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The Rhizosphere

With 57 Figures

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Preface

The Plant Root and the Rhizosphere was a major topical feature of the first International Symposium on Factors Determining the Behavior of Plant Pathogens in Soil held at the University of California, Berkeley in 1963. The symposium was edited by K. F. Baker and W. C. Snyder and published under the title *Ecology of Soil-Borne Plant Pathogens*. Since that time, several other international efforts, either on the root–soil interface specifically or on topics relating to the root environment, have provided a wealth of valuable information basic to promoting the culture of healthier, more productive plants.

For the writing of this book, inspiration has come, in large part, from 10 years of cooperative rhizosphere research in association with leading scientists participating in a regional effort within the southern United States. We have attempted to bring together in this work the major aspects of rhizosphere research and the principles of rhizosphere ecology for the benefit of developing young scientists and technologists, as well as for the established professional researcher and teacher. A prime objective and hope is that this volume might generate ideas that will bring forth new approaches and methodology leading to further advances in our understanding of rhizosphere interactions and their implications for agriculture.

Because of the enormous complexity of the chemical, physical, and microbiological environment of roots, the methods used by various workers are rarely standardized but must be devised or modified for each experiment. Consequently, conflicting results are often reported for apparently similar studies, thus making generalized statements of fact hazardous or in many cases impossible. This has necessitated very careful documentation, resulting in an extensive bibliography. However, a mere literature review is not intended, since much good work has not been cited. We have deliberately drawn upon some old research information on the rhizosphere and related areas, largely for the benefit of advanced students and young scientists, to show where rhizosphere research has come from and where it may be going. In doing this we believe we have revealed many of the gaps in our knowledge which are yet to be filled. For meaningful contributions to be made in the future the need for refined technology and a multidisciplinary pooling of expertise by soil microbiologists, phytopathologists, soil physicists and chemists, plant physiologists, and zoologists should be clearly evident.

Chapter 2, which deals with the structure and physiology of roots, may appear at first to dwell in unnecessary depth and detail on the

structure and function of the aboveground plant parts as well as roots. However, this chapter is central to the primary purpose of rhizosphere study, i.e., to understand the relationship of rhizosphere ecology to the function and performance of the *whole* plant, not just the root system. Along with conventional plant breeding, the potential for genetically engineering specific modifications in shoot, root, and rhizosphere for desirable growth-enhancing characteristics would seem to emphasize further the essentiality of whole-plant involvement in rhizosphere investigations.

While we assume sole responsibility for any omissions or errors in the text, we are grateful to all those unselfish individuals who have contributed to the manuscript preparation over several years. We thank the many authors and journal editors or other officials who kindly granted permission for us to use data or to reproduce illustrations of figures, and we especially acknowledge the generous response of those who provided illustrative materials; proper credit for these contributions is given in the text. We are indebted to rhizosphere specialists at other institutions who gave of their time and expertise to examine specific chapters and offer constructive suggestions: Dr. G. J. Griffin, Virginia Polytechnic Institute and State University; Dr. L. F. Johnson, University of Tennessee; and Dr. N. C. Schenck, University of Florida. Further recognized are the valuable contributions of our own Auburn University colleagues, Dr. R. R. Dute, Dr. C. M. Peterson, Dr. J. D. Weete, and Dr. W. D. Kelley for examining various sections of the manuscript. For technical assistance in preparation of the manuscript, we express our sincere appreciation to Tammy Forbus, Susan Ledbetter, Barbara McFadyen, Robert Rush, Susan Scott, Jennifer Weete, and William Wiese.

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Auburn University, 1985

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