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Impact of Climate Change on Crop Pests

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Abstract

Crop pest includes insects, pathogens and weeds which are one of the most crucial factors that cause yield loss to a greater extent.The negative impact of climate change on agriculture must be discussed under the light of its effect on crop pests. Climate change indirectly affects the pest dynamics by altering their ecology. Population dynamics, life cycle, geographic range, physiology of the pests depends on temperature, rainfall, relative humidity, radiation, carbon-di-oxide concentration, soil moisture etc. The host-pest-environment relationship is influenced by the changes in weather, soil and crop factors which are subjected to alteration due to the climate change.

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Keywords

CO_2 concentration, insects, pathogens, temperature

Introduction

Climate change is the most burning issue now-a-days. The impacts of climate change on agriculture are generally discussed under the light of its negative influence on crop productivity, soil fertility, fresh water availability, pests, atmospheric constituent etc. Pest (insects, pathogens and weeds) is one of the most crucial factors that limit crop productivity to a greater extent. Pest abundance in crop field depends on several parameters which include meteorological parameters, soil parameters and crop parameters. When the parameters deviate from the normal or optimum, the interaction between plants and pest is changed. Agricultural productivity is affected by climate induced phenomena in two ways viz. the direct effects from changes in temperature, precipitationor carbon dioxide concentrations, and the indirect effects through changes in soilmoisture and the distribution and frequency of infestation by pests and diseases.Climate changes directly affects the crops by creating a number of stresses like drought, water logging, extreme temperatures which weaken the crops and make it more susceptible to the pests. As a consequence of the climate change, crop micrometeorology is altered which in turn influences the pest dynamics. Climate change endangered food safety as the increased pest problemscause higher pesticide toxicity. Climate change mainly takes account of gradual increase in the air temperature and Carbon-di-oxide (CO_2) concentration, changes in the rainfall pattern (intensity and distribution). In this article the effects of increased temperature and CO_2 concentration and changed rainfall pattern on the pest including insects, pathogens and weeds will be discussed in details.

Effect of Increased Temperature

The population, reproduction and life cycle of insect and disease pests greatly depends on the air temperature and crop canopy temperature. Temperature determines

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the geographic range of a certain pest. With the gradual temperature increase, the poikilothermic insects (insects whose body temperature varies with the temperature of the surrounding environment) migrate towards the higher latitudes and altitudes. It was reported earlier that several insect pests such as cereal stem borers (*Chilo, Sesamia,* and *Scirpophaga* spp), pod borers (*Helicoverpa, Maruca*, and *Spodoptera* spp.), aphids, white flies shift from the tropical region to the temperate region (Sharma, 2014). A particular insect requires a certain amount of heat units or degree days to complete its life cycle. If the temperature is more, the insects take less time to complete life cycle and cause more crop loss. Sometimes rising temperature negatively influences the interaction between host crop and natural enemies which results in reduced parasitism. Increased temperature also reduces the resistance of the crops against the pathogens by modifying the host plant physiology. Rising temperature results in the movement of invasive weed species towards the temperate regions. The competition between crops and weeds for resources is affected if temperature increases. Higher temperature promotes more assimilates partitioning towards the root biomass in some shrubs (*Parthenium* sp.) (Kathiresan, 2006a).

Effect of Increased CO_2 Concentration

Increased CO_2 concentration affects the pest population in the crop field by influencing the temperature and relative humidity in the crop canopy. When the concentration of CO_2 becomes more in the surrounding environment plants produce more sugars in their body which attracts more pests. Sometimes insects take more time to complete their life cycle due to slow development when C/N ration of the plant is higher. Higher CO_2 level results in vigorous growth of crop canopy which increases the relative humidity within the canopy and this situation favours the development of plant pathogens. In increased CO_2 conditions, plant decomposition rate becomes slower which is conducive for overwintering of the organisms (Coakley *et al.,* 1999). Increased CO_2 concentration is beneficial for some weed species.

Effect of Changed Rainfall Pattern

In the changed climatic condition the rainfall pattern including its intensity and distribution is changed. Number of rainy days decrease and more intense rainfall is observed. Heavy rainfall removes insects from the crop field and flooding is used to wash out the pathogens that overwinter in the crop residues. Rainfall increases the relative humidity, soil moisture and leaf wetness which are very much conducive for development of pathogens. Frequent drought events are observed which make the crops less able to compete with the weeds for nutrients.

Conclusion

It can be concluded that climate change indirectly influence the pest dynamics in the crop field and causes yield loss. The host-pest-environment relationship is influenced by the changes in temperature, CO_2 concentration and rainfall pattern. Host susceptibility increases and pesticide sue efficiencies decreases as the indirect effects of climate change. However, suitable mitigation strategies like selection of pest resistant crop varieties, selection of proper cropping pattern, adjustment of sowing dates, application of cultural and biological control measures etc. are to be taken to make the production system sustainable and efficient to combat the negative effects of climate change.

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