International Research Journal of Research in Environmental Science and Toxicology Vol. 11(6)
pp. 1-3, November, 2022
Available online https://www.interesjournals.org/research-environmental-science-toxicology/archive.html

Editorial

Sugarcane Cultivation and its Impact on Climate Change

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Received: 31-Oct-2022, Manuscript No. JREST-22-84154; **Editor assigned:** 02-Nov-2022, PreQC No. JREST-22-84154 (PQ); **Reviewed:** 16-Nov-2022, QC No. JREST-22-84154; **Revised:** 21-Nov-2022, Manuscript No. JREST-22-84154 (R); **Published:** 28-Nov-2022, DOI: 10.14303/2315-5698.2022.14

Keywords: Geographical, Climate change

ENVIRONMENT

Sugarcane (Saccharum officinarum L.), a vital crop for bioenergy and sugar, is grown all over the world. As a result of climate change-induced global warming and rising greenhouse gas emissions, extreme weather events become more frequent and more intense. Climate change is anticipated to have significant effects on sugarcane production worldwide, particularly in developing nations, due to the world's relatively low adaptive capacity, high vulnerability to natural disasters, inadequate forecasting systems, and inadequate mitigation strategies. Climate change is likely to increase the frequency and severity of extreme environmental conditions, which could have harmed sugarcane production and will probably continue to do so (Takahiko Mitsui et al., 2021).

The extent to which sugarcane will be affected by climate change is influenced by both geographical location and adaptability. To more readily comprehend the impacts of environmental change on sugarcane creation, we explored sugarcane reaction to environmental change occasions, sugarcane creation in a few unique nations, and difficulties for sugarcane creation in environmental change in this paper. Then, we came up with plans for reducing the negative effects of climate change while also making sugarcane production more sustainable and profitable Michael Davies (2021).

Some crops, particularly C3 plants, may benefit from rising temperatures and atmospheric [CO2] levels in some regions. Climate variability and climate change are expected to alter sea levels, rainfall patterns, the frequency of extreme high and low temperatures, floods, droughts, and other abiotic stresses, as well as tornadoes and hurricanes (Szentágotai-Tătar A et al., 2017). The combination of high temperatures and drought stress is one of the main issues affecting agricultural production and economic effects worldwide. Under climate change scenarios, the agriculture sector faces the challenge of ensuring food security for a growing global population while simultaneously safeguarding the health of its ecosystems and the surrounding environment (Seo S et al., 2019). The majority of nations that rely heavily on rainfall and have inadequate mitigation mechanisms, little or no irrigation, or both, could see these issues worsen (Noble D et al., 2012). Agriculture is vulnerable to climate change because of both the direct effects of changing climate conditions (such as changes in temperature and/or precipitation) and the indirect effects of changing pest pressures, pollination services, and other ecosystem services that affect agricultural productivity (Noble PJ et al., 2019). The majority of status assessments on the effects of climate change predict a decrease in crop productivity. Climate change poses unprecedented challenges to agriculture because of the sensitivity of agricultural productivity and the costs associated with improving growth environmental conditions. Adaptive action can control the effects of climate change by altering patterns of agricultural activity to take advantage of new opportunities and reduce costs associated with negative effects.Sugarcane is an important industrial crop that is also used to make bioenergy and sugar (Grandjean P et al., 2006). One of the most important C4 crops, it is primarily grown in tropical and subtropical regions of the world. Weather and climate-related events, such as the growth environment of the atmosphere,

 ISSN: 2315-5698

temperature, precipitation, and other extreme weather, are the primary determinants of sugarcane output worldwide, particularly in many developing nations. Chandiposha has investigated the potential negative effects of climate change on sugarcane production in Zimbabwe, particularly in terms of temperature and rainfall (Santos Jet al., 2015) . The sugarcane crop and sugar production have changed as a result of extreme climate events like drought and tropical cyclones. In 1994, Fiji produced a record amount of sugar (516,529 tonnes) thanks to favorable weather; However, production decreased by 47, 50, and 43 percent in 1997, 1998, and 2003, respectively. Using crop simulation models, Marin discovered that climate change increased sugarcane yield and water efficiency in several Brazilian regions (Lloyd Det al ., 2001). They predict that the average amount of cane produced in 2050 could rise by 15 to 59 percent. Sugarcane photosynthesis, water use efficiency, biomass, and productivity have all increased in controlled environments, according to studies. At higher temperatures, sugarcane uses water more efficiently because of lower stomatal conductance. Sugarcane's growth and development are affected by the stage of plant development, the severity of the water shortage stress, and the length of the stress as a result of climate change-induced drought. Cane production typically decreases as a result of drought, resulting in a low sucrose yield, particularly in the early and middle stages of growth. Stalk sugar concentration can be increased by moderate dryness during the late growth stage. Drought is the most significant stressor for sugarcane production in China, ranked third globally, as more than 80% of sugarcane grows in rainfed conditions. Guangxi saw a lot of sugarcane production in 2007–2008 due to favorable growth conditions and the optimal distribution of rainfall For instance, due to financial considerations, sugarcane farmers in China's major production regions (Guangxi, Yunnan, Guangdong, and Hainan) have planted other crops that are more lucrative. Sugarcane acreage in Guangxi, the country's largest cane-producing province, is expected to decrease by 6% in 2014–15, according to the Provincial Sugar Industry Bureau, as farmers cultivate trees that require little labor and grow quickly for industrial use. As per commonplace measurements, Hainan's stick hectarage is anticipated to diminish 11% in 2014-15 as a result of low productivity. In addition to low prices, the company's low profitability is largely attributable to high labor costs. Because more than half of the sugarcane acreage is located in hilly areas where mechanized operation is impossible, hand labor is used extensively for harvesting, field management, and planting. When evaluating agricultural and crop production systems, as well as climate change and its detrimental effects on crop production, numerous economic, environmental, and social considerations must be carefully taken into account. Consider carefully how to deal with contradictions between climate change and crop production systems, how to strike a balance between short-term and long-term objectives, how to introduce new technologies and transfer them to growers, how to adhere to environmental regulations, and so on. Sugarcane production systems are undoubtedly also challenged by these particular issues (Auffray C et al., 2008).

Impact Reduction of a Stressful Environment While Maintaining Sugarcane Production The world's sugarcane production has tripled in the last 41 years due to increased demand. This is despite the fact that climate change raises the uncertainty and sensitivity of adverse effects on agriculture and increases the frequency and intensity of extreme weather events. In most non-industrial countries, as referenced over, the rising stick creation was connected to expansions in both stick yield and hectarage. In light of both the current circumstances and the effects that climate change is expected to have, much more work needs to be done to focus on increasing revenues and yield. Crop genotypes, biotic and abiotic growing conditions (such as insects, diseases, weeds, and other climate-related factors), and management practices all have an impact on sugarcane yield.

Therefore, increasing green harvest can increase soil organic carbon and reduce sugarcane production's CO2 emissions. The impact that perennial bioenergy crops have directly on the climate in the United States. A thorough analysis of the costs and benefits of bioenergy-related land use change must take into account potential effects on the surface energy and water balance in order to fully address significant climate change concerns at the local, regional, and global levels. Sugarcane is a plant that can grow relatively more quickly than other plants because it can fix carbon at the C4 level. In a recent Brazilian study, it was found that when natural vegetation is converted to a crop or pasture during clear skies during the day, the region warms by an average of 1.55 (1.45–1.65) °C, while the region cools by an average of 0.93 °C when the crop or pasture is converted to sugarcane. It is clear that climate change has and will continue to affect sugarcane production. The escalating frequency and severity of extreme weather, particularly drought caused by climate change, are the biggest obstacles to sugarcane production. Current adaptation strategies can mitigate a number of future effects, but not all of them. If greenhouse gas emissions continue to be high, it is very likely that the negative effects of climate change on sugarcane production will get worse after 2050. Some of the multidisciplinary approaches that should be utilized to improve sugarcane yields and mitigate the potential negative effects of climate change on agriculture include the development of new cultivars using breeding and molecular biology, the enhancement of best management practices, the enhancement of new technology transfer, and increased productivity and profitability. Additionally, these approaches should be used to improve productivity and profitability. For sugarcane production systems to be sustainable and more resilient to climate change, natural resources like water and soil must be safeguarded. Utilizing sugarcane products for ethanol, cellulosic biofuel, and other coproducts can boost profits even further.

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