Climate Variability: And Its Impact On Crop Production

By Ranjan Das

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CLIMATE VARIABILITY

and its Impact on Crop Production

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PREFACE

Climate change is one of the most important global environmental challenges in the history of mankind. The accelerating pace of climate change, combined with global population and income growth, threatens food security everywhere particularly in the developing countries. Assuming a global temperature rise of 4.4°C by 2080 over the cultivated areas, India's agricultural output is projected to fall by 30-40% which would be quite alarming unless proper remedial measures are taken. Further, occurrence of new diseases, pests together with severity of the existing ones is also foreseen. The impacts of climate change on Indian continent are less explored and less known till now making the future scenarios more uncertain for vulnerability assessment and risk management. This book is an effort to quantify the climate-change impacts, assess the consequences for food security and estimate the investments that would offset the negative consequences for human well-being.

Some chapters in this book elaborate some key findings regarding the role of GHGs in responding to potential climate change and their mitigation; significant differences in possible regional impacts to agricultural systems, plant diseases and pests; resource conservation, social issues, potential changes in the level and patterns of food production and security. A few chapters of the book explain about biotechnological research and green biotechnology as a tool for mitigating climate change impacts. The book also deals with recent summaries of CDM and carbon credit effects.

Production of this book was a major enterprise, in which many people were involved, with a wide variety of contributions. I wish to thank the generous contributions made by the scientists/researchers of different organizations/institutions who have generated their valuable knowledge in the form of writings.

I am especially grateful for the contribution and support of Dr. K.M. Bujarbaruah, Honourable Vice-Chancellor, Assam Agricultural University, Jorhat, who had constructively guided me for production of this book.

I would also like to express my gratitude to Dr. D.C. Uprety, National Fellow, IARI, New Delhi, Dr. B. C. Bhowmick, Ex-Director of Extension, Assam Agricultural University, Jorhat, Dr. N.N. Sarmah, Ex-Director of Research (Agri), Assam Agricultural University, Jorhat, Dr. G. N. Hazarika, Director of Research (Agri), Assam Agricultural University, Jorhat and Dr. B. Haloi, Ex-Head, Department of Crop Physiology, Assam Agricultural University, Jorhat for their valuable advice throughout this endeavour.

Special thanks goes to Dr. L.L. Somani, who has taken up the entire responsibility in publishing this book.

I sincerely hope that my attempt will prove to be beneficial for scientists and students alike.

Ranjan Das
(Editor)

FOREWORD

Climate is the primary determinant of agricultural productivity. It is now well recognized that agriculture, a complex sector involving different driving parameters is very sensitive to climate change with different effects according to region. According to the Fourth Assessment Report of the IPCC analysis on climate change impacts, a general reduction of potential crop yields and a decrease in water availability for agriculture and population in many parts of the developing world is estimated.

Crop production is affected biophysically by changing meteorological variables, including rising temperatures, changing precipitation regimes, and increasing levels of atmospheric carbon dioxide. Climate change is expected to influence not only crop and livestock production, input supplies and other components of agricultural systems but also the types, frequencies, and intensities of various crop and livestock pests; the availability and timing of irrigation water supplies; and the severity of soil erosion.

It has further been projected that the climate change will impact severely the developing countries necessitating thereby escalated research attempts in these countries to develop appropriate coping mechanisms for a climate neutral agriculture so that food security to the burgeoning population could be ensured.

This book "Climate Variability and Its Impact on Crop Production–Physiological Perspective Towards Mitigation Strategies" synthesizes research on the physical and economic effects of climate change on agriculture drawing primarily on experiences in climate change issues, climate changes at regional scales, future technologies, population and income growth; land degradation, social issues, food security. A few chapters also deal with the sequestration of carbon-dioxide and carbon enrichment technologies.

I hope this book will provide useful assistance for Scientists/ researchers working in the line of climate change and I trust that it will contribute to strengthening the adaptation and mitigation process of the global climate change.

(K.M. Bujarbaruah)
Vice-Chancellor,
AAU, Jorhat

ABOUT THE BOOK

Societies, cultures and economies in the world's history have successfully developed by mastering their abilities to adapt to climatic conditions. However, the last decades have been characterized by a dramatic growth in human population that is imposing unprecedented pressures on natural ecosystems and on existing agricultural production systems. In addition to this pressure, societies are expected to face changes in climate at also unprecedented rate. Agricultural production systems will require effective adaptive strategies to overcome these expected pressures in the immediate future.

Increasing climatic variability associated with will result in considerable seasonal/annual fluctuations in food production. All agricultural commodities even today are sensitive to such variability. Droughts, floods, tropical cyclones, heavy precipitation events, hot extremes and heat waves are known to negatively impact agricultural production, and farmer's livelihood.

Climate change is one of the most important global environmental challenges in the history of mankind. The accelerating pace of climate change, combined with global population and income growth, threatens food security everywhere particularly in the developing countries. Assuming a global temperature rise of 4.4°C by 2080 over the cultivated areas, India's agricultural output is projected to fall by 30-40% which would be quite alarming unless proper remedial measures are taken. Further, occurrence of new diseases, pests together with severity of the existing ones is also foreseen. The impacts of climate change on Indian continent are less explored and less known till now making the future scenarios more uncertain for vulnerability assessment and risk management. This book is an effort to quantify the climate-change impacts, assess the consequences for food security and estimate the investments that would offset the negative consequences for human well-being.

ABOUT THE EDITOR

Dr. Ranjan Das is Associate Professor of Assam Agricultural University, Jorhat, Assam. He has obtained his Ph.D. from Indian Agricultural Research Institute. New Delhi in Plant Physiology with specialization in climate change and stress physiology. Earlier Dr. Das worked in the capacity of a scientist in Remote Sensing Application Centre, Guwahati and gathering knowledge in simulation modeling, digital image processing and Geographical information system. After that he joined the Assam Agricultural University and has about 14 years of experience in teaching, research and extension. He has guided many postgraduate students and acted as a resource person in various trainings pertaining to climate change in different institutes all over India. He has also authored and co-authored a few books related to climate change and has numerous publications in national and international Journals. He has been the Zonal Secretary of Indian Society for Plant Physiology (East Zone) since last 6 years. He has worked extensively on crop response to climate change, carbon sequestration, limiting water and production physiology for sustainable development and currently he is handling three different projects related to climate change funded by ICAR and DST.

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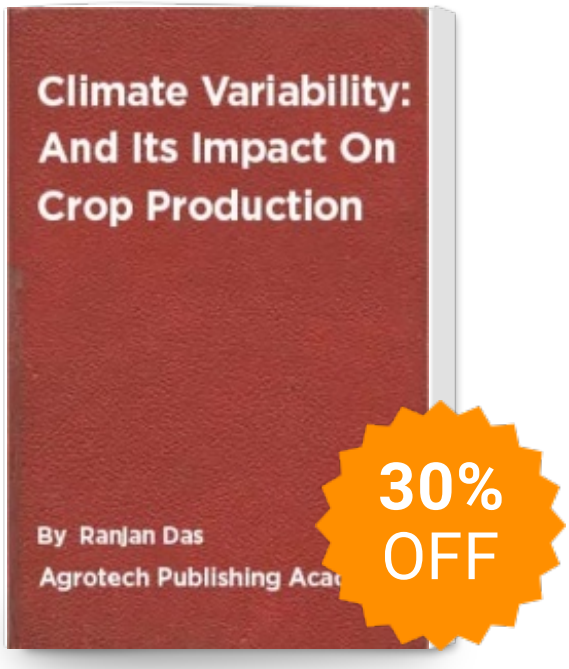

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