

Table of Contents

Foreword	ix
Introduction	xi
Acknowledgements	xv
Chapter 1. A Multichannel System for Steady-State and Continuous Measurements of Gas Exchanges from Legume Roots and Nodules	1
D.B. LAYZELL, S. HUNT, B.J. KING, K.B. WALSH and G.E. WEAGLE	
1. Introduction	1
2. Overview of the Gas Exchange System	3
3. Application of the Gas Exchange System to Studies of Legume Physiology	20
4. Conclusions	24
Chapter 2. Quantification of Diffusion Characteristics in Spherical Nodules: A Comparison of Methods	29
P.R. WEISZ and T.R. SINCLAIR	
1. Introduction	29
2. Homogeneous Model of Nodule Diffusion	30
3. Diffusion Barrier Models	33
4. Comparisons Among Diffusion Barrier Models	46
5. Conclusions	48
6. Appendix. <i>Sensitivity of Transient Analysis to Changes in V_{mx}</i>	49
Chapter 3. Simple Apparatus for Growth of Nodulated Plants and for Continuous Nitrogenase Assay Under Defined Gas Phase	55
W.B. SILVESTER, R. PARSONS, F.R. MINCHIN and J.F. WITTY	
1. Introduction	55
2. Apparatus — Plant Growth in Defined O ₂ Levels	56
3. Apparatus — Assays in Open, Flow-Through Systems	59
Chapter 4. Continuous Measurements of Nitrogenase Activity in the Study of Environmental Responses of <i>Frankia</i> and Other Bacteria	67
W.B. SILVESTER and L.J. WINSHIP	
1. Introduction	67
2. Materials and Methods	68
3. Results	69
4. Discussion	76

Chapter 5. Limitations and Errors in Gas Exchange Measurements with Legume Nodules	79
F.R. MINCHIN and J.F. WITTY	
1. Introduction	79
2. Sources of Error	79
3. Avoidance of the Acetylene-Induced Decline	92
4. Conclusions	92
Chapter 6. Principles and Approaches in Modeling Steady-State Gas Diffusion in Legume Nodules	97
S.T. GAITO, S. HUNT and D.B. LAYZELL	
1. Introduction	97
2. General Diffusion Models	98
3. A Model of Gas Diffusion in Legume Nodules	104
4. Other Models of Gas Diffusion	116
Chapter 7. Modeling Gas Exchange by Actinorrhizal Root Nodules Using Network Simulation Analysis	121
L.J. WINSHIP and W.B. SILVESTER	
1. Introduction	121
2. Model Construction	125
3. Simulation Model Output	136
4. Conclusions	141
Chapter 8. Continuous and Steady-State Nutrient Absorption by Intact Plants	147
A.J. BLOOM	
1. Introduction	147
2. Nutrient Flow System	147
3. Ion-Selective Electrodes	151
4. Measurement Artifacts	156
5. Validity of Continuous and Steady-State Measurements	161
Chapter 9. Steady-State Control and Investigation of Root System Morphology	165
R.W. ZOBEL	
1. Introduction	165
2. Overview	166
3. Environmental Factors which Affect Roots	169
4. Aeroponics	173
5. Conclusion	180
Chapter 10. Measurement of Carbon Cost in Ectomycorrhizae	183
J.V.D. ROUSSEAU and C.P.P. REID	
1. Introduction	183

2. Carbon Cost as Loss of Potential Dry Matter	183
3. Carbon Flow from Shoot to Root	186
4. Carbon Flow from Root to Fungus	187
5. Modeling Carbon Flow in Ectomycorrhizae	191
6. Conclusions	193
Chapter 11. Approaches to Measuring Soil Nitrogen Transformations Under Continuous or Steady-State Conditions	197
D.D. MYROLD	
1. Introduction	197
2. The Soil Environment	198
3. Soil Nitrogen Transformations	200
4. Continuous and Steady-State Terminology	201
5. Laboratory Methods	202
6. Field Methods	205
7. Isotope Dilution	210
8. Summary	212
Chapter 12. Methodological Considerations in Measuring Biomass, Production, Respiration and Nutrient Resorption for Tree Roots in Natural Ecosystems	217
K.A. VOGT, D.J. VOGT, E.E. MOORE and D.G. SPRUGEL	
1. Introduction	217
2. Problems Associated with Field Root Studies	217
3. Root Biomass and Production	220
4. Root Respiration	223
5. Root Resorption of Nutrients	226
6. Conclusions	230
Subject Index	233
Authors' Index	239