

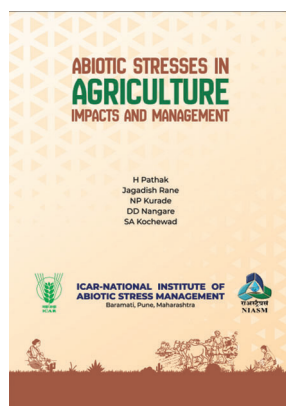
Cave Science: Insights from the Indian Subcontinent. Jayant Biswas (ed.). National Cave Research and Protection Organization, New Delhi. 2022. 224 pages. Price: Rs 3500.

This book on cave science is the first of its kind from India and was certainly overdue. Caves have always intrigued earth scientists and biologists, and the recent studies on palaeoclimatic reconstruction using speleothems recovered from caves have been one of the most valuable research deliverables that have come out in this field. Knowledge of cave habitats and biology has been even scantier and this book has done a great job in not just providing a wonderful documentation of the cave ecosystem but also highlighting the major threats to this fragile ecosystem. India has been known for several caves in different parts of the country falling in different monsoonal regimes, but it has always been difficult to find any proper documentation of these caves. This book has delivered just that. The book is divided into eight chapters starting with an excellent introduction and distribution of caves in India with special emphasis on caves in Meghalaya. This description includes the GPS locations of all the caves and some vivid photographs of the caves. The second chapter on the reconstruction of Indian monsoons from speleothems provides a brief description of methods and techniques involved in such studies and a summary of the findings so far. This is a very useful chapter for beginners who are planning to get initiated in the field of palaeoclimatic studies from speleothems. Chapters 3, 4 and 5 are devoted to cave biology and ecology, and they provide fascinating documentation of cave habitats in India, including one full chapter on cave bats. It is amazing to learn that caves can have such biodiversity, and there are some hair-raising photographs of bats hanging from the cave roof! Chapter 6 provides some beneficial information on the hydrogeological aspects of karsts and caves and

dwells upon various methods for cave development and mapping for their management. Chapter 7 deals with a relatively unexplored aspect of cave science – the palaeoanthropology of caves and provides an account of the available geoarchaeological records from different parts of India. The final chapter 8 touches upon the sensitive topic of ecotourism of caves and caving practices in India. This book is a rare collection of topics in cave science, and it will go a long way to popularize this science in India which is completely underdeveloped. The effort put in by the editor is praiseworthy, and most importantly, the book's presentation makes it an easy read for professionals and beginners alike. The technical content of the book, particularly the illustrations and photographs, are carefully chosen, and they are a treat to the eyes. The book is commendable and provides excellent background information on the caves of India to readers from India and abroad.

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Abiotic Stresses in Agriculture: Impacts and Management. H. Pathak, Jagadish Rane, N. P. Kurade, D. D. Nangare and S. A. Kochevad (eds). ICAR-National Institute of Abiotic Stress Management, Baramati, Pune, Maharashtra, India, 2022. xii + 583 pages. Price: Not mentioned. eBook ISBN: 978-81-949091-0-1; http://niam.res.in/sites/default/files/pdfs/Book_AbioticStressesInAgriculture.pdf

Climate change effects are now a reality, with increased occurrences of abiotic stresses affecting the growth and development of living organisms. Abiotic stresses from water (drought and flood), soil (salinity, sodicity, acidity, heavy metal, nutrient de-

ficiency, and toxicity), and temperature (high and low) have serious implications for national and global food production, limiting crop productivity and threatening food security. Only about 9% of the world's agricultural land is suitable for crop cultivation, with the remainder subject to various stresses. The present food security challenge has added dimensions due to the increasing population, with limited scope to overexploit natural resources and no provision for indiscriminate human intervention in agroecology. Therefore, quantification and understanding of the abiotic stress responses in plants, animals, and fishes; and enhancing their stress resilience through accelerated adaptation and mitigation strategies are the most demanding areas in agricultural research.

Against this backdrop, the book under review presents an overall assessment of the impacts of abiotic stresses across agriculture sectors, including crops, horticulture, livestock, aquaculture and all other subsectors with non-optimal ecological factors which may act independently or in multiples. It also discusses the technological and strategic options for managing the stresses and suggests implementable research and development guidelines to the stakeholders for increasing productivity, profitability, and resilience. The editors have done an excellent job of organizing the information into seven major sections, which have then been divided into thirty chapters. The book provides state-of-the-art information in national and international contexts on the impacts and management of abiotic stresses on crops (cereal, pulse, oilseed, fodder crops), horticulture (vegetable, fruit, flower), sugar crop (sugarcane), medicinal and aromatic plants, agroforestry, new crops (quinoa), halophytes, animal (cattle, goat, sheep and other livestock, poultry, dairy), fisheries (shellfish and finfish), biotic factors (insects and diseases) and also on the air, soil and water. The authors of the various chapters have made extraordinary efforts to organize information about abiotic stress on specific plants, their adaptation mechanisms, and various strategies to mitigate the effects.

The book's first section emphasizes the abiotic stresses in agriculture, mainly dealing with water, soil, and atmospheric stresses. Four chapters under this theme address the critical effects of these stresses on agriculture and the management options to deal with them. The first chapter briefly introduces the concepts, impacts and management of abiotic stresses for sustainable agriculture whereas subsequent chapters highlight key

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effects of water, soil and atmosphere; categories and different resource management options, including genetic and genomic interventions to deal with those stresses. The authors also cover several important parameters such as plant-based water stress indicators, the use of eco-friendly technologies, including 4R nutrient stewardship concept, and commodity-specific management options based on real-time characterization of stress situations. This section thus lays the foundation for additional insights and in-depth investigations under individual commodities by introducing the reader to the world of abiotic stress.

The second section comprises six chapters that deal with the impact and management strategies of important field crops (rice, wheat, maize, pulses, oilseeds & millets). Major food crops in India include rice and wheat, which grow on around 43.8 and 29.3 million hectares and produce a total of 177.6 million tonnes and 103.4 million tonnes respectively. Dr Pathak and his co-authors highlight the loss in rice production caused by several abiotic stresses, ranging from 7 (high temperature) to 70% (drought and salinity). The authors of wheat and maize chapters elaborate a comprehensive strategy for developing relevant varieties for drought tolerance and including advanced approaches like genome editing by CRISPR-Cas and nano-technology to enhance the tolerance of crops against stresses. The chapter on pulse crops emphasizes the importance of understanding the molecular mechanisms of tolerance and adaptation through RNA regulatory factors and processes. The oilseed and millets chapter presents important information on their area, productivity, and production, as well as research and development needs for enhancing their production under abiotic stress. The authors have also emphasized key management strategies such as nitrogen application, early and timely sowing, biofertilizer application, conservation agriculture and crop diversification, spraying of PGRs, and irrigation scheduling to improve the crop yield in a stressed environment.

Three chapters on fruits, vegetables, and flowers make up the third section of the book, i.e. horticultural crops. India occupies the leading position in the area and production of these three commodities. However, these crops are more vulnerable to abiotic stresses due to their succulent nature and increased water content. Authors of these chapters mention that the length and severity of heat stressors might impact a plant's physiological and metabolic processes by

denaturing proteins, enzymes, and nucleic acids, which ultimately cause cell death. The chapters in this section enlist the stress-tolerant vaterites/genotypes/cultivars/rootstocks, improved cultural practices, use of PGR compounds and standard water-saving techniques to manage different types of abiotic stress.

The fourth section on 'abiotic stresses in other crops' includes seven chapters providing information on sugarcane, fibres, fodder crops, medicinal and aromatic, agroforestry systems, quinoa, and halophytes. Under current climate change scenarios, these crops are considered climate-resilient and can tolerate extreme conditions. The first chapter highlights not only the importance and significance of sugarcane in Indian agriculture and economy but also the impact and management options related to the crop. Subsequent chapters on fibre, fodder, and medicinal and aromatic plant crops provide a detailed overview of the impact of various abiotic stresses on crop growth and productivity. The chapter on agroforestry provides fascinating information about the role of trees in achieving sustainable development goals. It depicts the distribution of different agroforestry systems and areas in India in the form of maps. The chapter on a new or future crop, quinoa, is mentioned as a potential drought and high-salinity tolerant crop, having the ability to grow and produce in a limited moisture environment with high nutritional value. The chapter on halophytes also provides handy information about high salinity tolerant crops, their diversity, associated microbes, and the mechanism of salt tolerance. The microbes from the halophytic condition could be game-changer in utilizing the unproductive high saline area for crop cultivation. This section highlights the significance of climate-smart technologies for some established crops like sugarcane and cotton, as well as the prospects of climate-smart crops in abiotic stress environments.

Livestock and fish farming is the backbone of Indian agriculture. India has the world's largest animal wealth, which helps empower the underprivileged rural sector. In section five of the book, highlighting abiotic stresses in animals, six chapters provide detailed information on their impacts on livestock, small ruminants, other minor livestock, poultry and fishery (fish and crustaceans). The authors of these chapters recommend a holistic approach towards adaptation and mitigation of different abiotic stressors, including nutritional balance, shade geometry, antioxidant supplement,

and management of light and temperature. Impact of stresses such as temperature, salinity, ammonia, dissolved oxygen, carbon dioxide and pH as well as their management strategies are highlighted in fish and crustacean chapter.

The sixth section focuses on biotic factors (insects, diseases, and microbes), one of the key fronts of climate change. Three chapters in this section provide crucial information and an in-depth understanding of abiotic factors and their interaction with biotic factors through exquisite schematic diagrams. The authors have also highlighted how a thorough knowledge of these interactions can assist in the timely prediction of the damage as well as their scientific management.

Section seven has only one chapter highlighting the role of both public and non-public sectors, national and international co-operations, robust extension system of the country in knowledge and information sharing and facilitating the effective transfer of technology related to abiotic stress management. They describe the importance of effective extension channels for sensitizing the farmers about the economic losses, symptoms, and strategic management options. The glossary of important terminologies related to agriculture and abiotic stresses is also compiled for better understanding.

The book improves our knowledge of how plants react to abiotic stress so that we can create new technologies or breed new kinds that can help us attain food security in the face of changing climatic conditions. Further, it has compiled all the important and useful information about abiotic stresses in agriculture and allied sectors systematically, highlighting their effects, processes, and management, including potential future approaches to tackle them. With the inclusion of recent literature and pictorial representations, the book is meant to not only introduce the reader to the subject but also to serve as a comprehensive reference and guidebook for under- and post-graduate students as well as all the stakeholders involved in research and development of abiotic stress management.

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