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ECONOMIC IMPACT OF CLIMATIC CHANGE ON AGRICULTURAL PRODUCTION IN INDIA – SOME EMPIRICAL ILLUSTRATIONS

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ABSTRACT

Concrete is most widely used man made construction material. Different types of experiments done on concrete every day to improve the properties of concrete. To modify the properties of the concrete different types of cementitious material are used with admixtures. Main advantage of using cementitious material is to lower down the consumption of cement and also it modifies the mechanical properties of concrete. Among all cementitious material Fly ash give best performance in strength, durability and workability aspect of concrete. Use of fiber along with cementitious material in concrete is not new but there is considerably change in types of fibers which are used in concrete. The main advantage to use fibers with cementitious material is that properly distribution fibers in concrete. In this paper combination of different types of polypropylene fibers with fly ash are studied on strength aspect of concrete.

INTRODUCTION

Climate change is any significant long-term change in the expected patterns of average weather of a region (or the whole Earth) over a significant period of time. It is about abnormal variations to the climate, and the effects of these variations on other parts of the earth. These changes may take tens, hundreds or perhaps millions of years. But increased anthropogenic activities such as industrialization, urbanization, deforestation, agriculture, change in land use pattern etc. lead to emission of greenhouse gases due to which the rate of climate change is much faster. Climate change scenarios include higher temperatures, changes in precipitation, and higher atmospheric CO2 concentrations. There are three ways in which the "Greenhouse Effect" may be important for agriculture. First, increased atmospheric CO2 concentrations can have a direct effect on the growth rate of crops. Secondly, CO2-induced changes of climate may alter levels of temperature, rainfall and sunshine that can influence plant and animal productivity. Finally, rises in sea level may lead to loss of farmland by inundation and increasing salinity of groundwater in coastal areas. The major impacts of climate change will be on rain fed or un-irrigated crops, which are cultivated on nearly 60 percent of cropland. A temperature rise by 0.5oC in winter temperature is projected to reduce rain fed wheat yield by 0.45 tonnes per hectare. Possibly there might be some improvement in yields of chickpeas, rabi maize, sorghum and millets and coconut on the west coast and less loss in potatoes, mustard and vegetables in north-western India due to reduced frost damage. Increased droughts and floods are likely to increase production variability.

INDIA'S AGRICULTURE

From ancient times India's agriculture has been dependent on monsoons. Any change in monsoon trends drastically affects agriculture. Even the increasing temperature is affecting Indian agriculture. In the Indo-Gangetic Plain, these pre-monsoon changes will primarily affect the wheat crop (>0.5oC increase in time slice 2010-2039; IPCC 2007). In the states of Jharkhand, Odisha and Chhattisgarh alone, rice production losses during severe droughts (about one year in five) average about 40 percent of total production, with an estimated value of \$800 million.

Recent studies done at the Indian Agricultural Research Institute indicate the possibility of a loss of between 4 and 5 million tons in wheat production in the future with every rise of 1oC temperature throughout the growing period. Rice production is slated to decrease by almost a tonne/hectare if the temperature rises by 2 degree celsius. In Rajasthan, a 2 degree rise in temperature was estimated to reduce production of pearl millet by 10 to 15 percent. If maximum and minimum temperatures rise by 3 and 3.5 degrees respectively, then soya bean yields in M.P will decline by 5 percent compared to 1998. Agriculture will be affected in the coastal regions of Gujarat and Maharashtra, as fertile areas are vulnerable to inundation and salinization.

FOOD SECURITY

Food security is both directly and indirectly linked with climate change. Any alteration in the climatic parameters such as temperature and humidity which govern crop growth will have a direct impact on quantity of food produced. Indirect linkage pertains to catastrophic events such as floods and droughts which are projected to multiply as a consequence of climate change leading to huge crop loss and leaving large patches of arable land unfit for cultivation which hence threatens food security. The net impact of food security will depend on the exposure to global environmental change and the capacity to cope with and recover from global environmental changes. On a global level, increasingly unpredictable weather patterns will lead to a fall in agricultural production and higher food prices, leading to food insecurity.

Food insecurity could be an indicator for assessing vulnerability to extreme events and slow-onset changes. This impact of global warming has significant consequences for agricultural production and trade of developing countries as well as an increased risk of hunger. The number of people suffering from chronic hunger has increased from under 800 million in 1996 to over 1 billion recently. United Nations population data and projections show the global population reaching 9.1 billion by 2050, an increase of 32 percent from 2010.

The world's population is expected to grow by 2.2 billion in the next 40 years, and a significant portion of the additional population will be in countries that have difficulties feeding themselves. Preliminary estimates for the period up to 2080 suggest a decline of some 15 to 30 percent of agricultural productivity in the most climate-change-exposed developing country regions – Africa and South Asia. Even the IPCC, scarcely alarmist, says a 0.5 degree rise in winter temperature would reduce wheat yield by 0.45 tons per hectare in India. Rice and wheat have an important share in total food grain production in India. Any change in rice and wheat yields may have a significant impact on food security of the country. And this when Indian agriculture is already in crisis, and in the last twenty years 300,000 farmers have killed themselves.

ADAPTION

In view of drastic environmental changes taking place it is necessary for farmers as well as for the Indian government to adapt to changing situation as soon as possible.

The Indian government should assist farmers in coping with current climatic risks by providing value-added weather services to farmers. Farmers can adapt to climate changes to some degree by shifting planting dates, choosing varieties with different growth duration, or changing crop rotations. An Early warning system should be put in place to monitor changes in pest and disease outbreaks. The overall pest control strategy should be based on integrated pest management because it takes care of multiple

pests in a given climatic scenario. Developing short-duration crop varieties that can mature before the peak heat phase set in.

Rising temperature affects flowering and leads to pests and disease buildup. Flood and excess rain over a short duration of time cause extensive damage to crops. Extreme weather events have caught attention of agrarian experts and scientists alike and they are now focussing on natural farming to arrest the impacts of climate change.

IMPACT OF CLIMATE CHANGE ON AGRICULTURE

While speaking at the Natural Farming Summit hosted by the Sri Sri Institute of Agricultural Sciences & Technology Trust (SSIAT) in Bengaluru from May 9-10, B. Venkateshwarlu, former director at International Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad, said, "Climate change affects all the three aspects of food security: availability, access and absorption. When production decreases, availability of food decreases. Climate change hits poor the most. They don't have income to buy the food, so their access to it is affected. This, in turn, has an impact on health and affects absorption."

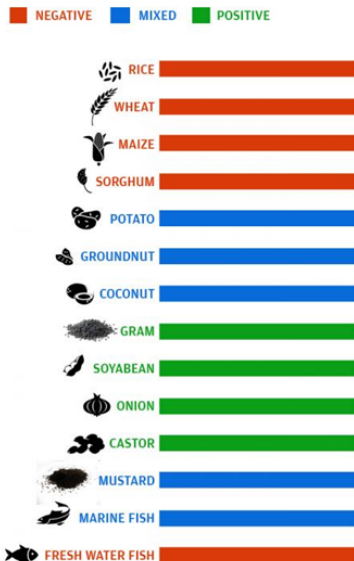
According to him, climate change has about 4-9 per cent impact on agriculture each year. As agriculture contributes 15 per cent to India's GDP, climate change presumably causes about 1.5 per cent loss in GDP.

HOW DIFFERENT CROPS REACT TO CLIMATE CHANGE

Highlighting the impact of climate change on crops, he explained how rice, wheat, maize and sorghum are the worst hit by this phenomenon. By 2030, rice and wheat are likely to see about 6-10 per cent decrease in yields. He also gave examples of crops like potatoes, soybean, chickpea and mustard, on which climate change will have a neutral or positive impact.

India - Commodity wise impacts

(from modelling)



Speaking to Down To Earth, Venkateshwarlu, currently the Vice-Chancellor at Vasant Rao Naik Marathwada Agricultural University, clarified that this positive impact is "conditional and short-term". "Crops like soybean and gram are likely to benefit from higher level of CO2 in atmosphere, which helps in CO2 fertilisation. But the positive effects are unlikely to last more than 10-15 years," he added.

According to him, a lot depends on the net sown area and the geographical location of a region where a particular crop is sown. "Mustard, for example, will experience a neutral-to-positive impact in northern India, especially in Punjab and Haryana, where winter temperature is very low. A 1°C rise in temperature won't

have much impact on production. However, a similar rise in temperature in eastern and central India will have a negative impact," he concluded.

Potato production will be positively impacted by elevated CO2 concentration. This view was previously endorsed by the experts at the Central Potato Research Institute in their research paper, where they claimed that potato yield will increase by 11.12 per cent at elevated CO2 of 550 PPM and 1°C rise in temperature. However, further increase in CO2 with a likely rise in temperature by 3°C will result in decline in production by 13.72 per cent in the year 2050.

Kharif crops will be affected more by rainfall variability, while Rabi crops by minimum temperature

Wheat is likely to be negatively impacted in Rabi season due to terminal heat stress with 1°C rise in temperature results in loss of 4 metric tonnes (MT) of wheat. Similarly, legumes are going to be benefitted because of elevated level of atmospheric Co2.

ADAPTING TO GLOBAL WARMING

Emphasizing the need to convince the government that we can produce enough food using natural farming, he called for using climate-tolerant crop varieties like the Swarna rice. This variety of rice, considered tolerant to water logging, used to be grown in India in the past.

The important mitigation options, according to him, include:

- Efficient water and nutrient management options to enhance use efficiency
- Evaluation of carbon sequestration potential of different land use systems
- Understanding opportunities offered by conservation agriculture and agro-forestry
- Identifying cost-effective methane emission reduction practices in ruminants and in rice paddy

CONCLUSION

"Global Warming" has now started showing its impacts worldwide. Climate is the primary determinant of agricultural productivity which directly impacts food production across the globe. The agriculture sector is the most sensitive sector to climate changes because the climate of a region/country determines the nature and characteristics of vegetation and crops. Increase in the mean seasonal temperature can reduce the duration of many crops and hence reduce final yield. Food production systems are extremely sensitive to climate changes like changes in temperature and precipitation, which may lead to outbreaks of pests and diseases thereby reducing harvest ultimately affecting the food security of the country. The net impact of food security will depend on the exposure to global environmental change and the capacity to cope with and recover from global environmental change. Coping with the impact of climate change on agriculture will require careful management of resources like soil, water and biodiversity. To cope with the impact of climate change on agriculture and food production, India will need to act at the global, regional, national and local level.

REFERENCES

1. Goyal RK (2004) Sensitivity of evapotranspiration to global warming: a case study of arid zone of Rajasthan (India).
2. Huntington TG (2003) Climate warming could reduce runoff significantly in New England. *Agric For Meteorol* 117: 193-201.
3. Eckhardt K, Ulbrich U (2003) Potential impacts of climate change on groundwater recharge and streamflow in a central European low mountain range. *J Hydrol* 284: 244-252.
4. Allen DM, Mackie DC, Wei M (2004) Groundwater and climate change: a sensitivity analysis for the Grand Forks aquifer, southern British Columbia. *Hydrogeol J* 12: 270-290.
5. Xu J, Shrestha AB, Vaidya R, Eriksson M, Hewitt K (2007) The Melting Himalayas-Regional Challenges and Local Impacts of Climate Change on Mountain Ecosystems and Livelihoods. ICIMOD Technical Paper. International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal.