AGRONOMY

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It is truly fitting that Methods of Soil Analysis, Part 2, Second Edition be dedicated to Dr. Charles A. Black. Dr. Black was editor-in-chief of the 1965 Methods of Soil Analysis, Parts 1 and 2, one of the most successful and widely acclaimed of the Society's monograph series. His dedicated efforts were largely responsible for the overall high quality of the first edition of the monograph. It is also fitting to recognize Dr. Black for his contributions to research and teaching and for his current role as one of the chief spokespersons for agriculture.

Dr. Black was born 22 January 1916 in Lone Tree, Iowa. He received B.S. degrees in chemistry and soil science from Colorado State University in 1937, and the M.S. and Ph.D. degrees in soil fertility from Iowa State University in 1938 and 1942.

He began his professional career as a research fellow in the Department of Agronomy, Iowa State University in 1937, and in 1939 joined that faculty as instructor in soils. Except for service with the U.S. Navy during World War II, a visiting professorship at Cornell University in 1955–56, and a NSF Fellowship at UC-Davis in 1964–65, Dr. Black has remained at Iowa State. He retired as distinguished professor in 1979 to devote full time to his current duties with the Council for Agricultural Science and Technology (CAST).

Dr. Black's research and teaching career has had a major influence on the discipline of soil science, particularly soil fertility and soil chemistry. He has contributed much to our knowledge of phosphate reactions in soils, uptake by plants, and interpretation of yield curves. He is author or co-author of approximately 100 research papers, has written two editions of a widely used textbook entitled Soil-Plant Relationships, and several editions of a laboratory manual on soil chemistry. He has also served as associate editor for the SSSA Journal; as consulting editor for Soil Science, and as editor of more than 100 publications issued by CAST. He has served the ASA and SSSA as a member of numerous committees, as SSSA president in 1961, and as ASA president in 1971. He has received numerous awards and honors, including the ASA Soil Science Award (1957), ASA Fellow (1962), Fellow of the American Institute of Chemists (1969), Honorary Member of SSSA (1975) and ASA (1981), AAAS Fellow (1976), the Henry A. Wallace Award from Iowa State University for Distinguished Service to Agriculture (1981), and the Bouyoucos Soil Science Distinguished Career Award, SSSA (1981).

Dr. Black's critical and forthright evaluation of research findings, coupled with a warm personality and a dry sense of humor, have made him a much sought-after counselor by students and colleagues. His graduate level soil-plant relationship courses at Iowa State were especially popular. Those privileged to learn under Dr.

Charles A. Black
Black gained the type of knowledge and philosophy which has served them well in their varied careers.

Dr. Black's career took on a new dimension in 1970 when, largely under his direction, CAST was developed. He was the president of CAST in 1973 and since then has served as the executive vice-president of this innovative, independent association of agricultural science societies.

He is providing invaluable service to the community of food and agricultural scientists through his dedicated efforts on the behalf of CAST. Through the Council, the scientific societies and the scientists they represent, can make an input into the development of national policies on food and agriculture by supplying scientific information to decision makers and opinion leaders.

GENERAL FOREWORD

Methods of Soil Analysis, Part 2—Chemical and Microbiological Properties, Agronomy Monograph 9, is the second edition and thus replaces the original Part 2 published in 1965. This new publication incorporates significant advances made in this field during the past 17 years and is an important addition to the Agronomy monograph series, which was started in 1949. The first six volumes of the series were published by Academic Press, Inc. In 1957 the American Society of Agronomy took over publication of its monographs and continued to be the sole publisher through the 18th monograph published in 1977. The Crop Science Society of America and the Soil Science Society of America were invited to participate in the series and have been copublishers since 1977. The monographs represent an important and continuing effort of the associated societies, their officers, and the 11,700 members located in 100 countries to provide mankind worldwide with the most recent information available.

On behalf of the members of the associated societies and myself, I sincerely thank A. L. Page, editor, and associate editors R. H. Miller and D. R. Keeney for their diligent work, the many authors for their contributions, managing editor R. C. Dinauer for his diligent efforts in the production of this monograph, and all others who have contributed directly or indirectly to the accomplishment of this publication.

August 1982

DAVID M. KRAL
Acting Executive Vice President
ASA-CSSA-SSSA

FOREWORD

Soil is one of the most important of our natural resources. It supports and provides nutrients for the plants and animals that provide our food, fiber, and shelter. It is also the receptacle for much of our waste material, helping to correct and often hide many of our mistakes and oversights. If managed properly, the soil provides protection for our environment.
The soil is also nonrenewable for all practical purposes, highly variable, and complex, especially from a chemical and biological standpoint. It is essential that we have the best possible understanding of the nature and properties of our soils if we are to make the most efficient use of them for food and fiber production, and at the same time preserve them for future generations. This understanding has been greatly enhanced in the past, through the use of new and improved analytical procedures. Yet, we have a great deal to learn, and new procedures based on the use of modern technology and insights gained from past experience are continually emerging.

The second edition of the book, *Methods of Soil Analysis, Part 2, Chemical and Microbiological Properties*, provides a timely and needed update of the new analytical procedures available today. The authors represent the many facets of the chemistry and biology of soils and are among the most highly respected and knowledgeable soil scientists.

On behalf of ASA and SSSA we want to express our appreciation to the organizing and editorial committees, the authors and reviewers, and the ASA Headquarters staff for the time and effort they have spent in making this publication possible.

September 1982

ROBERT G. GAST

C. O. GARDNER

*president*

*president*

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*American Society of Agronomy*

**PREFACE**

The first edition of *Methods of Soil Analysis, Part 2, Chemical and Microbiological Properties* was published in 1965. The purpose of the book was to provide a comprehensive and authoritative treatise on laboratory methods for the chemical and microbiological characterization of soils. The book was extremely well received and has been recognized internationally as the standard reference for the methods of soil analysis. More than 12,300 copies have been sold worldwide. Dr. C. A. Black, to whom the second edition is dedicated, edited the first edition.

Since 1965 the technological advances in analytical instrumentation and methodology have been substantial. Additionally, the widespread public concern over environmental quality created a need to expand the coverage to include methods for elements and constituents not contained in the first edition. Recognizing these needs and following a recommendation by the ASA Monographs Committee, the Executive Committee of ASA approved publication of this second edition.

In a system as complex as soil, and a discipline that contains such diverse constituents, it is impossible for any one individual to prepare a text of the type needed. The editorial committee, therefore, selected those considered to be most knowledgeable to prepare chapters in their subject matter area specialty. The book consists of 54 chapters prepared by 73 authors and co-authors. All chapters were reviewed by at least two members of the editorial committee and one or more outside reviewers.
Members of the editorial committee who participated in the planning and development of the book are as follows:

A. L. Page, chairperson, University of California, Riverside, CA
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As with the first edition, the intent of this second edition is to guide the reader through virtually all chemical and microbiological methods currently in use to characterize soils. Seven chapters deal with principles, methods, and applications of various types of instrumentation. Separate chapters are devoted to general soil chemical properties such as cation exchange capacity, exchangeable cations, soluble salts, carbonate and gypsum, soil pH, and lime requirement. Methods for the determination of soluble, adsorbed, and total concentrations of 30 elements, as well as information on their sources and sinks in soil, and indices of plant availability and phytotoxicity are included. Five chapters are devoted to methods to determine the various forms of nitrogen in soil, including total, organic, inorganic, urea, and methods for isotope ratio analysis.

Methods for characterization and enumeration of specific groups of soil microorganisms, as well as methods for analyzing soil microbiological activity, are extensively covered in this edition. Chapters that deal with general cultural, microscopic, and most probable number of methods for enumerating soil microorganisms, as well as coverage of specific groups of soil organisms such as fungi, actinomycetes, anaerobic bacteria, nitrifying bacteria, Rhizobium, free-living nitrogen fixing organisms, algae, protozoa, nematodes, mites, and other soil arthropods, are included. Other chapters cover methods for measuring microbial biomass, soil respiration, activity of soil enzymes, and the characterization of soil organic matter.

The editorial committee expresses its appreciation to the many anonymous reviewers who provided their time and talents to aid in maintaining the quality of the monograph. Special thanks are due R. C. Dinauer and Kristine Gates of the ASA Headquarters staff for their many, most helpful suggestions pertaining to format, indexing, etc., and for their conscientious and painstaking job of style editing the final copy for publication.

We wish to pay a special tribute to Roscoe Ellis, Jr., member of the editorial committee and co-author of Chapter 17, and to John B. Stout one of the co-authors of Chapter 52. Their untimely deaths occurred while the monograph was in progress. The assistance of G. W. Yeates in the editing and indexing of Dr. Stout’s chapter is gratefully acknowledged.

September 1982

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