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Innovative soil-crop management systems for climate smart sustainable agriculture

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Climate change is significantly affecting the natural resources, food security and human health all over the world. It is projected that water availability will increase in some parts of the world, which will have its own effect on water use efficiency and water allocation. Crop production can increase if irrigated areas are expanded or irrigation is intensified, but these may increase the rate of environmental degradation. Since impact of climate change on soil water balance will lead to change in soil evaporation, and plant transpiration, consequently, in future the crop growth period may shorten impacting on water productivity. Crop yields affected by climate change are projected to be different in various areas, in some areas crop yield will increase, and for other areas it will decrease depending on the latitude of the area and irrigation application. Existing modeling results show that an increase in precipitation will increase crop yield, and what is more, crop yield is more sensitive to precipitation than temperature. If water availability is reduced in future, soils of high water holding capacity will reduce the impact of drought while maintaining crop yield. With the rise in temperature and precipitation fluctuations, water availability and crop production are likely to decrease in future. If the irrigated areas are expanded, the total crop production will increase; however, food and environmental quality may degrade. With nearly 690 million people facing hunger, agri-food systems emitting one third of global anthropogenic GHG emissions and a growing public demand for climate action, it is pressing to achieve food security while adapting to - and mitigating - climate change.

Sustainable agricultural (SA) practices are the conservation and management of the natural resource base, and the orientation of technological change in a manner so as to ensure the attainment of continued satisfaction of human needs for present and future generations. In simple words, SA covers all agricultural production systems and practices which are economically viable, environmentally sound and socially acceptable, contributing to a better quality of life for agricultural producers, their families and general public. Furthermore, climate smart agriculture (CSA) is an approach for transforming and reorienting agricultural systems to support food security under the new realities of climate change. Three objectives are defined as follows; (1) sustainably increasing agricultural productivity to support equitable increase in income, food security and development; (2) adapting and building resilience to climate change from the farm to national levels; and (3) developing opportunities to reduce GHG emissions from agriculture compared with past trends. Therefore, by integrating SA and CSA become CSSA (Climate Smart Sustainable Agriculture) is strengthening the adoption of environmentally friendly agriculture (eco-farming system) in sustainable ways by implementing the innovative, appropriate and adequate (1) sustainable soil management, (2) water management, (3) crop management and (4) mitigation and adaptation practices to climate change.

Soil organic carbon (SOC), greenhouse gas (GHG) emissions and water footprint (WF) are the key indicators of environmental sustainability in agricultural systems. Increasing SOC, while reducing GHG emissions and WF are effective measures to achieve high crop productivity with minimum environmental impact indicating as a multi-pronged approach of CSSA. In conventional agricultural systems, intensive soil tillage and removal of crop residues can lead to increased negative environmental impact due to reduced SOC, GHG emission and high water consumption. Conservation agriculture (CA) based conservation tillage systems (CTS) with crop residue retention is often suggested as a resource conserving alternative to increase crop productivity without compromising soil health and environmental sustainability of different cropping systems. A fundamental challenge is to address the needs of broad and diverse groups of stakeholders by identifying an appropriate set of innovative soil-crop management systems for climate smart sustainable agriculture. This requires knowledge of the type and extent of expected changes in the climatic variables that affect crop production and the best

adaptive management options for a given context. There is no template or set of procedures easily embraced to assure a climate smart sustainable agricultural system. Success depends upon location, scale, types of production and the objectives of the farmer. However, it is the acute set of issues and the opportunities that can be captured by getting it right that has inspired so many to embrace sustainable agriculture. To this end, millions of practitioners, scientists and other interested parties are actively experimenting, collaborating and applying innovative approaches.

This Theme Section of *Journal of Environmental Biology* (JEB) covers the innovative soil-crop management systems for climate smart sustainable agriculture ensuring food, nutritional and environmental security under climate change scenario. The compilation of papers include various issues of global concern as well as different regions of the country.

I would like to thank the esteemed contributors for sharing their valuable research for publication in this Theme Section and appreciate their efforts for patiently revising their papers to meet the suggestions of reviewers and responding to the requirement of the journal. I am highly thankful to all the reviewers of this Theme Section for critically evaluating the manuscripts and providing their valuable input for the technical improvement of each manuscript.

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About the Editors

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Dr. Sanjay Swami is Professor in Soil Science and Agricultural Chemistry at School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences, Barapani, Meghalaya under Central Agricultural University, Imphal. Apart from teaching postgraduate students, he is an active researcher in the field of conservation and management of natural resources, especially soil and water conservation in the Indian Himalayan Region for more than 18 years. He handled 7 externally funded projects and contributed over 150 research papers in various journals of international repute. He has also to his credit 18 standard books and more than 50 book chapters. He has guided/guiding 5 Ph.D. and 15 M.Sc. scholars, attended more than 35 international conferences, presented research papers and won many prestigious awards viz. SCSi Gold Medal Award, SCSi Leadership Award, Young Scientist Award, Distinguished Scientist Award, etc. He holds the prestigious position of National Fellow of the Soil Conservation Society of India and actively serving as the Chairman of Meghalaya State Chapter. He is the Fellow of the Himalayan University Consortium (HUC), International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal; Mentor for Interns of the Indian Knowledge System, Ministry of Education, Government of India; Associate Fellow at UGC-Inter University Center at Indian Institute of Advanced Study, Rashtrapati Niwas, Shimla, India; the Ambassador of the Global Forum on Food Security and Nutrition (FSN Forum), Food and Agriculture Organization of the United Nations; and Member of the International Advisory Council of The Grassroots Institute, Montreal, Canada. He is also the Senior Global Fellow of The Grassroots Institute.



He has wide international exposure and visited many countries like The Netherlands, China, Mongolia, South Korea, Japan, Nepal, Bangladesh, Thailand, etc. for various academic purposes. He is editor, associate editor, consulting editor and reviewer of many national and international journals.

Dr. Purnima Raizada did M. Sc. in 2003 from University of Lucknow, Lucknow and Ph. D. in Botany from Banaras Hindu University, Varanasi in 2010. Dr. Raizada has also served as UGC Post Doc Fellow in Jawaharlal Nehru University, New Delhi (2010-2011). She has also qualified CSIR-UGC NET and GATE. She has worked as Assistant Professor Botany in Ashoka College, Nashik, Maharashtra, and rendered educational consultancy to Ashoka Education Foundation, Nashik. Dr. Raizada has about 15 research publications and more than 10 years of teaching experience. Currently, she is associated with the Research and Development Division of *Journal of Environmental Biology* and working as Assistant Professor Botany in Aryavart Institute of Higher Education, Lucknow.

