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Effects of Climate Change on Agriculture

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Abstract— Agriculture production is dependent on climatic and weather conditions but now-days increasing in temperature, precipitation, and CO2 concentration directly affects crop production. The CO2 concentration is rising at a rate of 1.5 to 1.8 ppm per year. Decline in rainfall of 0.7 percent and 3.0 percent in 2050, of 5.0 percent and 7.6 percent in year 2100 and 3-4 degrees Celsius temperatures are increased by the end of the 21st century should be observed in India. Increasing in 10C in temperature reduces wheat production by 4 to 5 percent. After harvesting the crop, crop residue is burned in the field that should also help in increasing the level of CO2 and kill the micro-organisms of that field. Climate change also affects an ecosystem directly or indirectly. Change in climate will affect the groundwater recharge, water cycle, soil moisture, livestock, and aquatic species. Change in climate increase the incidence of pests and diseases, which causes a huge loss in crop production. Due to climate change deterioration in soil fertility, promote salinity, defiance many pesticides, herbicides and deterioration of irrigation water quality should be found.

Index Terms— ***Climate change, Effects, Soil, Water, Crop production, CO2, Temperature.***

I. INTRODUCTION

As the scientific consensus grows that forceful climate change, in particular, increased precipitation and temperatures, is very likely to appear over the 21st century (Christensen and Hewitson 2007), economic research has attempted to measure the possible effects of climate change on society. Due to universal climate change, one of the biggest effects is expected to be on agriculture and many impacts also expected (Nordhaus 1991; Pearce 1996; Cline 2007). Agriculture production is directly dependent on weather and climate change. Possible changes in rainfall rates, change in temperature and CO2 concentration are expected to significantly impact crop growth. Worldwide food production is considered to be little cautious with successful adaptation and adequate irrigation due to brunt of climate transformation (IPCC 1998). Global agricultural production should be promotes because of doubling of the CO2 fertilization effect. Agriculture will also be impacted due to climate changes imposed on water resources (Gautam 2007). In north-western India, there is now a great problem about deterioration in soil fertility, promote salinity, change in the water table, degradation of irrigation water quality and defiance many pesticides (Sinha et al. 1998; CGWB 2002). In Northern Europe, eastern parts of North America, South America, Northern Asia as well as Central Asia has been found increase in rainfall. Tropics and Subtropics have been facing severe and long-lasting droughts since the 1970s whereas areas like Sahel, Southern Africa, and Central Asia have parched lands (Aggarwal 2008).

Changes in both crop yields and requirement for irrigation water under short term climate scenarios are estimated through simulation models (Reilly et al. 2003) and this tools is also used for estimating likely effects of climate on crop yields (Schlenker et al. 2008). Small-scale farmers face a series of challenges, to which climate change will be risk multiplier. They include poor natural resource management (especially of water and land), limited land tenure security, small farm sizes, low technological access, low market access and limited investment (Morton 2007). (IPCCWGI 2007) reported that changes in climate and atmosphere as inevitable for the coming decades, raise concerns regarding the adaptive ability and/or the likely responses of the agricultural sector. Information on the fiscals of climate transformation suggests that global crop production may be increase lightly by global warming in the short term (before 2030), it will later turn negative over the deeper term (Bruinsma 2003; IPCC 2007b). Climatic change effects world-wide, which effects significant perturbations that can be expected to be natural systems that have possible effects on the fiscal policies of highland range (Kohler 2012) through both direct and indirect means (Fahad 2017).

II. CLIMATE CHANGE CAN EFFECT ON AGRICULTURE IN A VARIOUS OF WAYS

1) Soil

Agriculture in India is assumed to have a negligible effect on the overall increase in the number of greenhouse gases. This is attributable to the minimal use of fertilizers and low soil fertility levels in the country (Khan et al. 2009). Change in frequencies, types, and intensities of various livestock pests and crops; the availability and limit of irrigation water supplies; and the harshness of soil erosion changes because of climate change (Richard M et al.1998). Due to extreme and unsuitable weather conditions in India, there exist high chances of soil infertility leading to a decline in the quantity and quality of the crop. Change in climate will affect the groundwater recharge, soil moisture, and frequency of drought or flood, and groundwater level in different areas (Allen et al. 2004, Eckhardt et al. 2003, Huntington 2003). Increased soil temperature may also lead to an increase in autotrophic CO2 losses from the soil caused by root respiration, root exudates, and fine-root turnover (Anupama Mahato 2014).

In general, current information from various method including soil chemistry, soil physics, agro-meteorology, plant breeding, crop physiology, and agronomy, into a set of mathematical equations to achieve growth, development, and

yield of a crop through crops models (Aggarwal and Kalra 1994; Hoogenboom, 2000). Long-term ancient weather data are used as input for the crop models by using climate change applications. Limiting the second crop by controlling the number of rice crops but replacing hedgerows to promote soil quality and support determine flood govern (Fischer and Hager 2005).

2) Crop production and Livestock

Dry season below temperatures would slow down or even damage crop growth that will decline crop production (Mendelsohn 2014; Mahendra 2011). The brunt trend of the average annual enthusiasm to the net income is dependent on seasons; the marginal could be decisive (if warm) or either adverse (if chilly) (Chen et al. 2016). (Swaminathan et al. 2010) show that a 10C increase in temperature reduces wheat production by 4 to 5 percent. A report of the (IMF 2017) founds that for rising market economies a 10C rise in temperature would decrease agricultural production by 1.7%, and a 100 millimeters decrease in rain would reduce growth by 0.35%. Animals are also harmed due to climate change (Ngondjeb 2013) as well as harmful for the production of aquatic species (Mishra 2014). Livestock would be impressed in 2 steps due to climate variation: the amount and quality of forage from steppe may be damaged and there may be a direct impact on livestock due to greater temperatures (Richard et al.1998). (Adams et al. 1998) reported that under a 5.0°C rise in temperature, the yields of livestock in the U.S. would decreased by 10% for cow/calf and dairy operations in Appalachia, the Southeast, the Delta States, the Southern Plains, and Texas; for a 1.5°C warming, yield loss was estimated at 1%. As the next sectors of crop agriculture, the production of livestock and processed food would also decrease with rising input costs. World output of livestock and processed food would decrease by 5.9% and 4.6%, respectively (Fan 2012).

3) Water

The water cycle will also be affected by climate change. (Xu J et al. 2007). Also, increase in sea level will boost the hazard of stable or seasonal saline interference into groundwater and rivers which will have effects on the nature of water and its likely use of domestic, industrial and agricultural uses. Climate change will have several effects on agriculture (Gautam HR et al. 2012). There is now a great worry about a decline in soil fertility, raising salinity, change in the water table, degradation of irrigation water quality and resistance to many pesticides in north-western India (Sinha et al. 1998; CGWB 2002). Additional tortuous effects may increase from shift in runoff and groundwater recharge rates, which disturb water supplies, and changes in capital or technological requirements such as irrigation methods and surface water storage (Richard M et al.1998). Because of the typical topography conditions of its high mountains, also the evidence of climate variation such as flash floods occur again and again now and with less time to assemble between the critical water levels and rainstorm; Rainfall levels are growing, rainy season is comes next with is more usual rain (ISPONRE 2009; Schad et al. 2011). The reports of the models presented that the scheme B2 of Northwest Vietnam, found that decrease in rainfall of 0.7 percent and 3.0 percent in 2050, of 5.0 percent and 7.6 percent in 21st century (Monre 2012). (Imhen 2010) reported that low temperature during dry season, accompanied by decreasing in rainfall and extreme low rainfall in the dry season leads to a scarcity of water for production and life. Reducing in irrigation water supplies because of shortfalls in rainfalls and also leading to reduce areas under irrigated crops and likely increased areas under rain-fed crops in the ensuing season (Kumar et al. 2004). (Bhaskaran et al. 1995) reported through UKMO GCM model Specific evaporation is boosted by 19%, exposing that the expanded monsoon rainfall is generally due to an expanded water content of the atmosphere.

4) Temperatures

Based on the results of the models run for the specific scenarios B2 of Northwest Vietnam, we considered an increased temperature of 1.1 0C and 1.5 0C in 2050, 2.2 0C and 3.0 0C in 2100 (MONRE 2012). (Bhaskaran et al. 1995) determine through UKMO GCM model the total rainfall is increasing by relatively 20% and an expanded in temperature by 1–4 0C during winter or rabi crop season and also increased in CO2 concentration. The net revenue affects certainly at a level through temperature or precipitation, which is more harmful for the crops. In warmer climates some crops are growing faster and leading to higher production and incomes. But when the temperature is very low or high and prolonged, it would be harmful for crop production (Mendelsohn et al. 1994). The temperatures in the high mountain areas go down to extremely low in dry season, even minus temperatures appeared, the lowest temperature minus 3.7 0C was found in a record (UNDP and IMHEN 2015; ISPONRE 2009).

5) CO2

(Keeling et al. 1995) reported that the concentration of CO2 was 280 ppm in 1850 (pre-industrial period) in steadystate and also conclude that concentration of CO2 is increasing at an estimation of 1.5 to 1.8 ppm in every year. The CO2 concentration would be doubled in year 2100. The climate models used in Cline's study predicted that under the IPCC's scenario A2, atmospheric concentrations of CO2 would increase to 735ppm by 2085 from a current level of 380ppm (IPCC's scenario A2 2007). The IPCC reports suggests through analysis of recent data that the production is boosting by 0–10% for C4 crops and by 10–25% for C3 crops when CO2 levels is 550ppm reached (IPCC 2007b). Estimates of diversity in national welfare measures in the more recent study by (Adams et al. 1998) for a 5°C increase, 0% precipitation increase and CO2 level of 530 ppm found in a welfare reduction of approximately $2 billion (1990 U.S. $) Global agricultural production should be expanded due to the increase of CO2 fertilization effect (Gautam HR et al. 2007). It is believed that the same increased levels of carbon dioxide (CO2) that are causing global heat may be beneficial to agriculture since carbon dioxide is important to plant development (Long et al. 2006). The impacts of inflated CO2 should be considered among others, in the context of, (A) changes in air temperature, particularly nighttime temperature due to increase in Carbon dioxide and other relic gases and changes in moisture availability and their side effect on vegetative versus reproductive improvement; (B)

requirement of more farm assets (e.g. fertilizers); and (C) continuity and dissemination of pest populations, thus promote a new equilibrium between pests and crops (Krupa 2003).

6) Pests and Diseases

Food production systems are very susceptible to climate variation like variation in precipitation and temperature, which causes an epidemic of diseases and pests thereby reducing in food security of the country by affecting harvest (Anupama Mahato 2004). Variation in the incidence and distribution of pests and pathogens causes indirect effects (Sutherst et al. 1995). Decrease in agricultural production due to variation in the patterns of pests and diseases with climate change (Fan Zhai and Juzhong Zhuang). Winter is a dry season, so increasing temperature and precipitation slightly with the already dry season may encourage diseases and insect pests (Mendelsohn et al. 1994). Climate change increases the rate of the reproductive cycle of insects and pests. Demand for more use of pesticides because of increasing in insect population, which causes more harmful effects to the ecosystem as well as human society (G. Malla 2008).

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