

THE IMPACT OF ELEVATED LEVELS OF CARBON DIOXIDE ON HOST PLANTS, INSECT PESTS, AND THEIR NATURAL ENEMIES: IMPLICATIONS FOR TROPICAL AGRICULTURE AND TROPICAL FRUITS

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Of all the climate change drivers, the rise in the carbon dioxide (CO₂) concentration of the atmosphere, due to fossil fuel combustion and other anthropogenic activities, is the most-well documented. This concentration is expected to continue to increase, doubling from the current level during the next century. The broad consensus is that this rise will result in hotter and drier environments in many parts of the world, which would also affect plant productivity. There is a vast literature on the direct effects of elevated levels of CO₂ on plants, and to a lesser extent on the effects on tri-trophic interactions (host plants-insect herbivores-natural enemies). Thus this paper reviews and summarizes our current understanding of this topic. It also discusses and provides insights on the implications of these effects on food and nutrition security in tropical agriculture and tropical fruits. Effects of elevated CO₂ on plant physiology, morphology, and phytochemistry are variable and not universal for most crops. These changes in the host plants affect insect herbivory either directly or indirectly. However, individual species' responses to elevated CO₂ among feeding guilds are inconsistent and remain unclear. The effects on natural enemy populations from elevated CO₂ are relatively few to be able to conclude if species-specific natural enemy actions will be buffered, amplified, or will have no significant changes. The overall impacts of tri-trophic interactions with elevated CO₂ are expected to be negative and consequently will threaten food and nutritional security in tropical agriculture regions. In future, more collaborative research is needed in the tropics especially on tropical fruits under long-term CO₂ plots, using controlled environment closed chambers, greenhouses, open and closed field top chambers, and free-air carbon dioxide enrichment (FACE) experiments, to understand the impacts of elevated CO₂.

Keywords: elevated carbon dioxide, tri-trophic interactions, food and nutritional security, impacts, tropical fruits