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Impact of green house gases on fruits production

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Abstract
The increased concentration of carbon dioxide (CO_2) and other greenhouse effect gases has led to global warming, which has resulted in climate change, increased levels of ultraviolet (UV) radiation and changes in the hydrological cycle, affecting the growth, production and fruit quality, which undoubtedly will be difficult to predict and generalize because the physiological processes of plants are multidimensional. Changing climate refers to a statistically significant variation either the state of climate or in its variability, persisting for an extended period. Its significant change in climate on a global as well as national level will impact horticulture and consequently affect the production systems. This article outlines how green house gasses in the atmosphere affect fruit crops.

Keywords: Green house gases, climate change, fruit production

Introduction
Climate change is a change of climate over comparable period of time that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere. The global mean temperature of the earth's surface has increased by about 0.74°C over last hundred years. The variation in surface temperature indicated that 1990's decade has been the warmest in the past millennium and 1998 was the warmest year. The rise in temperature is attributed to alarming increase in the atmospheric concentration of greenhouse gases viz., CO_2, CH_4, N_2O and chlorofluorocarbons mainly due to accelerated rate of industrialization. The expected carbon dioxide concentration in 2100 is estimated to be 100% higher than the one observed at the pre-industrial era. With global temperatures expected to rise by up to 6°C by the end of the 21st century compared to pre-industrial levels, it is unlikely that this agro climatic metric will remain stable (Singh, 2010) [1].

An orchard is characterized by an environment composed of light, temperature, water, humidity, wind, various atmospheric gases, soil nutrients and other conditions of the rhizosphere. During the growth of plants different climatic and stress factors are effective at the same time for the crop, i.e. drought, heat, UV light, etc. Climatic factor alone can decide the physiological staging, for example, photosynthesis depends not only on radiation, but also on temperature, Carbon dioxide, water and nutritional elements. As shown by these authors, planting a crop in an eco-physiologically unfit place increases the costs of production and, thus, reduces the chance of high economic success. Taking into account environmental factors, at a given site, growing conditions decide on the size of the plant, the duration of phenological stages, the time and volume of the harvest.

Effect of green house gases on fruit plants
Solar radiation: The visible solar radiation is essential as a source of energy for photosynthetic activity in plants, with its key role as an energy source for biomass production and finally fruit crops yield. Long periods of low radiation, with diffused or reduced light, stimulate the longitudinal growth of fragile vegetative structures because of an undersupply with carbohydrates (Dwivedi and Dwivedi, 2012) [3]. Therefore, the correct and not excessive density of plants and branches as well as the tree height and shape of the crown, which are regulated by pruning and espalier, and also by the direction of the rows from north to south, are important aspects to maximize light interception in plantations.

Temperature: Das (2012) [2] narrated that "plants can grow only within certain limits of temperature".

Global warming stimulates crop growth and, thus, shortens the time of fruit formation, and the number of fruits and seeds within may be reduced by the effects of high temperatures on reproduction, particularly the formation and function of pollen. In peaches, a shortening of the earlier phases of fruit development by high temperatures can decrease fruit size and yield. These authors indicated that the shorter growing season would result in lower seasonal water loss by transpiration despite of increased temperature. Countries in the northern hemisphere will benefit more from rising temperatures because the growing season will be extended.

Soil temperature: The soil temperature influences such important processes as the germination and emergence of seeds, absorption of water and nutrients and synthesis of hormones (cytokinins and gibberellins) in the roots, among others. For example, in the citrus root zone, the temperature must exceed 12°C for bud sprouting and this event can be at any time of the year.

Water: Water not only plays an important role in plant physiological process but also in the illumination of the planet atmosphere with oxygen. In the process of photosynthesis, two H_2O molecules are broken to produce O_2, released into the atmosphere, while the resulting hydrogen is used in the reduction of CO_2 to carbohydrates. In fruit trees, many juicy fruits water contain between 80 and 90%, while young twigs and leaves about 55-60%.

Soil waterlogging: Large cropping areas within Colombia have been affected by climate change abiotic stresses such as waterlogging and flooding. Both stresses have been intensified by climate change conditions. Since 2007, there has been an increase in heavy and prolonged rains in numerous provinces across Colombia. Heavy rainfall also can occur during the "dry" months of the year, affecting large scale fruit tree orchards because lacking of an efficient drainage system. Root anaerobic conditions are generated as a consequence of poor drainage (Das, 2012) [2]. Furthermore, many fruit trees require a water table level ≥1-1.5 m.

Carbon dioxide: Because of the high level of emissions, the concentration of CO_2 is now as high as 398 μmol mol^{-1} in the atmosphere. The carbon dioxide level is one of the most regulated growth factor for fruit trees. The increase of CO_2 concentration in the air near the leaf blade decreases stomatal aperture, stomatal conductance and transpiration; in consequence, photosynthesis and growth increase because of elevated water use efficiency. An increase in growth because of an elevated CO_2 requires higher water and fertilizer supply. This is because more nitrogen is required to ensure high crop productivity under climate change conditions.

Future research strategies for optimizing production under climate scenario

Crop improvement strategies

1. Introduction of low chilling cultivars of pome, stone and nut fruits.
2. Introduction and collection of gene source from plant and animal kingdom for future improvement.
3. Multiformity with other high value fruit crops like peach, apricot, walnut, kiwi.
4. Development of new genotypes having resistance to high temperature and CO_2 concentrations.
5. Marker assisted selection and development of transgenic having resistance to biotic and abiotic resistance.
6. Development of genotypes having resistance to heat and drought.

Development of agro-techniques

1. Evaluation of the environmental impacts of apple production using Life Cycle Assessment (LCA) in order to evaluate alternative agricultural production methods that may reduce environmental impacts, assessment tools are required that measure the consequences of changing systems.
2. Extreme events, such as late spring frost or windstorm, may cause crop failure. Future climate may also increase incident of extreme impacts on crops, e.g. weather conditions resulting in significant reduction in yield and quality (for example severe drought or prolonged soil wetness).
3. To develop a set of high resolution daily based climate change scenarios, suitable for analysis of agricultural extreme events
4. To identify climatic threshold having various impacts on yield, quality and environment for representative crops and to assess the risks that these thresholds will be exceeded under climate change
5. To analyze extreme weather impacts on reproductive and vegetative crop yields, using crop simulation models
6. Identify key inputs/outputs associated with crop production and determine their environmental impact.
7. Determine the impact of horticulture in different geographical areas.

Plant protection strategies

1. Strengthen surveillance of pest and diseases.
2. To study the pattern of increasing climatic variability and change could lead to rapid movement of pathogens and insect pests.

Post harvest management strategies

1. Development of cost effective storage techniques.
2. Development of varieties having longer shelf life.
3. Studies on mitigation of post harvest spoilage

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