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Review Article

IMPACT OF CLIMATE CHANGE ON AGRICULTURE

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Abstract: Climate change has materialized as the leading global environmental concern. Agriculture is one of the zones most critically distressed by climate alteration. As global temperature rises and climate conditions become more erratic posing threat to the vegetation, biodiversity, biological progression and have enduring effect on food security as well as human health. The present review emphasizes multiple consequences of climate change on agricultural productivity.
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INTRODUCTION

Climate alteration is one of the most stupendous challenges facing the global commune. It has been recognized as a decisive global conversion leading to environmental deprivation and demographic hassle which displace millions of inhabitants and generate severe communal cataclysm. According to IPCC "Climate change is a statistically substantial disparity that endures for a comprehensive phase, typically decades or longer" (Malla, 2008). It comprises change in the frequency and extent of intermittent climate consequences with sluggish continuous intensification in global mean temperature. It is just about the emission of green house gases attributable to increased carbon sequestration by plants, incineration of fuels from mechanized commotion and transportation is perhaps the best known consequence of the rise in atmospheric CO_2 and other gases which results in prompt warming of World's climate. Although variation has always been a component of the world (Cheddadi et al., 1996) but escalating anthropogenic activities manipulating the surroundings and marine biospheres concurrently represent the global climate change.

Climate alteration i.e. increase in global mean temperature and vents of inconsistent rainfall affect crop production through direct impacts on the biophysical factors such as plant and animal growth and the physical infrastructure associated with food processing and distribution (Schmidhuber and Tubiello, 2007) to rising sea levels and accelerate corrosion of coastal zones, increasing intensity of instinctive catastrophe, species annihilation and spread of vector borne aliments. Change in ambience may also affect the phenology and dispersal series of both crop plants and there pollinators, leading to chronological and spatial divergence. Variation in climate pattern is also envisaged to increase invasion and proliferation of alien species. Warming may also facilitate weeds in comparison to crops and increase the profusion of many crop offensive pests (Cerri et al., 2007). According to NARC annual reports from 1987/88 to 1997/98, cold wave in Nepal had depressing impression on agricultural productivity and showed diminution in the production of crops viz. potato, toria, sarson, lentil and chickpea by 27.8, 36.5, 11.2, 30, 37.6 and 38% respectively (Malla, 2008).

Studies by Parry et al (1985) recommended that the crisis coupled with increased humidity stress under distorted climate regimen could be assuaged and yield could be augmented by switching over from spring wheat to winter wheat. Likewise, Rosenzweig (1985) assessed that the climate change would increase wheat production in Canada and also cause provincial alteration in wheat cultivars in US.Sinha and Swaminathan (1991) stated that 2ºC increments in mean air temperature results in dwindling rice acquiesce by about 0.75 ton/hectare in the high yield areas and by about 0.06

ton/hectare in low yield coastal region. Further a 0.5ºC increase in winter temperature would reduce wheat crop interval by 7 days and thus reduce yield by 0.45 ton/hectare. Aggarawal and Sinha (1993) reported the effect of climate variation on wheat yield in North India and found that 1ºC rise in mean temperature would have no momentous effects on yield while 2ºC increase would reduce yields. Liverman and O'Brien (1994) reported the effect of climate change on the production of maize and it was found that the yield vary from -61 to 6%. Similar studies in Brazil reported that due to climate change wheat yield vary from -50 to -15% (De Siqueira *et al*, 1994). Rao and Sinha (1994) reported the impact of climate change on wheat wheat yield and found that the wheat yield reduced by 28-68%. Muchena (1994) surveyed the impact of climate change on maize production in Zimbabwe and found that 2º rise in ambient temperature lead to deplorably minimal yield.

Darwin (1995) also assessed the impact of climate change and found 20-30% reduction in grain production. Fischer and Velthuizen (1996) investigated the influence of climate variation and reported that elevated temperature would have affirmative impact in higher land area. Likewise, Hulme (1996) reported that plant metabolism instigate to collapse above 40ºC. In addition to this, decline in growing periods owing to hastened progression can reduce the yield. Reilly et al (1996) assessed that a doubling of CO_2 concentration bring about yield recuperation from 10-30%. Mearn et al (1999) evaluated the impacts of climate change on corn and wheat yield in the Central Great Plain using 2 crop models (CERES and EPIC) and found considerable discrepancy between crop models. Lutze (1999) reported that crop growth under prominent CO_2 levels led to spring frost impairment in field grown seedling of snow gum (*Eucalyptus parviflora* Sieb, ex Spreng). It was found that increase in frost receptiveness may lower grains productivity. Likewise, studies by Gregory et al (1999) summarized experimental conclusion on wheat and rice crops that showed decreased crop interval of wheat as a result of warming and reduction in yields of rice about 5% per degree rise above 32ºC. Mendlesohn and Dinar (1999) also assessed the impact of climatic variation on agriculture by using three different methods viz. ricardian, agro economic model and agro ecological zone analysis. The result concluded by these models showed that increase in temperature will lower crop production especially for the crops grown in cool areas. Alezandrov and Hoogenboon (2000) reported that high CO_2 levels (330 ppm) resulted in yield reduction of winter wheat in Bulgaria. Murdiyasso (2000) estimated the probable influence of climate change and inconsistency on rice production in Asia, led to 7.4% of rice potential per degree increase in temperature. Likewise, Tubiello et al (2000) testified combined effects of increased CO_2 concentration and climate change and found reduction in crop yields by 10- 40%.

Studies by Rathore et al (2001) reported the impact of climate change on rice production in India by using CERES rice model and concluded that by the middle of 21st century, an increase in rice yield is expected in Central and South India. Studies by Uprety et al (2003) reported increase in rice grain yield due to elevated CO_2 concentration. The increased net photosynthetic rate and larger accretion of sugar contributed significantly to the accelerated development of leaves, tillers and finally grain yield. Similar studies by Lobel and Asner (2003) suggests a 17% decrease in both corn and soyabean yields in United States for each degree increase in growing season temperature indicating a higher pragmatic sensitivity of agriculture to temperature. Likewise, Pathak et al (2003) reported disapproving inclination of increasing solar radiation on potential yields of rice and wheat in Indo-Gangetic Plains of India. Seo et al (2005) examined the effect of climate variation on Srilankan agriculture which includes 4 important crops, rice; rubber, tea and coconut using 2 experimental model viz. Ricardian and AOCM methods. Both models showed that for all crops tested, increased precipitation expected to be favorable and benefit vary from 11-122% while increase in temperature seems to be harmful and loss ranges from -18 to -50% of the current agricultural productivity. Alteration in climate pattern lead to confirmation reduction in maize yield was reported by (Ciais et al, 2005).

Studies by Lobell et al. (2006) estimated the impact of climate change on six major perennial crops in California. It was found that without CO_2 fertilization, expected losses range from 0 to >40% depending on the crop and course of climate change. Deressa and Hassan (2009) have analyzed the profitable impact of climate alteration on crop production in Ethiopia by ricardian method. It was found that subsidiary increase in temperature during summer and winter has a negative substantial effect on net crop profit per hectare though minor increase in precipitation during spring possesses a positive significant effect. Ziska et al. (2010) assessed that increase in temperature along with higher atmospheric CO_2 may facilitate the growth and survival of many pests and diseases restricted to agricultural crops. Recently, Blanc (2012) evaluated the impact of climate change on Sub- Saharan Africa on yields of four different crops viz. millet, maize, cassava and sorghum. A panel statistics was used to correlate yield with temperature and precipitation. It was found that yield changes -19 to +6% for maize, zero for cassava, -47 to -7% for sorghum and -38 to -13% for millet under varied climatic regime. Similar studies testified by Teixeira et al. (2012) reported that increase in temperature increases the probability of heat stress throughout decisive reproductive phase which causes sterility, reduced yield and chance of inclusive crop malfunction. Impact of climate change on winter wheat and maize using the info crop model was studied by Haris et al. (2013). It was found that under changed climate, wheat yield decreased whereas the yield of winter maize increased due to warmer winters and enhanced CO_2 compared to baseline. In addition to this, duration of both crops was found to decrease owing to higher temperature.

CONCLUSION

It can be concluded that the inclusive impact of climate change i.e. variation in atmospheric structure and global ambience in terms of elevated level of CO_2 and other gases brings about hidden hunger crisis among individuals by decreasing indispensable nutrient content in food crops.

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