

Foreword

N. P. Kefford

A dominant theme for agricultural production throughout the world is the utilization of the resources that can influence a crop, such that optimal sustained productivity is obtained. This is the theme of Dr. Clements' book, and it is, therefore, a timely and critical guidepost to the many workers who are now striving toward optimal productivity for specific crops in environments throughout the world. The book provides a comprehensive discussion of the factors within a crop and in the environment of a crop, which can be studied and manipulated, and which can be utilized to achieve optimal sustained yield.

Dr. Clements presents a case study of the research and technology necessary for bringing a crop, by successive steps, toward optimal sustained productivity. The specific crop is sugarcane, but the philosophy, approach, principles, and practices apply to all crops, as has already been proven in Hawaii and elsewhere in the world. It is appropriate that the case center upon sugarcane, because it is with this crop in Hawaii that a systematic approach to optimal production first achieved a desirable level of sophistication.

The approach of the book as a scientific text is significant. The most common scientific approach is analytical—the taking apart of systems, structures,

and processes and the detailed study of component parts in isolation. Seldom does research take the more difficult path of synthesis—the fitting together of the fragments of knowledge on isolated processes to form a unified, functional whole. Dr. Clements' research achieved this and was proven by the harsh test of crop performance in the field, under a variety of conditions in Hawaii and around the world, requiring a profit to the owners. The book represents a considerable and unique achievement because it is chiefly based upon the original research of the author who was a pioneer and a most successful practitioner of an integrated approach to crop control. The author relates his integrated approach to the productivity of a crop. It is rare that an individual has the critical abilities in the necessary widespread areas of botanical science to make a successful integrated attack. There are many narrow investigations that make an impact on an isolated aspect of productivity. Dr. Clements, on the other hand, has shown an ability to attack each problem that the crop system sets, no matter what the required skills are.

In turn, Dr. Clements treats the structure of the sugarcane plant, the processes occurring in the plant, and the factors in the environment pertinent to productivity. For each, their effects upon productivity

and the interactions between factors are studied and the means by which the factors may be varied and adjusted to achieve optimal productivity are indicated.

In addition to its importance to world concerns for crop production, the book presents Dr. Clements' contributions to basic plant science—in plant nutrition, nutrient interactions, mineral toxicity, regulation of development, and morphology. I will make specific mention only of the latter. The section of the book on the development of the sugarcane plant is definitive and beautifully done; the necessary thorough job has not been done before. But it is more significant that the morphology of the plant was studied so that it could become the basis for the understanding of the physiology and productivity of the plant. The book develops this relationship and is a model for the study of other crop plants.

Dr. Clements' extensive studies, which are brought together in this book for the first time, extended from laboratory studies in plant morphology, development, nutrition, and chemistry to the field. Problems detected in the field were subject to laboratory investigation, and new principles resulting from laboratory work were put to trial under the complexity of field conditions. Rarely do we find laboratory and field studies so closely intertwined; indeed, scientists are no longer trained to expect or to be capable of, this desirable approach. Thus, this book is a case study of the way in which the scientific method may be applied to and tested by natural system. It is most important that those responsible for the organization of crop research throughout the world are made aware of the need for this approach.

Readers may be surprised to find that some aspects of research on sugarcane have been given relatively slight treatment by Dr. Clements. In the instances I can think of, this occurs either because the basic discoveries have had, as yet, no impact on the manipulation of crops for increased productivity or because an effect on productivity has been obtained empirically and there is little to relate about processes or mechanisms. I believe it is important, when dealing with such an urgent problem as crop productivity, that the realities of the relationships between basic

research and agricultural practice be laid out and faced. A cataloguing and criticism of all work on sugarcane productivity is not the role of this work and, in my opinion, would be a much less worthwhile endeavor for this author.

Dr. Clements has given his readers a strongly personal account of his contributions to the botany of sugarcane and, hence, to the efficiency of sugar production. He has achieved a scientifically sound account, which also permits the reader to see the personality behind the scientific method. The energetic drive, the persistent experimental approach, the critical evaluation of results, the determination and confidence that production problems will yield to experimentation, the persuasion of others in the production team to accept new attitudes and approaches, the need for perspective and a sense of humor—all these are revealed through the reading of the text. I believe it is an achievement to present sound scientific argument and, at the same time, reveal the humanity that must be behind the scientific method.

A further achievement of the book is its coverage of the topic from basic studies and their technological development to specific practical applications in the field and plantation laboratory. Individuals involved in all phases of crop production, from research to practice, can find the message appropriate to their levels. At the same time, all readers will be able to comprehend enough from every section of the book to be enlightened and to gain useful information.

Yet another message to be taken from the book is the mutual profit to be gained from an integrated approach to crop research by a research team involving the unique resources and attributes of both a university and an industry.

NOEL P. KEFFORD
Acting Associate Director

*Hawaii Agricultural
Experiment Station
University of Hawaii*