Modeling Plant Response to Changing Environment: Consequences of Rising Carbon Dioxide Concentration

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After an industrial revolution, different environmental parameters are changing creating different changes in the environment and its components. Including all living beings, plants are also getting affected by different changes in the environment. In order to capture the response of plants to different changes in the environment, this study tries to conduct series of experiment resembling the present and changing future scenario. Focusing on plant and its growth, the study tries to go in-depth focusing on the changing carbon dioxide concentration in the environment. Increased photosynthesis rate and decreased stomatal conductance are the major identified factors stimulating plant growth under rising carbon dioxide concentration. However, different plant groups including different grasses, legumes, and forbs show a different response to changing the environment. Hence, the study aims to model the plant response to rising carbon dioxide using crop and spatial models. Major global food crops were selected and were grown under ambient and elevated growth chamber. Major parameters including photosynthetic rate, stomatal conductance, yield, and biomass were measured under different carbon dioxide concentration. The growth and physiological responses are then modeled using Agricultural Production System Simulator (APSIM) for each individual crop. Finally, with all the crop simulation completed, spatial modeling is carried out using Geographic Information System (GIS) methods to estimate and visualize the effects across different regions in the world. Further, a meta-analysis is carried out using up to date publish literate to improve the model capabilities. Therefore, the proposed study helps to advance our understanding of the response of different environmental parameters including carbon dioxide concentration on different plant groups. This will hence, help to plan crops under changing environmental conditions to maintain the potential yield over various agricultural regions. Further, the model can hence be adapted or adjusted to any other regions of agricultural benefits.

Keywords: carbon dioxide concentration, environmental change, plants, modeling

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