

Drought and Heat Stress: Threats to Global Food Security

S Sarkar and AKM Aminul Islam*

Department of Genetics and Plant Breeding, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur City, Bangladesh

***Corresponding Author:** AKM Aminul Islam, Department of Genetics and Plant Breeding, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur City, Bangladesh.

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Abiotic stresses are the major constraints to global food security now a days. Food security is being disturbed globally by harsh climate change and overgrowing population. Arable lands are being reduced due to abiotic stresses. In every year 51 to 82% yield loss of agricultural crops occurs due to the abiotic stresses. Drought and heat stress are two most devastating stresses whose impact have fallen the agriculturist as well as farmers in a great dilemma. Agriculture is mostly affected by drought and heat stress resulting various annoyance to food security and livelihood of global people. Agricultural crops are very sensitive to these stresses at their developmental and reproductive stages. Growth and yield of crops are negatively affected by drought and heat stress due to physiological and biochemical disruption which causes ultimate loss in the production of these crops abating global food security. Both of these stresses are equally important in the developing countries.

Drought has affected the globe more than any other natural hazards and the affected areas have been doubled due to the increasing frequency, severity and duration of drought in the last 40 years (FAO). Global warming affects the evapotranspiration leading to increased drought in dry areas and expansion of dry areas. According to CGIAR (Consultative Group of International Agricultural Research), around 30% of the world's population lives in dry lands and about one third of this population depends on agriculture for their livelihood. In these areas frequent drought and scarcity of natural resources are extreme challenges for production of food. Every year, these areas are facing about 20 million ton of potential grain production loss due to severe drought and desertification. The regions of the world where rain-fed agriculture is practiced are gradually coming under the requirement of irrigation which has increased the cost of farming falling great impact on the livelihood of farmers. With increasing population, demand for the supply of fresh water both for consumption and irrigation is increasing. Due to scarcity of fresh water a large agricultural area of the world are being faced drought stress declining agricultural crop production which is a great threat to the food security of the world. In a recent study by Daryanto., *et al.* 2016 based on the published data from 1980 to 2015, it has been found that 21 and 40% yield reduction of wheat (*Triticum aestivum*) and maize (*Zea mays*) respectively were caused by drought stress. Even in a country like Australia, it had become necessary to import food from other countries as drought worsened the soil quality with significant loss of crops in the years between 2002 and 2009. As wheat is used as staple food in most of the countries of the world, reduction in yield of this major crop due to drought stress has become a great concern to these countries.

On the other hand, drought stress has a link with the increasing temperature. In most cases drought stress appears along with heat stress and show united effects on the growth and development of agricultural crops. According to IPCC, Average global combined temperature of air and ocean has been increased by 0.85°C from the year 1880 to 2012. Global temperature is increasing with the increase in GHGs (greenhouse gases) and its increasing rate is faster in the sub-Saharan Africa comparing to other parts of the world where drought is also a major constraints to food production. In the 4th assessment report of IPCC, heat stress had been found as a major threat to global food supply. Heat stress mainly affect the reproductive stage of agricultural crops disrupting the yield contributing characters which ultimately reduces the yield of crops. The number of cold days has reduced whereas the number of hot days and heat waves has increased worldwide in the last 50 years. With this increasing temperature, the infestation of disease and insect has also increased. There is also a

probability of appearing new strains of these pathogens and insects due to diverse changes in temperature which may cause huge intimidation to crop production and global food security through creating a situation like famine.

Drought and heat stress cannot be prevented and even difficult to forecast. So, it is better to take proper measures to mitigate the effects of these stresses to ensure food security of the globe. Following actions can be undertaken to reduce the overwhelming impact of drought and heat stress on crop production and global food security:

- Selection of different types of crops for the heat and drought-prone areas
- Varying date of sowing to escape the stresses
- Improving chemical properties of crops (which works against stresses and help to sustain crop yield) by genetic engineering
- Developing sustainable water harvesting schemes for recycling and reuse of water
- Development of crop varieties resistant to both drought and heat stress using conventional or modern breeding techniques
- Practice of crop rotation
- Regular monitoring of soil moisture
- Modern agronomic management practices
- Expansion of crop insurance schemes and establishing alternative livelihood to provide income in these heat and drought prone areas.

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