Abdul Wakeel
Muhammad Ishfaq

Potash Use and Dynamics in Agriculture

Springer

Potash Use and Dynamics in Agriculture

Abdul Wakeel • Muhammad Ishfaq

Potash Use and Dynamics in Agriculture

Springer

Abdul Wakeel
Institute of Soil and Environmental Sciences
University of Agriculture
Faislabad, Pakistan

Muhammad Ishfaq
College of Resources and Environmental Sciences
China Agricultural University
Beijing, China

ISBN 978-981-16-6882-1 ISBN 978-981-16-6883-8 (eBook)
https://doi.org/10.1007/978-981-16-6883-8

This Springer imprint is published by the registered company Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

This book is dedicated to Professor Konrad Mengel (1929–2012) from Justus Liebig University, Giessen, Germany, for his legendary work on potassium nutrition of plants.

Foreword

Pakistan is an agricultural country, and a major share of its economy is dependent on agriculture. However due to mismanagement and lack of systematic agricultural research, agricultural production is declining very rapidly. There is a need to promote problem-based research in Pakistan for which there is a dire need of capacity building based on precise subject-related and site-specific data. The book in hand is a specialized book with comprehensive knowledge of potassium nutrition starting from its behavior in soil to its impact on produce quality leading to human health. It is obviously a concise and comprehensive book ever before which has concluded the scope of potassium nutrition in a beautiful way.

The first chapter of the book provides an introduction to potassium with recent updates in potassium research developments, followed by its behavior and dynamics in soil in the next chapter. The important thing is that it has focused the Pakistani soils in global scenario. Chapter 3 throws light on some scholarly aspects of the physiological role of potassium in plants, followed by Chap. 4 focusing on the phytoavailability of potassium for plants which is a complete guidance for modern research aspects related to potassium nutrition. The fifth chapter is about the determination of potassium in soil, which has a key role to understand the potassium dynamics in soil and phytoavailability of potassium to plants. The sixth chapter explains the role of potassium to maintain and enhance the quality of cereals, sugar crops, vegetables, and fruits considering nutrition as well as aesthetic aspects of agricultural commodities, while seventh chapter grasps the biofortification aspect of potassium nutrition in staple crops in the light of contemporary studies. Chapter 8 usefully and critically covers the potassium research in Pakistan, considering reasons of low use of potassium fertilizers and the strategies to improve its judicious use. The key chapter is the last chapter which concludes with the future research options for Pakistani agriculture, directing researchers not only working in Pakistan but also at the global level. This book will open new avenues in agricultural research in Pakistan.

I believe that this book is the first-ever comprehensive book on potassium nutrition equally beneficial for undergraduate and research students. Furthermore, for extension workers in the public and private sector, this manuscript will be a big

asset in the upcoming decade. Indeed, I appreciate the efforts of the authors who have spent their precious time compiling this valuable information.

Sultan Qaboos University Muhammad Farooq
Muscat, Oman

Preface

Potassium (K), an essential plant nutrient, has long been overlooked in agriculture in many developing countries. In most of the agroecosystems of these countries, potash balance is negative because its application seldom matches with removal. The current imbalanced fertilization practices without K fertilizer application led to its mining, which results in certain negative impacts, including low nutrients use efficiency such as nitrogen, decreasing farmers' income ultimately. At the same time our agro-technicians lack enough skills and resources to promote the right source of fertilizer at the right rate, time, and place to facilitate profitable farming. Therefore, farmers need to update their farming practices to improve their crop yield and quality under expanding unfavorable climatic conditions to feed huge population of the developing countries.

Food security and agriculture sustainability depend on how small farmers, who are typically resource-limited and isolated from advanced technology, manage their farming practices. The evidence in support of K deficiency is rising in these countries. Combined approaches are needed to pursue balanced fertilization program in developing countries. Building trust, participatory innovation, developing human capacity, and creating awareness among local farming communities are critical to uplift the agricultural economy.

There is a great potential to increase crop yield per unit land area in most of the developing countries by application of K fertilizers. However, crop response to K fertilization cannot always be linear, and there is a need to attain the site-specific K benchmark based on distinct soil type and minerology. It is important to effectively promote the significance of balanced fertilization at grassroots level for the benefit of the farming community. In this book, as far as possible, the consequences of K nutrition under the current agriculture scenario are highlighted stating K nutrition for soil, plants, and humans. It is emphasized that to ensure economic agriculture sustainability, balanced and site-specific potash recommendations are needed in developing countries such as Pakistan. This book contains useful information equally demanded by graduate students, progressive farmers, extension workers, and policy makers. I am very thankful to Dr. Hafeez ur Rehman and Dr. Ahmad Nawaz for their contributory support to complete the draft of this book.

Faisalabad, Pakistan — Abdul Wakeel

About the Book

This book covers the use and dynamics of potassium fertilizers in agriculture. It explores potassium dynamics in soil, phytoavailability, uptake and translocation in crop plants, impact of potassium fertilizers on the quality of agricultural produce.

Potassium is an essential plant nutrient that has long been overlooked in agriculture of many developing countries. In most of the agro-ecosystems of such countries, potassium balance is negative because its application seldom matches with crop removal. Agro-technicians lack enough skills and resources to promote the right source of fertilizer at the right rate, time, and place to facilitate profitable farming. There is a need for farmers to update their farming practices so as to improve the crop yield and quality under unfavorable climatic conditions. Correct application of potassium fertilizers is directly linked with increased crop yield per unit land area in most of the developing countries. Therefore, this book fills the gap in the information and provides the readers with the latest updates on the use of potassium fertilizers.

This book contains the latest information relevant for graduate students, progressive farmers, extension worker, early career researchers, and policymakers.

Contents

About the Authors

Abdul Wakeel is an Associate Professor (Tenured) at University of Agriculture Faisalabad. He received PhD degree in agriculture from Justus Liebig University Giessen, Germany, and worked there as a postdoctoral researcher afterwards with Prof. Sven Schubert. He also worked with Prof. Konrad Mengel and shared his legendary experiences of potassium nutrition. Dr. Wakeel coordinated the research and extension activities of International Potash Institute Switzerland in Pakistan for several years and has extensive experience of potash fertilization in Pakistan and south Asia. Dr Wakeel is working on sustainable nutrient management under changing climate. Currently, he is the chairman of Pakistan Agricultural Scientists Forum and managing editor of *Pakistan Journal of Agricultural Sciences*.

Muhammad Ishfaq is a researcher at the College of Resources and Environmental Sciences, China Agricultural University, Beijing, China. His major research interests are plant–soil interactions, plant physiology, root biology, soil health, and molecular plant nutrition. He graduated in soil science from the University of Agriculture Faisalabad, Pakistan, and worked as a research associate to promote precise and balanced use of fertilizers in Pakistan. Ishfaq is actively engaged in different research and developmental activities and published several peer-reviewed SCI papers in reputed journals. He was nominated for International Plant Nutrition Institute (IPNI) Scholar Award 2018 in recognition of an outstanding scholastic record and appreciation of contribution to the agricultural sciences.