Chapter 67
Impact of Climate Change on Potato Production in India

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ABSTRACT

Potato is a temperate crop and higher day temperatures cause some areas to less suitable for potato production due to lower tuber yields and its quality. Tuber growth and yield can be severely reduced by temperature fluctuations outside 5-30 °C. The rate of warming in last 50 years is double than that for the last century. Increase in temperature and atmospheric CO2 are interlinked occurring simultaneously under future climate change and global warming scenarios. If CO2 is elevated to 550 ppm the temperature rise is likely to be 3 ºC with decline in potato production by 13.72% in the year 2050. The changing climate will affect the potato production adversely due to drought, salinity, frost, flooding, erratic unseasonal rains etc. It may reduce seed tuber production, impact storage facility and potato processing industries. Therefore, the quantification of regional vulnerability and impact assessment is very important for the development of early warning on disease forecasting systems, breeding of short duration and heat, drought, salinity tolerant and disease resistant cultivars.

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INTRODUCTION

The book chapter "Sustainable Potato Production and the Impact of Climate Change" deals with the possible impact of global warming and elevated CO_2 on Potato production. The results presented in this chapter are summarized findings of the research conducted in India; its agricultural universities and Indian council of Agricultural Research (ICAR). The level of atmospheric temperature and carbon dioxide raised under controlled conditions to some possible changes in near future to assess the impact on climate change on potato production. Findings of various researchers of India are compiled in the form of book chapter for easy understanding and in line of future work. Mitigation of impact of climate change on potato is discussed in global context.

BACKGROUND

The bottom-line conclusion of the Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2001) is that the average global surface temperature will increase by between 1.4°C and 3°C above 1990 levels by 2100 for low emission scenarios and between 2.5°C and 5.8°C for higher emission scenarios of greenhouse gases and aerosols in the atmosphere. The effect of increased temperatures on potato production in specific areas will vary depending partly on the current temperature of that area. Temperatures above 30 °C can have several negative impacts on potato production like: slowing tuber growth and initiation, less partitioning of starch to the tubers, physiological damage to tubers (e.g. brown spots), shortened/non-existent tuber dormancy, making tubers sprout too early. These effects can reduce crop yield and the number and weight of tubers. As a result, areas where current temperatures are near the limits of potatoes' temperature range will likely suffer large reductions in potato crop yields in the future.

Potato farming is the most important economic activity in some parts of India. Uttar Pradesh, Punjab and West Bengal are the major potato producing states. There is direct effect of global warming and serious risk to future crop production and food security in the country. At high altitudes, global warming will probably lead to changes in the time of planting, the planting of late-maturing cultivars, and a shift of the location of potato production. In many of these regions in India, changes in potato yield are likely to be relatively small in initial stage but expected to trigger in coming era of global warming. Shifting planting time or location is less feasible at lower altitudes, and in these regions global warming could have a strong negative effect on potato production. It is likely that the currently observed trend of global warming, which has been 0.6 ºC + 0.2 since 1900, will continue and that the average global temperature will increase by between 1.4 and 5.8 ºC over the period 1990 to 2100. It is shown that heat-tolerant potato cultivars could be used to mitigate effects of global warming in (sub) tropical regions. Climate change is now an acknowledged fact and reality. The evidence gathered world over using state-of-the-art technology by various national and international agencies is irrefutable. Human activities like rapid industrialization, intensive agriculture, and indiscriminate use of fertilizers, deforestation and increasing use of fossil fuels during past 150 years are the major contributing factors for climate change. The continued effect of these activities resulted in increasing emission of CO_2 and other greenhouse gases (GHG) leading to global warming as a '*greenhouse effect*' due to entrapment of back radiation from earth by these gases. The increase in temperature due to global warming is 0.76 ºC since 1850. The rate of warming in last 50 years is double than that for the last century. The rate of warming is increasing. The 20th century's last two decades were the hottest in 400 years and possibly the warmest for several millennia, according