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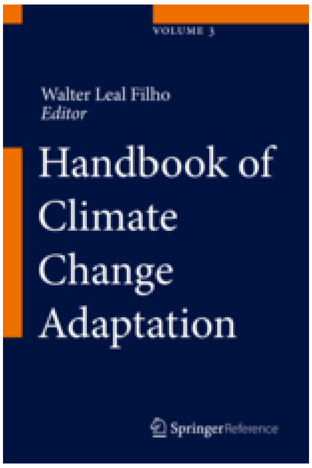

Agriculture and Climate Change in Southeast Asia and the Middle East: Breeding, Climate Change Adaptation, Agronomy and Water Security

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Abstract

The agriculture of South East Asia and the Middle East is under threat due to vagaries of abiotic stress including climate change and water-related factors. With a particular focus on the challenges facing non-indutrialized and developing countries, this paper attempts to create a framework for policy makers and planning commissions as well as increasing national and regional water stress awareness. The study elaborates the agriculture eminence, water provision, conventional water usage and adverse consequences of water status under the changing climatic conditions and urban or industrial development. The study addresses the nature of problems, regional issues, current barriers, farmer's perceptions and concrete efforts to save regional agriculture for sustainable food security. The consequences of climate change, water stress and salinity have affected huge areas of developing countries from an economic and resource security perspective, that leads to disaster and unstable law and order issues. Long-term planning-over timescales beyond the human lifespan and anticipation of threats and opportunities is required. Consequently, an emergency plan is also needed for international, national and regional footprints including procedures for climate change mitigation and to implement inclusive plans to combat prevailing poverty, social changes, and allied anticipated risks. It elaborates the attempts to provide a framework for policy makers and political understanding to check the hidden but viable issues relating risks of climate change in local and global scenario. It is concluded that a viable charter of climate proofing and domestication is the way to success from on-farm-to-lab and lab-to-field outreach to mitigate declining food issues. The regional and international collaborative efforts are focused to modernizing crop genetics, agronomy, field-to-fork scrutiny and adaptation training to increase quantity and quality of food with sustainable use of water.

Keywords - Southeast Asia, Climate change, Irrigation scheduling, Quality food

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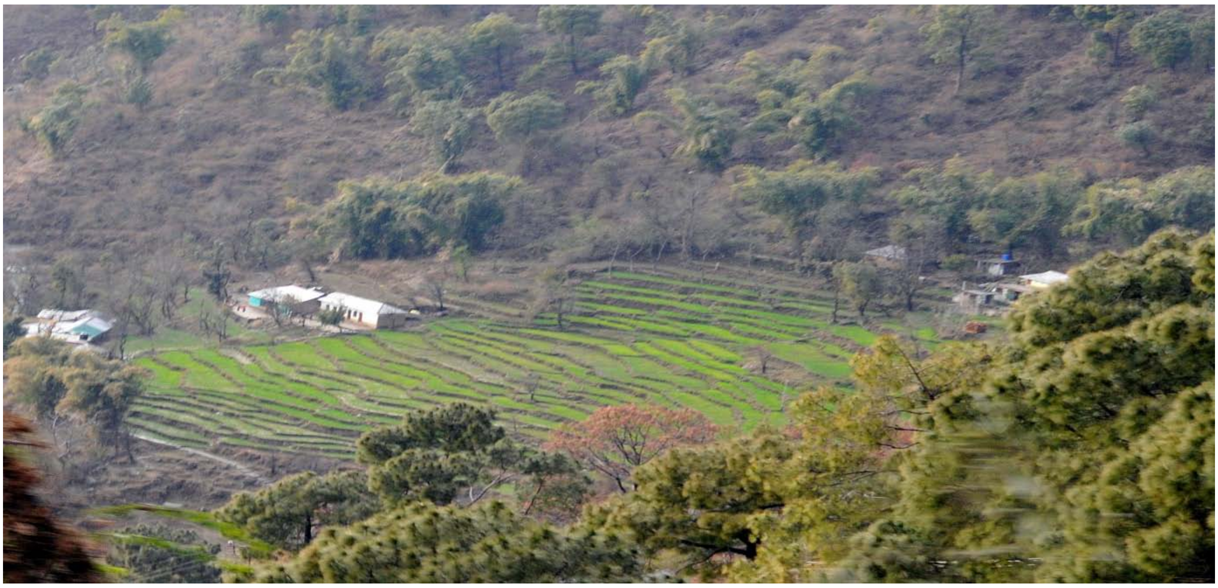

Shallow terracing seen here allows efficient use of water in rainfed agriculture while preserving soil and slowing runoff.

Introduction

The agriculture of South East Asia and the Middle East is mainly dependent on rain and ground water which is, with current crops and management practices, neither sufficient nor reliable to meet the requirements of the crops (Noorka and Afzal, 2009). Due to this, crop production is under serious threat, and potentially for survival, given the vagaries of abiotic and biotic stress under the changing climatic conditions. The consequences of climate change, water stress and salinity have not only affected huge areas but also health and socio-economic issues throughout the world particularly in the developing countries, leading to severe poverty, shaken resources, food insecurity, internal and external security issues and catastrophes. Under the burgeoning population pressure including increasing urbanization, and severe weather conditions, South Asia and Middle East countries will suffer food shortage in coming decades if the present momentum of climate change situation persists for longer time as it is predicted. So short and long-term planning-over timescales, according to the wishes and necessities of human lifespan is needed.

Climate Change and agriculture

Climate is considered as the average weather and variations in relevant quantities for number of decades, centuries or potentially years. According to World Meteorological Organization the classical periods lags for long time with the surface variables like wind, rainfall, and prevailing temperature. The change in climatic conditions is the observance of natural climatic forces, solar cycles, and volcano position and atmospheric changes direct imposition on land inhabitant, flora and fauna (Pahl-Whost, 2007; O'Brien et al. 2008). The climate change commitment is simply an account of predicted future changes in shape of hydrological cycle, changes in sea level, rise and fall in weather conditions with constant anthropogenic emissions. It is anticipated that climate change takes place over a few decades or less, that directly or inversely has the potential to provide substantial interferences in human as well as in ecosystems (Kashyap, 2004; New et al. 2007).

Overgrazing and lack of terracing leads to low grassland productivity, soil erosion, and invasion by aggressive aliens (here, *Argemone mexicana*)

The immediate action is to combat climate change is adaptation, a process of larger and smaller changes required to anticipate expected outcomes of climatic effects, by exploiting beneficial opportunities and minimising harmful effects. In our natural systems, the process of sectorial resources management by augmentation of applied and basic research and to tackle the forthcoming climatic threats (Power et al. 2005; One World Sustainable Investments 2008) Climate change and agriculture are interrelating and dependent on each other (IPCC, 2007). Climate proofing and domestication of plants have played significant role to counteract changes in climate over the 10,000 years of human agriculture, and have the potential to meet the challenges of global warming which have significant impacts on agriculture by the interaction of various elements like rainfall, fluctuating temperature and carbon dioxide concentration, glacial run-off etc to ensure crop maximization (Fischer et al. 2002, Fraser 2008).

Lobell et al. (2008) concluded their study that due to climate change by 2030, Southern Africa may lose their Maize crop by 30% while in South Asia staple crops like rice, maize and millet would be affected up to 10%. It is matter of grave importance that agricultural production will definitely be affected by the predominance and pace of climate change, if it will transpire step by step but in contrast the rapid climate change will upset the present momentum of agriculture production in lot of countries, exclusively having poor and degraded soil with hot weather and under drought condition (Ziervogel et al. 2010).

The optimum natural selection and adaption could lead to genetic erosion as well as non-conservation of genetic resources, so care must be taken to avoid such loss of valuable genetic resources. Thus, the affiliation in climate change and agriculture is in multiple ways confounded and contrasted: agriculture significantly contributes towards climate change, and climate change can detrimentally distress agriculture.

Adverse consequences of water status under changing climatic conditions

Water, the necessity of life, has been emerged as the top commodity of present and future time and shall remained on top of planning concerns for farmers, policy makers and researchers (Noorka et al. 2013a). However water managers have been visible and front line worker to combat water stress, occasional drought, seasonal climate forecasts to support decisions making to manage water resources and dam management (David et al. 2008, Noorka and Schwarzacher, 2013). Drought is considered as the complex natural hazard that causes corrosion of water resources by quantity and quality (Noorka and Taxirea, 2012). Droughts have imposed a serious menace to agricultural production and development of socio-economic activities in the semi-arid and arid regions which are more susceptible to the effect of drought (Noorka et al. 2013b). Agricultural production in semi-arid and arid regions are constrained by low rainfall, poor or low nutrient soils, high temperatures, high solar radiation, and low precipitation, raising food insecurity. IPCC (2007) highlighted the large potential for biofuels to meet the growing energy needs as well as contributing to GHG emissions reduction and enhancement of carbon sequestration in soils and biomass.

Agriculture in South East Asia and the Middle East

The agriculture of South East Asia and the Middle East is under threat due to ultimate vagaries of abiotic stress including climate change and water-related factors (Angus and Van Herwaarden, 2001; Ahmad, 2005) and it is expected that it will affect the agriculture by a series of steps e.g Change in rainfall, extreme temperature and water stress will open the doors of severe drought by direct and indirect ways. By the increase in temperature, some specific areas like Philippines will lose its agriculture production while Indonesia and Malaysia are projected to gain the rice yield. Resultantly the driving force in agriculture is increasing the demand for food and fiber throughout the globe. With particular focus on the challenges facing developing countries, this paper attempts to create a framework for policy makers and planning commissions as well as increasing national and regional water stress awareness (Singh, 2002).

Wheat trials exploiting diversity in the search for plants with efficient growth under rainfed conditions. Here, selections with and without awns are being trialled under low input conditions.

The geographical situation in this area depicted that under the changing set of climatic situation up to 2050 the most parts of countries will become more hotter, abridged and un-reliable rainfall, in consequences the severe reduction in agricultural production assuming current policies, crops and genetic attributes are retained unchanged.

Agriculture Eminence

Agriculture is the social and economic core and main employer in many developing countries. Drought and its consequence of desertification with salinity and soil loss is expected to increase in coming decades, with disastrous consequences from climate change (Moss and Dilling, 2004; Hampel, 2006). Droughts impose a serious threat to agricultural production and development of socio-economic activities in the semi-arid and arid regions by low rainfall, poor or low nutrient soils, high temperatures, high solar radiation, and low precipitation. A viable charter of climate proofing and super-domestication through genetic improvement, in combination with optimized agronomy, is the way to success from on-farm to lab and lab to field outreach to mitigate declining crop productivity and food issues. The regional and international collaborative efforts are focused on research and experiments to modernize the crop genetics, agronomy, field-to-fork scrutiny and adaptation training to increase quantity and quality of food with sustainable water harvest.

Current Barriers in Understanding

Introduction and problem identification of climate change is expected to make this seasonal distinction even stronger, with more frequent summer droughts coupled with increased winter rainfall and more floods. On-farm water storage of the higher winter flows is one of the main options for securing a more reliable water supply for irrigation. Media the most effective weapon of present time have to play a major role in converting the people perception to portraying climate change (Hampel 2006). Sometime media creates confusion by their own perception without taking the confidence of scientific community (Moser and Dilling 2004)Water availability and its continuous forthcoming shortage is another important barrier for efficient crop water productivity that varies from one spatial scale to another. Reckoning crop water productivity it is determined that there is gap among policy makers, consultant, researcher, extensionist, agronomist and farmers themselves to enjoy full supply crop water productivity. However a big breakthrough was observed by the employment of molecular breeding, domestication and climate proofing (Heslop-Harrison and Schwarzacher, 2012)

Farmer's Perceptions

The farmers are the most beleaguered community of South Asia and Middle East society. The Governmental policies to confront the negative image of climate change, food insecurity, middle man role in agricultural marketing, insufficient storage facilities, Conventional agricultural production practices, lack of extension services and technology transfer (Schulze 2000; Roux et al. 2006). The young peoples in farming community are absconding towards the big cities in search of livelihood by ignoring their small land holdings. The old peoples, their forefathers are unable to understand the latest technologies to employ in agriculture and to achieve the potential of the varieties. The media and agriculture department can play an important role to educate the farmers (Jury et al. 2005) while Governmental healthy and farmer's friendly policies like timely announcement of support price of staple food as well as cash crops, farms to market road access, water provision, water stress tolerant varieties and quality production.

Concrete Efforts to Save Regional Agriculture for Sustainable Food Security

Genetic resources are the vital source of crop production and food security across the borders (Von Bothmer et al. 1992; Skovmand et al. 1992). A range of genetic diversity is precarious source to potential production and to exploit new sources of resistance and tolerance against biotic and abiotic stresses (Ahmad et al. 2010). The Food and Agriculture Organization of the United Nations (FAO) Commission on Genetic Resources for Food and Agriculture and the International Plant Genetic Resources Institute (IPGRI), and the International Board of Plant Genetic Resources (IBPGR), have played an important role to publicise and preservation of germplasm (Skovmand et al. 1992). The International community is bound to aid agricultural research system throughout the globe in the context of climate change to ensure world's food security and peace. Building a partnership for development is one of the United Nations Millennium Development Goals.

Conclusions

The consequences of climate change, water stress and salinity have affected huge areas of developing countries from an economic and resource security perspective, that leads to disaster and unstable law and order issues. Long-term planning – over timescales beyond the human lifespan – and anticipation of threats and opportunities is required. Consequently, an emergency plan is also needed for International, national and regional footprints including procedures for climate change mitigation and to implement inclusive plans to combat prevailing poverty, social changes (including urbanization of populations and changes in diets), and allied anticipated risks. The researchers urge more climate proofing infrastructure, water scheduling, improved drainage and water harvesting. The water resources management, use of treated wastewater, serious attempts to limit greenhouse gas emissions, and societal impacts on climate change and shorten/ shifting the growing periods of crops will definitely help the researchers to cut down the negative impact of climate change. The study attempts to provide a framework for policy makers and political understanding to check the hidden but viable issues relating risks of climate change in local and global scenario.

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