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Impacts on Crop Yield in Agriculture Due to Climate Change in India

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***Abstract*— Agriculture is highly dependent on the climate. The possible physical effects of climatic change on agriculture, such as changes in crop and livestock yields, as well as the economic consequences of these potential yield changes. In recent times, the crop simulation models have been used extensively to study the impact of climate change on agricultural production and food security. Climate models predict a gradual rise in carbon-dioxide (CO2) concentration and temperature across the globe. These results suggest that climate change is likely to impose significant costs on the Indian economy unless farmers can quickly recognize and adapt to increasing temperatures. Local weather conditions such as rain,**
temperature, sunshine and wind, in combination with locally adapted plant varieties, cropping systems, and soil conditions can maximize food production as long as plant diseases can be controlled. Climate change could make it more difficult to grow crops. The effects of climate change also need to be considered along with other evolving factors that affect agricultural production, such as changes in farming practices and technology. With the temperature increasing and fluctuations of weather, water availability and crop production are likely to decrease in the future. If the irrigated areas are expanded, the total crop production will increase.

***Keywords*: Agriculture productivity; Climate change; Rainfall**

I. INTRODUCTION

Agriculture production is directly dependent on climate change and weather. Possible changes in temperature, precipitation and CO2 concentration are expected to significantly impact crop growth. The overall impact of climate change on worldwide food production is considered to be low to moderate with successful adaptation and adequate irrigation (IPCC .,1998). Since climatic factors serve as direct inputs to agriculture, any change in climatic factors is bound to have a significant impact on crop yields and production. Studies have shown a significant effect of change in climatic factors on the average crop yield. (Dinar et al., 1998) Climate change is posing a great threat to agriculture and food security. Water is the most critical agricultural input in India, as 55% of the total cultivated areas do not have irrigation facilities.

Global warming may also threaten India food security if there is a negative effect on agriculture. Although, the effect of increasing CO2 concentrations will increase the net primary productivity of plants, but climate changes, and the changes in disturbance regimes associated with them, may lead either to increased or decreased net ecosystem productivity. In many tropical and subtropical regions, potential yields are projected to decrease for most projected increases in temperature. The impacts of elevated CO2 should be considered among others, in the context of, (A) changes in air temperature, particularly nocturnal temperature due to increase in CO2 and other trace gases and changes in moisture availability and their effect on vegetative versus reproductive growth; (B) need for more farm resources (e.g. fertilizers); and (C) survival and distribution of pest populations, thus developing a new equilibrium between crops and pests (Krupa, 2003).

The rising temperatures and carbon-dioxide and uncertainties in rainfall associated with global warming may or may not have serious direct and indirect consequences on crop production. It is, therefore, important to have an assessment of the direct and indirect consequences of global warming on different crops especially on cereals contributing to the food security (Gadgil et al., 1995, 1999a,b).

Studying the potential socioeconomic impacts of climate change involves comparing two future scenarios, one with and one without climate change. Uncertainties involved in such an assessment include: (1) the timing, magnitude and nature of climate change; (2) the ability of ecosystems to adopt either naturally or through managed intervention to the change; (3) future increase in population and economic activities and their impacts on natural resources systems; and (4) how society adapts through the normal responses of individual, businesses and policy changes that after the opportunities and incentives to respond. The uncertainties, the long periods involved and the potential for catastrophic and irreversible impacts on natural resources systems raise questions as to how

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to evaluate climate impacts, investments, and other policies that would affect or be affected by changes in the climate.
In India, substantial work has been done in last decade aimed at understanding the nature and magnitude of change in yield of different crops due to possible climate change. The objective of the present review is to examine the present status of the knowledge of climate change impact on Indian agricultural production.

Impacts on Agriculture and Food Production

Food production in India is sensitive to climate changes such as variability in monsoon rainfall and temperature changes within a season. Studies by Indian Agricultural Research Institute (IARI) and others indicate greater expected loss in the Rabi crop. Every 1°C rise in temperature reduces wheat production by 4-5 Million 11 Tonnes. Small changes in temperature and rainfall have significant effects on the quality of fruits, vegetables, tea, coffee, aromatic and medicinal plants, and basmati rice. Pathogens and insect populations are strongly dependent upon temperature and humidity, and changes in these parameters may change their population dynamics.
Other impacts on agricultural and related sectors include lower yields from dairy cattle and decline in fish breeding, migration, and harvests. Global reports indicate a loss of 10-40% in crop production by 2100.Indian climate is dominated by the southwest monsoon, which brings most of the region‘s precipitation. It is critical for the availability of drinking water and irrigation for agriculture. Agricultural productivity is sensitive to two broad classes of climate-induced effects (1) direct effects from changes in temperature, precipitation or carbon-dioxide concentrations, and (2) indirect effects through changes in soil moisture and the distribution and frequency of infestation by pests and diseases. Rice and wheat yields could decline considerably with climatic changes (IPCC 1996; 2001). However, the vulnerability of agricultural production to climate change depends not only on the physiological response of the affected plant, but also on the ability of the affected socio-economic systems of production to cope with changes in yield, as well as with changes in the frequency of droughts or floods. The adaptability of farmers in India is severely restricted by the heavy reliance on natural factors and the lack of complementary inputs and institutional support systems. The loss in net revenue at the farm level is estimated to range between 9% and 25% for a temperature rise of 2 °C to 3.5 °C. Scientists also estimated that a 2°C rise in mean temperature and a 7% increase in mean precipitation would reduce net revenues by 12.3% for the country as a whole. Agriculture in the coastal regions of Gujarat, Maharashtra, and Karnataka is found to be the most negatively affected. Small losses are also indicated for the major food-grain producing regions of Punjab, Haryana, and western Uttar Pradesh. On the other hand, West Bengal, Orissa, and Andhra Pradesh are predicted to benefit to a small extent from warming.
Availability of water is the most important factor in agricultural production. Water quality and quantity are serious constraints for agriculture in most parts of India. Agriculture must adapt to changing climatic conditions by tapping water resources and developing improved water management approaches. Simultaneously, there is also need to develop and implement technologies and policies which will help in reducing and mitigating greenhouse gas emissions. Therefore, assessment of the availability of water resources is future national requirement and expected impact of climate change and its variability is critical for relevant national and regional long-term development strategies for sustainable development.
India is home to 16% of the world population, but only 4% of the world water resources. Agriculture is directly dependent on climate, since temperature, sunlight and water are the main drivers of crop growth. While some aspects of climate change such as longer growing season and warmer temperatures may bring benefits in crop growth and yield, there will also be a range of adverse impacts due to reduced water availability and more frequent extreme weather conditions. These impacts may put agricultural activities at significant risk.

Climate change has already caused significant damage to our present crop profile and threatens to bring even more serious consequences in the future (WHO, 1992).In India, the growing population is a major concern, and there is a need to understand the availability of water in terms of increase in population growth. A decline has been projected in mean per capita annual freshwater availability and growth of population from 1951 to 2050 [Gautam HR] is shown in below figure. The graph clearly indicates the ‘two sided’ effect on water resources as the rise in population will increase the demand for water leading to faster withdrawal of water and this in turn would reduce the recharging time of the water-tables.

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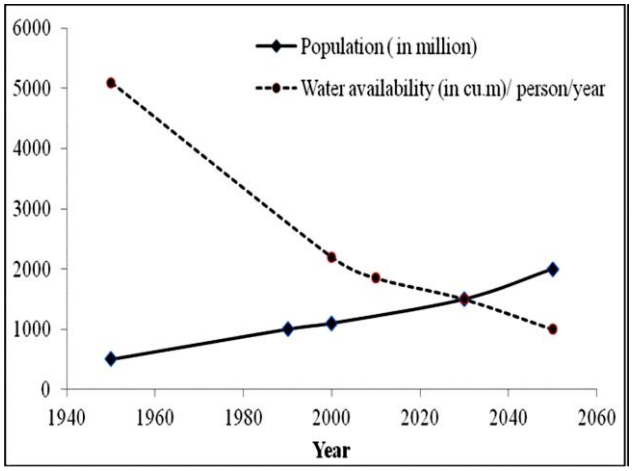

Impact Assessment on crop models:

Estimates of impact of climate change on crop production could be biased depending upon the uncertainties in climate change scenarios, region of study, crop models used for impact assessment and the level of management. So it is very important to give these uncertainties due importance while assessing the impacts of possible climate change on crop productivity for formulating response strategies.The environmental factors such as cloudiness and solar radiation at the earth's surface will also change but the GCMs are less consistent in their predictions, particularly on a regional basis (Mitchell et al., 1995; IPCC, 2001).

CONCLUSION:

The effect of climate change poses many threats; one of the important consequences is bringing about changes in the quality and quantity water resources and crop productivity. It can be concluded that the Indian region is highly sensitive to climate change. Agriculture sector is the most prone sector as it will have a direct bearing on the living of 1.2 billion people. India has set a target of halving greenhouse gas emissions by 2050.

REFERENCES

IPCC (1998) Principles governing IPCC work, Approved at the 14th session of the IPCC.

Dinar, A., R. Mendelsonhn, R. Evenson, J. Parikh, A.Sanghi, K.Kumar, J.McKinsey, S.Longergan (Eds.) (), Measuring the Impact of Climate Change on Indian Agriculture, World Bank Technical Paper 402, Washington, D.C., U.S.A

Krupa, S.: 2003, 'Atmosphere and agriculture in the new millennium', Environmental Pollution 126, 293–300.

Gadgil, S., Abrol, Y. P. and Rao, Seshagiri, P. R.: 1999a, 'On growth and fluctuation of Indian food grain production', Current Science 76(4), 548–556.

Gadgil, S., Rao, Seshagiri, P. R. and Sridhar, P. R.: 1999b, 'Modeling impact of climate variability on rainfed groundnut', Current Science 76(4), 557–569.

IPCC (2001) Climate Change 2001: Impacts, Adaptation & Vulnerability: Contribution of Working Group II to the Third Assessment Report of the IPCC. Cambridge University Press, Cambridge, UK.

IPCC (2007) Summary for Policy-makers, Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the IPCC. Cambridge University Press, Cambridge, United.

Gautam HR, Sharma HL (2012) Environmental degradation, climate change and effect on agriculture. J Kurukshetra 60: 3-5.

Mitchell, J. F. B., Johns, T. C. and Senior, C. A.: 1998, 'Transient response to increasing greenhouse gases using models with and without flux adjustment', Hadley Centre Technical Note 2. Available from Met. Office, London Road, Bracknell, RG12 2SZ, UK.

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