

Effect on Indian Agriculture :- Global warming

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Introduction :-

20th century that rising temperature plays an important role towards global warming as compared to precipitation. Researchers have confirmed that crop yield falls by 3% to 5% for every 1°F increase in the temperature. In India, crop production may be divided into two seasons: Kharif and rabi. Present study shows that the crop production is dependent on temperature. Temperature vs. crop production shows a funnel shape for all the seasons. For the lower temperature both the properties are almost linearly correlated. In rabi, at the beginning production show a negative trend with temperature which slowly converts to the positive trend. In kharif that negative trend is not visible. At higher temperatures production increases for both the seasons but with large scattering. The findings may be helpful to study the effect of climate change on the crop production.

Mankind is in need of an equitable standard of living like adequate food, water, energy, safe shelter and a healthy environment for present as well as future generations. But casual acts of human race, such as emission of greenhouse gases by burning fossil fuels and deforestation has increased the earth's average surface temperature, which is defined as global warming. It is proved that the warming on the earth's surface over last 50 years is mostly due to the anthropogenic activities.

Hence, global warming can be considered as the major affecting parameter in changing the earth's climate. Warming of the climate system is observed all over the world. Recent climate changes have shown its impact on natural as well as human systems. Any significant change in climate may affect agriculture at larger scale. Various factors such as increase in temperature change in rainfall pattern, increase of CO₂ content in atmosphere, frequency and intensity of extreme weather events may have significant impact in agriculture sector. It is predicted that increase in temperature will show overall negative effects on agriculture in the world.

India has one of the largest and institutionally most complex agricultural research systems in the world. Historically, the Indian agricultural research system is the zenith of a process which started in the 19th century and which resulted in the establishment of the Imperial Council of Agricultural Research on the recommendation of a Royal Commission on Agriculture in 1929. Since then there was a stupendous evolution of agricultural research in India.

Key words :- Effect on Indian agriculture global warming may affect agriculture at larger scale.

Methodology:-

The data sets for the annual mean temperature of India over the period 1990-2013 was taken from India Meteorological Department. Development in the agriculture and allied sectors of India are of interest to a wide spectrum of people across the world. The Directorate of Economics and Statistics of the Department of Agriculture and Cooperation, Government of India publishes "Agricultural Statistics at a Glance 2014" that presents comprehensive information on this sector. All the data sets of food grain production including rabi and kharif were taken from this report.

Agricultural Research in colonial India:-

The early development of agricultural research in India was associated with the reappearance of famines. This acted as a nasty reminder of the little precedence accorded to agricultural research and development in colonial India.

The provincial agricultural departments could seldom go beyond the collection of revenue data and famine relief operations. No doubt, experimental farms had been established and in 1884. For conducting experiments the government looked more to agricultural societies than to its own agencies. The society in Calcutta agreed to conduct all experiments in economic products. The Government of Bengal raised its

grant from Rs. 2400 to Rs. 6000 per annum. The objectives of Agricultural and Horticultural Society of India were .

The official experimental farms were obsessed with cotton. Mounting pressure from British cotton tycoons had forced the Government of India to initiate a vigorous cotton improvement program. However, the earlier projects of 1840s and 1860s could not be made successful mainly because of insufficient botanical knowledge or the necessary market research. Later, in 1890, the association of an expert botanist in cotton experiments was specifically called for. The cultivation and marketing of existing varieties produced a relatively stable and acceptable return to money-lenders and dealers. New and untested varieties involved different methods of cultivations and great labour input, without a higher level of output or profit, and with the risk of severe losses to each of these classes.

Indian Scenario :-

Like other countries, India has also started experiencing extreme weather events which lead to change the climate. As mentioned earlier, global warming is one of the major affecting parameter to change the climate. In India, it is observed that the annual mean temperature has increased at the rate of 0.42°C.

- [1] Indian agriculture system is based upon south-west and north-east monsoon. Almost 80% of the total precipitation comes from south-west monsoon in India.
- [2] Any fluctuations and uncertainties in long range rainfall pattern may affect the agriculture sector and also lead to increase the frequency of droughts and floods at regional scale.
- [3] A significant increasing trend in rainfall was reported along the west coast, north Andhra Pradesh and North West India.
- [4] While significant decreasing trend was observed over parts of Gujarat, Madhya Pradesh and adjoining area, Kerala and northeast India.
- [5] North western region of India gets affected by western disturbances at small scale as such disturbances have impact only on rabi production.

Not only monsoon, but temperature has also shown its effect on agriculture. Extreme maximum and minimum temperature showed an increasing trend in the southern part whereas decreasing trend in the northern part of India . Research studies show that with the increase in temperature, crop productivity is likely to decrease in future . Hence, there is a need to study the dependency of temperature on crop productivity, stability, yield and quality to uplift the country's economy.

Effect of temperature in Indian agriculture :-

Research studies shows that rise in global surface temperature would affect Indian agriculture. Several climatic factors which affect agriculture productivity are heat waves, high temperature , heavy and prolonged precipitation and excess cold. These factors have positive as well as negative effects on crop production. Almost every year India faces several weather events due to changes in such climatic parameters in various regions which reduces crop yield. Varied nature of such weather events tends to affect the crop growth cycle and plant physiological processes . In India, about 17% of the years during 1901-2010 were reported as drought years, which result into severe impacts on agriculture, water resources, food security, economy and social life in the country . The variation in temperature and precipitation above threshold value may affect photosynthesis and transpiration process in crops . Excess rainfall and flood may leads to physical damage of the crops .

Studies predicted that changing trends in temperature and precipitation will continue to have significant impact on agriculture . A small rise in temperature (1-2°C), especially in the seasonally dry tropical regions would decrease crop yield .

Indian agriculture is divided into two main seasons: Kharif and Rabi based on the monsoon. It is reported that overall temperature rise is likely to be much higher during winter (rabi) rather than in rainy season . Moreover, it is predicted that the mean temperature in India will rise by 0.4-2.0°C in Kharif and 1.1-4.5°C in Rabi by 2070. Decline in agricultural productivity leads to increase food prices at state as well as at country level . Hence, temperature could be one of the significant affecting factor which results into greater instability in agriculture of India.

Conclusion :-

The average annual temperature shows an increasing trend over India. Present study shows that the crop production depends on temperature. Funnel-like structure is observed for overall production which signifies their dependency on temperature. At low temperature, rabi (wheat) production was observed whereas not in kharif (rice). This shows that rabi production has affected comparatively more than kharif at lower temperature.

At high temperature range, both types of production shows increasing trend. Moreover, in case of high temperature, it has been observed that scattering in production gets increases. Our study confirms the report of IPCC which states that crop production will get affected at high temperature.

Hence, temperature can be one of the significant parameter in crop production studies. At high temperature, prediction of crop production may become difficult as the data points got more scatter. If anyhow, such predictions can be improved further then it may help farmers to make their field planning better, identification of appropriate crop type in particular field, estimation of crop yield and requirement of water for irrigation. In this way, damage to the crops can be minimized and better enhancement in the crop yield can be achieved.

Hence, government needs to adopt such predictions and accordingly reframe their plans and policies which may help agriculture sector to uplift and hence can strengthen our economy. Predictions can be improved further by doing long term analysis as the present study contains data of only 23 years. Present study may be limited to the monsoon dominated region. Similar studies may be done for other regions as well to gain the confidence.

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