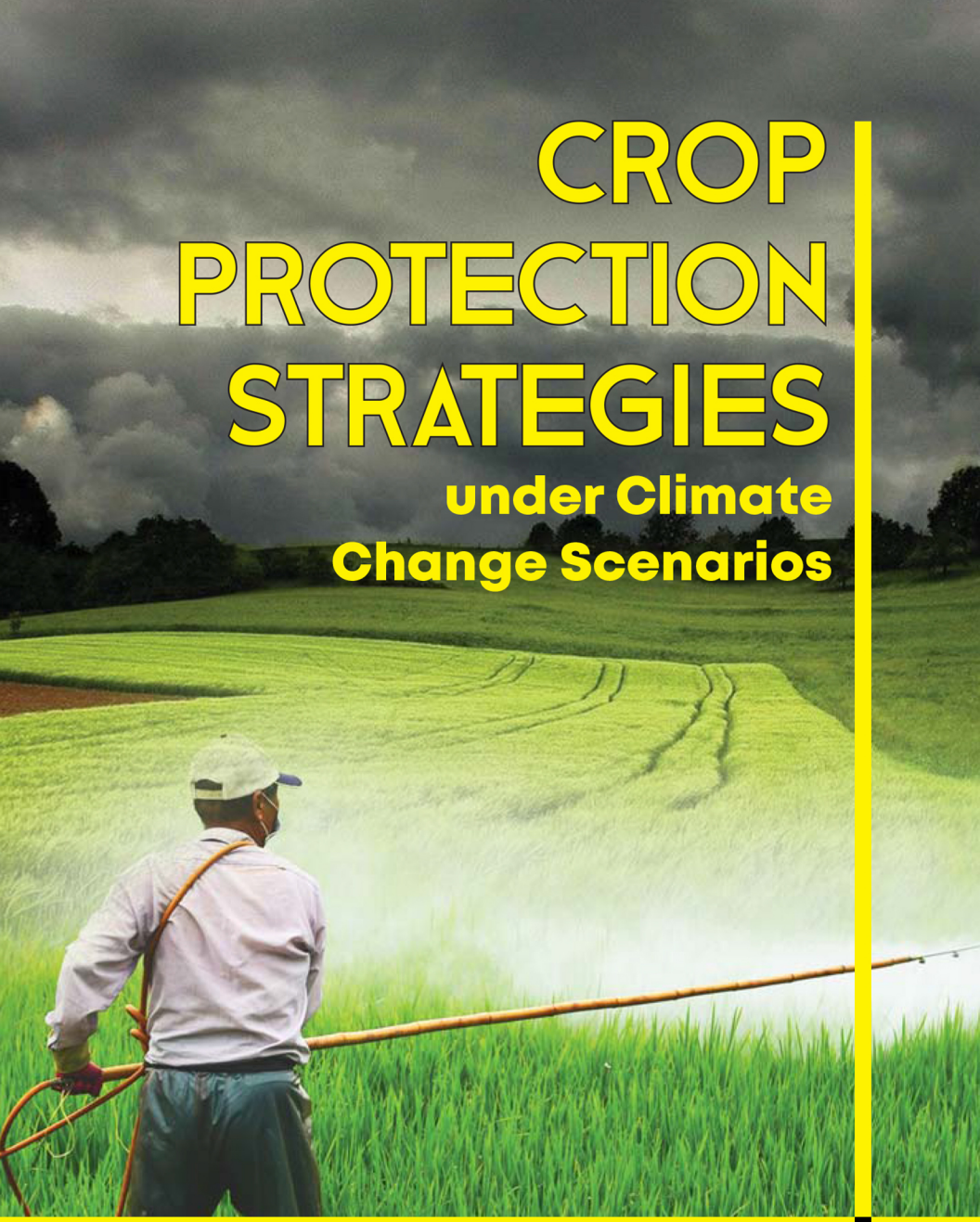
CROP PROTECTION STRATEGIES

under Climate Change Scenarios



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Crop Protection Strategies under Climate Change Scenarios

By

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Preface

Agriculture in the twenty-first century faces the challenge of meeting food demands while satisfying sustainability goals. Global food production must increase by 70% to meet the projected demand of the world's population which is likely to reach 9.5 billion by 2050. The challenge is further complicated by climate change, which affects the distribution of crop pests (insect pests, disease and nematode pathogens and weeds) and the severity of their outbreaks. More than 30 per cent of crops worldwide are blemished, damaged or destroyed by agricultural pests. The crop losses due to pests viewed in terms of food security would represent the equivalent of food required to feed over one billion people. Most existing pest management strategies have been based on the indiscriminate use of pesticides in agriculture. Increasing concerns over health and the environment, as well as new legislation on pesticide use urge us to find sustainable alternatives to pesticide-based pest management. Crop damage could occur more rapidly than expected due to climate change, because many pests develop more rapidly in response to rising temperatures. In addition, as temperatures increase, the frequency of spring frosts will decline and the resulting extended frost-free periods will increase the duration and intensity of pest outbreaks. This has major implication for the intensification of yield losses due to potential changes in crop diversity and increased incidence of insect-pests in the context of impending climate change. Agriculture needs to meet food demands, satisfy sustainability goals, and adapt to climate change. Indeed, maintaining, or even increasing, crop yield while simultaneously reducing reliance on pesticides represents a challenging task that is further complicated against the background of climate change scenarios.

Current agricultural practices may need to be redesigned because of climate change. Crop protection per se has an important role to play in mitigating climate change. Crop protection practices can contribute to the reduction of greenhouse gases (GHG) emissions. The conventional crop production systems coupled to reduced tillage is generally the best for producing high yields to minimize GHG emissions and to contribute to global food security. Optimum control of pests is insurance for optimum exploitation of all other investments in crop production. IPM is a widely used strategy that integrates cultural, biological, and chemical controls to reduce harmful insect populations below a threshold which otherwise will cause economic losses. Hence, time has come to elaborate new crop protection strategies that are robust and reliable enough for the challenges of changing climatic conditions and more stringent human and environmental protection.

In the view of these developments, the present book on "**Crop Protection Strategies under Climate Change Scenarios**" is timely and is need of the hour. The book provides the following information on insect and mite pests, disease pathogens (fungi, bacteria, viruses and nematodes), and weeds in a very systematic manner:

1. Overview on the crop pest scenarios in changing climate.
2. Effects of abiotic stresses due to climate change [increased temperatures, elevated carbon dioxide levels, varying precipitation patterns and frequency and magnitude of extreme weather events (drought, cyclones, floods, etc.), and elevated levels of atmospheric pollutants [ozone, acid rain, and elevated ultraviolet B] on crop pests.
3. Impacts of climate change induced consequences (expansion of geographical distribution, increase in number of generations, increased overwintering survival, pest population dynamics and outbreaks, risk of introducing invasive alien species, crop-pest interactions, loss of ecological biodiversity, changes in phenology, increased incidence of insect vectored plant diseases, disruption of plant-pollinator interactions, reduced effectiveness of pest management strategies) on crop pests.
4. Development of modelling to predict future pest change scenarios.
5. Formulation of sustainable adaptation and mitigation pest management strategies including physical, cultural, chemical, biological, host resistance, and integrated methods under climate change scenarios.

This book will be of immense value to scientific community involved in teaching, research and extension activities related to crop protection under changing climate. The material can be used for teaching post-graduate courses. The book can also serve as a very useful reference to policy makers and practicing farmers. Suggestions to improve the contents of the book are most welcome (E-mail: reddypp42@gmail.com). The publisher, Scientific Publishers, Jodhpur, India, deserves commendation for their professional contribution.

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About Author

Dr. P. Parvatha Reddy obtained his Ph. D. degree jointly from the University of Florida, USA and the University of Agricultural Sciences, Bengaluru.

Dr. Reddy served as the Director of the prestigious, Indian Institute of Horticultural Research (IIHR) at Bangalore from 1999 to 2002 and during this period the Institute was honoured with "ICAR Best Institution Award". He also served as the Head, Division of Entomology and Nematology at IIHR and gave tremendous impetus and direction to research, extension and education in developing bio-intensive integrated pest management strategies in horticultural crops. These technologies are being practiced widely by the farmers across the country, since they are effective, economical, eco-friendly and residue-free. Dr. Reddy has about 34 years of experience working with horticultural crops and involved in developing an F1 tomato hybrid "Arka Varadan" resistant to root-knot nematodes. He has over 250 scientific publications to his credit, which also includes 30 books. He has guided a few Ph.D. students at the University of Agricultural Sciences, Bengaluru.

Dr. Reddy served as Chairman, Research Advisory Committee (RAC), Indian Institute of Vegetable Research, Varanasi; Senior Scientific Advisor, Dr. Prem Nath Agricultural Science Foundation, Bengaluru; Member, RAC of National Centre for Integrated Pest Management, New Delhi; Member of the Expert Panel for monitoring the research program of National Initiative on Climate Resilient Agriculture (NICRA) in the theme of Horticulture including Pest Dynamics and Pollinators; Member of the RAC of the National Research Centre for Citrus, Nagpur and the Project Directorate of Biological Control, Bengaluru. He served as a Member, QRT to review the progress of the Central Tuber Crops Research Institute, Thiruvananthapuram; AICRP on Tuber Crops; AICRP on Nematodes and AINRP on Betel vine. He is the Honorary Fellow of the Society for Plant Protection Sciences, New Delhi; Fellow of the Indian Phytopathological Society, New Delhi and Founder President of the Association for Advancement of Pest Management in Horticultural Ecosystems (AAPMHE), Bengaluru.

Dr. Reddy has been awarded with the prestigious "Association for Advancement Pest Management in Horticultural Ecosystems Award", "Dr. G.I. D'souza Memorial Lecture Award", "Prof. H.M. Shah Memorial Award" and "Hexamar Agricultural Research and Development Foundation Award" for his unstinted efforts in developing sustainable, bio-intensive and eco-friendly integrated pest management strategies in horticultural crops.

He has organized "Fourth International Workshop on Biological Control and Management of *Chromolaena odorata*", "National Seminar on Hi-tech Horticulture", "First National Symposium on Pest Management in Horticultural Crops: Environmental Implications and Thrusts", and "Second National Symposium on Pest Management in Horticultural Crops: New Molecules and Bio-pesticides".

Section I
INTRODUCTION