C. Chattopadhyay and D. Prasad (eds),
Dynamics of Crop Protection and Climate Change

Climate Change Impact on Tropical Plant Diseases and Its Management Strategies

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Increasing world food production by more than 50% is the projected demand of the exponential growing of world's population by 2050. Achievement of this target is harder due to drastic climatic changes which affect the world food production. In the last four decades, management of pest and disease have played its role in doubling food production, but fungal, bacterial and viral pathogens still claim 10%–16% of the global agricultural products harvest. This impact of climate change on the complex biological interactions very much affects pests and pathogens which eventually results in affecting the grain production. Currently, manipulations of this mitigate climatic change impact is the big challenge being faced by the agricultural scientists.

Besides direct losses in grain production, different methods for disease management mainly fungicides methodology which can result in high risk of environmental contamination, in addition to social and economic problems. Further, climate change will increase uncertainty in the production and protection of many agricultural crops in many countries where cereals, pulses and cash crops may form an important basis of the gross domestic product. Very high concentrations of CO_2 and O_3 have remarkably increased since the beginning of the industrial revolution, and these CO_2 and O_3 will further continue to increase in 21st century. After three decades, concentration of CO_2 is expected to double or more due to chemical and plastic industrial levels, whilst concentration of O_3 is increasing very much as 2.5% annually (Solomon *et al.* 2007). Very high level of increasing CO_2, may direct to increased humidity within the crop canopy and most favourable environment for pathogen survival (Pangga *et al.* 2011).

The major climate change factors, which influence plant disease severity and spread of the diseases include warmer winter temperatures, atmospheric CO_2, heavy and unseasonal rains, increased humidity, drought, hurricanes and cyclones (Anderson *et al.* 2004). Parker and Gilbert (2004) reported that drastic change of climate leads to temperature increases and rainfall patterns which effectively alter current land use for food crops, resulting in introduction of a pathogen in a new crop, which may infect effectively a previously unaffected indigenous host and new host. Equally, climate change may restrict the occurrence of a pathogen or a crop, accordingly restricting the occurrence of plant pathogen infection.

Impact of climate change may increase CO_2 that may modify pathogen aggressiveness and host resistance or susceptibility, affecting the preliminary establishment of the pathogen on the host (Matros *et al.* 2006). Due to increase in climate change, scientists predicted that heat stress and water stress in plants are increased in many regions, and this is likely to persuade plant disease epidemics. Nonetheless, agricultural grain production has been doubled over the last four decades as the outcome of changes in plant protection, including a several-fold augment in pesticide use worldwide (Oerke 2006).

Plant pathogens threats are effectively noticed by multipart changes in agricultural practice that may inhabit many tropic niche which are not sufficiently protected by a resistance mechanism, forecast of future threat by plant pathogens involves identifying where and when such niches will occur. Deliberately to avoid such threats occurring, pre-breeding for suitable resistance and deploying it in prompt ways are needed to safeguard its long life. These may involve confirming that when such niches occur, they are (i) pathogen detected rapidly, (ii) pathogen inoculum is limited, (iii) these niches are less spread, and (iv) further barriers that limit spread (Newton *et al.* 2009).

Extensive climatic change results in altered scales of temperature, wind velocity, rainfall and periodicity. These climate changes affect the actions and vigour of soil and aerial-borne pathogens. Few plant pathogens very competent of devastating crops and harvested produce have become more vigorous because of their geographical ranges expand as a result of extensive climate change. Even so, scientists already reported on the impact of climate change on diseases of cereal crops mainly rice, wheat, and few tropical and plantation crops.

Rice Diseases

Rice is a staple food crop of the world's population. Continuous demand for rice to grow steadily as the population increases, whilst water and land resources are on the decline phase. Due to climate change, increasing temperature, changes in patterns of rainfall and rising sea levels will lead to substantial modifications in water and land resources for rice production (Nguyen 2002). In rice, there are several important diseases, out of which rice blast (*Magnaporthe grisea*) and sheath blight (*Rhizoctonia solani*) causes crop losses annually worldwide. Change in temperature emerged as the

Few Pages are not available

infection caused by *Peronospora manshurica* in soybean. The suppression in downy mildew incidence may result of accelerated soybean leaf senescence, and hence a decreased susceptible period of soybean, which effectively caused by elevated O_3 concentration. Research reports such as focusing on various level of CO_2 concentration allow scientists to effectively assess the simultaneous effects of variability in temperature and precipitation (Eastburn *et al.* 2010). Further, under erratic climate change, increased biomass of crops under different situation and host plants will further increase inoculum production effectively. To be further effective against climatic change, partial host resistance should be combined with agronomic and other practices to further develop robust integrated crop protection strategies, which will not suffer such boom-bust cycles to increase the production and productivity of crop yield.

Conclusion

Extensive knowledge of plant pathogen biology either morphological or physiological and deep query about epidemiology of plant diseases in farming systems must effectively improve report for wide changes in geographical distribution of crops to better manage necrotrophic pathogens under various climate changes. It is always important to consider pathogen development under several circumstances and the effectiveness of resistant plant varieties for an accurate evaluation of plant diseases on food crops in the future. Other important factors to consider include disease management practices, such as the use of durable resistant crop cultivars and integrated crop management practices, such as stubble retention, crop rotations, time of planting, irrigation practices, minimum fungicides, quarantine and potential biocontrol agents.

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