction	3
-------------------------------------	----------

Allen V. Barker and David J. Pilbeam

Section II

Essential Elements—Macronutrients	19
--	-----------

Chapter 2 Nitrogen	21
---------------------------------	-----------

Allen V. Barker and Gretchen M. Bryson

Chapter 3 Phosphorus	51
-----------------------------------	-----------

Charles A. Sanchez

Chapter 4 Potassium	91
----------------------------------	-----------

Konrad Mengel

Chapter 5 Calcium	121
--------------------------------	------------

David J. Pilbeam and Philip S. Morley

Chapter 6 Magnesium	145
----------------------------------	------------

Donald J. Merhaut

Chapter 7 Sulfur	183
-------------------------------	------------

Silvia Haneklaus, Elke Bloem, Ewald Schnug, Luit J. de Kok, and Ineke Stulen

Section III

Essential Elements—Micronutrients	239
--	------------

Chapter 8 Boron	241
------------------------------	------------

Umesh C. Gupta

Chapter 9 Chlorine	279
---------------------------------	------------

Joseph R. Heckman

Chapter 10 Copper	293
--------------------------------	------------

David E. Kopsell and Dean A. Kopsell

Chapter 11 Iron	329
<i>Volker Römheld and Miroslav Nikolic</i>	
Chapter 12 Manganese	351
<i>Julia M. Humphries, James C.R. Stangoulis, and Robin D. Graham</i>	
Chapter 13 Molybdenum	375
<i>Russell L. Hamlin</i>	
Chapter 14 Nickel	395
<i>Patrick H. Brown</i>	
Chapter 15 Zinc	411
<i>J. Benton Storey</i>	
Section IV	
Beneficial Elements	437
Chapter 16 Aluminum	439
<i>Susan C. Miyasaka, N.V. Hue, and Michael A. Dunn</i>	
Chapter 17 Cobalt	499
<i>Geeta Talukder and Archana Sharma</i>	
Chapter 18 Selenium	515
<i>Dean A. Kopsell and David E. Kopsell</i>	
Chapter 19 Silicon	551
<i>George H. Snyder, Vladimir V. Matichenkov, and Lawrence E. Datnoff</i>	
Chapter 20 Sodium	569
<i>John Gorham</i>	
Chapter 21 Vanadium	585
<i>David J. Pilbeam and Khaled Drihem</i>	
Section V	
Conclusion	597
Chapter 22 Conclusion	599
<i>Allen V. Barker and David J. Pilbeam</i>	
Index	605