Agricultural Production and Food Security in Climate Change Process of Europe

Maliha AFREEN

Nigde Ömer Halisdemir University, Faculty of Agricultural Sciences and Technologies, Nigde, Turkey

Corresponding author: malihaafreen120@gmail.com

ORCID: 0000-0001-7542-1318

Abstract

Climate change is known as changing in weather and atmospheric air which remains for centuries and these changes could be happened naturally or due to human actions. These climatic changes might have negative effects on Agricultural production. In this review I will discuss about the negative effects of climate change on agriculture in Europe. These climatic changing negative factors include heavy rainfalls, drought and temperature instabilities, salinity, soil sterility, and insect pest outbreaks which leads to endangerment of natural life cycle, and have negative impacts on agricultural yield. In European countries temperature and rainfall are the major fluctuating factors which have negative impacts on agriculture food crops and becomes a threat for food security in future. The major food crops in Europe which can be effected by variability in climate includes wheat, rice, sorghum, maize and barley.

Keywords: Climate change, Agriculture production, crops, Food security

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INTRODUCTION

Conferring to scientists, climate change is a condition where atmospheric air have been changed and retain for centuries. Climate change known as collection of several atmospheric changes which can be happened by human activities or could be natural (Elsheikh et al., 2022b; Bağdatlı and Arıkan, 2020). This Global climate variation, negatively impacted on surrounding atmosphere by releasing carbon dioxide in the atmosphere (Bağdatlı and Can, 2019). It is considered that climate change produced due to Global warming which occurs by expulsion of many industrial gases included methane, nitrogen oxides, carbon dioxide, and ozone unceasingly in the air and enhancing the globe temperature (Bağdatlı and Belliturk, 2016; Bağdatlı and Arslan, 2020; Bağdatlı and Can, 2020). Growing Population is also an important reason for climate variation will raise several issue for worldwide food supply due to which numerous nutritional complications could rise in the upcoming future. Production of food is a major concern which could be effected by climatic variations (Bağdatlı et al., 2023), like upsurge in sea-level due to climate change, leads to the devastation of forests which are key source of food in many regions (Afreen et al., 2022).

Water, is an important element, for existence of living lives. Precipitation and Rainfall both are sources of water and various activities of living beings depends on both these aspects like life survival, Agricultural productivity, migration of living beings and urbanization (Bağdatlı and Arslan, 2019; Elsheikh et al., 2022a).

Global climatic variation also produce open surface evaporation causes rise in temperatures and precipitation, which are much significant dynamics for living lives, because it leads to continuing decline of water resources, endangerment of natural life cycle, and have negative impacts on agricultural yield. Plants growth and development also influenced by climatic variation, which also include drought and land ruining leads to less yield of agricultural crops (İstanbulluoğlu et al., 2013; Bağdatlı and Ballı, 2019). It was also observed that long-lasting tendency of growing temperature created a negative outcome of agricultural yield for the long period (Bağdatlı et al., 2014) like temperature of soil according to specific growing plant is also a significant aspect for improved yield of agricultural crops (Bağdatlı and Ballı, 2020).

All living beings like humans, plants, animals and fishes have been influenced by the life-threatening environmental situations all over the globe. The vulnerability to the global climatic situations has generated anxiety amongst the whole world because crop productivity might be conceded by variabilities in different environmental features that can threat food security (Lesk et al., 2016; Altieri and Nicholls, 2017). Climate variability and food uncertainty are the two main concerns of the 21st century era. About 815 million individuals are pretentious by malnutrition, hampering viable developmental schemes to attain the goal of eradicating hunger in 2030 (Richardson et al., 2018). The augmented frequency of heavy rainfalls, drought and temperature instabilities, salinity, soil sterility, and insect pest outbreaks are expected to declining crop production leading to extreme threats of hunger (Dhankher and Foyer, 2018).

Presently, the important concern is decreasing the stress on food security (Campbell et al., 2016). Sufficient food production for an increasing population has continuously been a challenge as humans turn out to be sedentary and began agriculture about 12,000 years back. This problem is not so far astounded, as the worldwide population remains to grow continuously (Cai et al., 2017). Higher level of agricultural crop production besides has its issues. The maximum use of agrochemicals joined with untenable practices of agronomy has directed to numerous external environmental factors. Agriculture also subsidizes to change in climate, accounting for almost 25% of the worldwide greenhouse gas secretions (IPCC, 2019). Climate variability will probably affect agricultural yield negatively by increasing temperatures, water stress, and increasing frequencies of extreme weather conditions.

This article presents an overview on changes in climate predicted at global level and successively focuses on the European Agricultural production. On the basis of studies on domestic crop yields, great differences in susceptibilities to existing changes in climate were identified across Europe. In Northern European region, the main concerns are cool temperature and short period for crop growth and development, whereas in Southern European region, extreme temperature and less rainfall limits the crop yield, though the utmost negative effects would be found for the main land climate in the Pannonian region, which comprises Serbia, Hungary, Romania and Bulgaria (Olesen et al., 2011).

It was expected that the increment of greenhouse gas secretions and sudden changes in climate will happen that might upsurge the crop productivity in North-Western Europe and decline the crop productivity in the Mediterranean region (Olesen and Bindi, 2002).

The European summer heat wave in 2003 was combined with predecessor lengthy drought era, caused an extensive shortfall of crop productivity in Southern parts of Europe and becomes the reason of approximate loss of 15 billion EUR (García-Herrera et al., 2010; Kurnik, 2017). Similarly in the 2018, northern and central European regions were facing a phase of abnormally extreme hot weather that has directed to record breaking drought and crop growth failure which was never happened in recent memory (The Guardian, 2018), except in 1976's extreme drought that happened in UK and rigorously affected agricultural production (Marsh et al., 2007). It was reported that, European drought 2018 has severely affected the European vegetable sector in the previous 40 years (Euractiv, 2018). In the latest history, Europe has faced numerous drought events, which were not only happened in the Mediterranean states and semi-arid states of Iberian Peninsula, but almost happened in whole territory, from Western Europe to East Europe, even in Scandinavia states (Spinoni et al., 2015).

CLIMATE CHANGE EFFECTS ON DIFFERENT CROPS

Wheat productivity is mainly influenced by the extreme temperature because of climatic variability in several countries, and might decrease the crop productivity by rising temperature (Asseng et al., 2015). The collective effect of drought and heat stresses on crop production have been observed in maize, sorghum, and barley. It was noticed that the collective effect of drought and heat stress had extra damaging results in comparison of individual stress (Wang and Huang, 2004). Likewise, if the temperature rise of around 30 ◦C at the time of blossom development it could be produce sterility in cereal crops. Throughout the meiotic phase, rice and wheat bared with 35–75% decline in grain set because of water deficiency, as drought stress significantly disturbs the procedure of anthesis and fertilization in rice crop (Ruf et al., 2015). It has been projected that agricultural productivity could decrease to 25.7% in 2080 because of climate variability and maize crop will be the maximum influenced crop in Mexico (Hellin et al., 2014). Wheat crop effected by drought stress throughout all developmental stages, however reproductive stage and grain formation are the utmost critical stages (Pradhan et al., 2012).

HOW CLIMATE CHANGE EFFECTS DIFFERENT EUROPEAN REGIONS

Assessments presents that European and non-European regions have differently effected by climate change and accordingly its influence on agriculture production and food security will differ for the different geographic regions. These influences on food security also include livestock production; growth of microalgae in oceans; mycotoxins growth on crops; remnants of pesticides and resistant pollutants; and pathogenic micro-organisms. Climatic conditions of different European regions is given below:

Central Europe

This region comprises Czech Republic, Poland, Hungary, Slovakia, Southern and Eastern Germany, Northern Romania, and Eastern Austria. It was estimated that Annual average temperature, has been increased 4 to 4.5 °C for Central European region and Black Sea Region.

Precipitation is estimated to upsurge in winter and lessening in summer, by an increasing risk of floods. Agriculture production of these regions is anticipated to be influenced by soil corrosion, loss of organic matter from soil, spreading of pests and crop diseases, drought and high temperature. In few regions, lengthy growing periods becomes advantageous for crops production (European Commission, 2007a).

Southern and South-Eastern Europe

This region comprises Spain, Portugal, Italy, Southern France, Greece, Slovenia, Cyprus, Malta and Bulgaria. It was estimated that annual average temperature, has been increased 4 to 5 °C for Southern European region and for the Black Sea region. Water availability, would be less, due to the possibility of hydropower commotion, especially in summer. When this condition combined with the increase of temperature might induce (i) declined agricultural productivity (ii) drought, (iii) heat stress (iv) ecosystem and soil degradation (v) finally desertification. The upsurge of fierce rainfall will increase soil erosion and consequently loss of organic material from soil (European Commission, 2007a).

Northern Europe

This region comprises Norway, Finland, Sweden, and Baltic States. It was estimated that annual average temperature, has been increased 3 to 4.5 °C in this region. Annual upsurge of precipitation up to 40% is also estimated with danger for floods and winter would be wetter (European Commission, 2007a). According to agricultural production, generally an increase in crop productivity was estimated due to frost free lengthy crop growing period and there could be a possibility for growing new crops, although new pests and crop diseases might appear (European Commission, 2007b). Pollution in the Baltic Sea and growth of Algal bloom could be produced in this region, which possibly causing food-related issues because of bio toxins accumulation in shellfish (European Commission, 2007a).

Western and Atlantic Europe

This region comprises Northern and Western France, Benelux, Northern Germany, United Kingdom, Netherlands, and Denmark. It was estimated that annual average temperature, has been increased 2.5 to 3.5 °C with dry and hot summers. There is greater intensities of precipitation exist, mainly in winter, and sturdy floods and storms are predicted to be more recurrent (European Commission, 2007a).

CONSEQUENCES OF CLIMATIC CHANGES IN EUROPE

Local conditions in regions of European Union will be influenced by the reduction in the amount of annual precipitation, extended dry periods and expected temperature upturns that may cause quicker growing periods and shorter lifespans. The length and timing of growing seasons may change geographically, so possibly changing the sowing and harvesting times and probably resulting in the necessity to alter crop varieties which have already used in a specific area. Crop systems might also be pretentious by rising of sea level and desertification which leads to decrease in cropping land. Crop productivity are estimated to vary crossways European countries. Southern Europe would possibly experience yield reduction in spring-sown crops like maize, soybean and sunflowers, the similar becoming further fit than before for farming in Northern regions.

Maize productivity is estimated to upsurge by 30 to 50% in Northern European areas whereas strongly decrease in the South of Europe (Wolf and Menne, 2007).

It was reported that higher temperatures, bigger occurrence and extent of extreme weather not only produce considerable changes in crop systems and productivity, but also increase amount of crop pests and changed transference ways of insects, pests, and plant infections, which will aggravate the productivity reduction and harm food security if suitable actions are not taken within due time. It was also noticed by scientists that fluctuation in precipitation patterns are more significant for crop pests and weeds' interfaces than a variation in yearly whole precipitation. The inconsistent heating at high elevations in winter can upset not merely crop growth and development, however also change the environmental balance amid the crop and its related pests (Rosenzweig and co-workers, 2001). The possible effect of climate variability on livestock does not much known for pubic as the effect on crop systems, however, both beneficial and harmful effects of climate variability on livestock could be assumed, according to the area and environmental conditions. The impacts of climate variability on livestock could be direct, like direct effect of high temperature stress on appetite of livestock. An indirect factor of climatic variability could be perceived in the demanded alteration of the quality and quantity of forages from grasslands and the sources of concentrates. Positive influences of climatic variability, like rising temperature and enough moisture, pretense advantageous consequences for efficient production in the affected areas (Watson et al., 2001; Bernstein et al., 2007).

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