NEW ERA AGRICULTURE MAGAZINE

Climate Resilient Crops in Indian Perspective

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Introduction:

India's agricultural growth has been phenomenal over last four decades as the country moved from severe food crisis before 1960's to self-sufficiency and surplus food grain production. Most of this increase in agricultural output could be attributable to green revolution under irrigated environments. In the early stages of the green revolution, the area under cultivation increased rapidly. However, it is no longer increasing and in fact there is a decline in the last two decades owing to urbanization and rapid industrialization. Currently the country is facing a challenge of producing adequate food to meet the demands of ever increasing population from shrinking natural resource base. Intensification of agriculture through enhanced productivity and resource use efficiency has to be the main focus as competition for land and water are increasing from non-farm sectors. Further in recent years climate change and its variability are emerging as major challenges to Indian agriculture. In addition to the temporal variation of the environment, there is also a large spatial variation in the rainfed belt. Feeding the ever-increasing population remains an uphill task with this rapid increase in population along with climatic adversities. Identifying stress tolerant cultivars for different agro-ecologies of the country appears to be the major challenge to increase the productivity in order to meet the demand of more food. Tolerant crop varieties with consistently higher yields under deficit and excessive rainfall and other abiotic stresses, such as temperature extremes, salinity etc. is of paramount importance. Further, integrated and efficient agronomic management strategies including optimal time of sowing, nutrient and pest management strategies contribute immensely for realizing the maximum genetic potential.

The major agents of climate change has been ascribed to the increased levels of greenhouse gases (GHGs) beyond their natural limits due to the uncontrolled activities such as burning of fossil fuels, increased use of refrigerants etc. Agriculture sector also contributes to climate change through emissions of GHGs as well as its expansion to

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non-agricultural land (e.g., forests) into agricultural land. The increase in frequency of weather aberration is being witnessed in various regions of the country during last 15 years.

Various adaptation and mitigation strategies including use of climate resilient crops and cultivars for different regions are most essential for agriculture to successfully cope with climate variability. Management practices that improve agricultural production under adverse climatic conditions enhance resilience under variable climate and extreme events. Major strategies of adaptation to climate change include water saving technologies such as in-situ and ex-situ moisture conservation, water harvesting for supplemental irrigation, residue incorporation (to avoid it's burning), growing tolerant varieties, conservation agriculture, site specific nutrient management practices etc. Developing and diffusing crop cultivars with tolerance to climatic stresses such as, drought, heat, submergence is of urgent priority. Indeed, climate resilient crop varieties play a crucial role for coping with climate variability in agriculture. Further, strengthening institutional interventions will go a long way in promoting collective action and build resilience among communities. Plant's response to abiotic stresses is crop and cultivar specific. Understanding of photoperiod sensitivity, genetic variation for transpiration efficiency will help in identifying short duration high yielding varieties that escape the terminal drought as well as other impending abiotic and biotic stresses.

The changing climate is a major impediment in sustaining agricultural productivity especially to small and marginal farming communities, where the event of loss of even a single crop can lead to starvation or malnutrition of the family. Rainfed agriculture which is more vulnerable to climate change, needs a robust decentralized seed system that is able to provide quality seed of diverse crops and varieties at affordable prices at right time to improve productivity and can buffer contingencies of climate risks such as repeat sowing in case of crop failure for enhanced resilience. There is also need to ensure conservation of the local agro biodiversity which has inbuilt tolerance to various stresses. It is necessary to improve the seed quality of farm saved seeds for enhancing crop productivity as in our country farmers often use these for subsequent crops. The need to replenish diversity in agricultural systems will encourage farming communities to build up community seed banks that facilitate the revival and distribution of traditional and stress-tolerant crops and varieties. Improved climate-resilient crops are key to the future food and nutritional security of the dry areas.

They help farmers maintain productivity against a backdrop of rising temperatures and increasing water scarcity; strengthen defenses against the emergence of new pests and disease; and provide a practical and sustainable way of adapting to climate change.

ICARDA plays a critical role in the development, improvement and dissemination of improved climate-resilient crops. The Center has a global mandate for the improvement of barley, lentil, faba bean, and grasspea, and shares mandates for wheat and chickpea with CGIAR partners CIMMYT and ICRISAT respectively.

Enhancing resilience of the farming community to climate risks to ensure sustainability over a period has to be focused on climate resilient agriculture in the country. Thus, the focus is on adaptation to climate variability, which entails appropriate strategies to contingent situations. In this context, climate resilient crop varieties are one the most important resources. Improved and tolerant varieties along with the proper management practices can enhance the coping ability through risk reduction in vulnerable environments. Ensuring seed availability of the resilient varieties in various crops at the appropriate time to the farmers is an important challenge to be addressed immediately. Issues related to managing trade-off between risk and expected returns in vulnerable areas to weather aberrations including drought, flood, heat and cold waves etc., also need urgent attention. Participatory approach to consolidate the involvement of village institutions will go a long way in ensuring the seed availability of resilient varieties locally. The important dimension of utilizing the present information on climate resilient varieties is that, these could be utilized as potential genetic resources for further advancement using tools of both conventional as well as marker assisted selection and other cutting edge science tools.