



This is the print version of the [Skeptical Science](http://sks.to/plant) article '[CO2 is plant food](http://sks.to/plant)', which can be found at <http://sks.to/plant>.

What The Science Says:

More Carbon Dioxide in the atmosphere is not necessarily good for plants.

Climate Myth: CO2 is plant food

Earth's current atmospheric CO2 concentration is almost 390 parts per million (ppm). Adding another 300 ppm of CO2 to the air has been shown by literally thousands of experiments to greatly increase the growth or biomass production of nearly all plants. This growth stimulation occurs because CO2 is one of the two raw materials (the other being water) that are required for photosynthesis. Hence, CO2 is actually the "food" that sustains essentially all plants on the face of the earth, as well as those in the sea. And the more CO2 they "eat" (absorb from the air or water), the bigger and better they grow. (source: [Plants Need CO2](#))

An argument made by those who prefer to see a bright side to climate change is that carbon dioxide (CO2) being released by the burning of fossil fuels is actually good for the environment. This conjecture is based on simple and appealing logic: if plants need CO2 for their growth, then more of it should be better. We should expect our crops to become more abundant and our flowers to grow taller and bloom brighter.

However, this "more is better" philosophy is not the way things work in the real world. There is an old saying, "Too much of a good thing can be a bad thing." For example, if a doctor tells you to take one pill of a certain medicine, it does not follow that taking four is likely to heal you four times faster or make you four times better. It's more likely to make you sick.

It is possible to boost growth of some plants with extra CO2, under controlled conditions inside of greenhouses. Based on this, 'skeptics' make their claims of beneficial botanical effects in the world at large. Such claims fail to take into account that increasing the availability of one substance that plants need requires other supply changes for benefits to accrue. It also fails to take into account that a warmer earth will see an increase in deserts and other arid lands, reducing the area available for crops.

Plants cannot live on CO2 alone; a complete plant metabolism depends on a number of elements. It is a simple task to increase water and fertilizer and protect against insects in an enclosed greenhouse but what about doing it in the open air, throughout the entire Earth? Just as increasing the amount of starch alone in a person's diet won't lead to a more robust and healthier person, for plants additional CO2 by itself cannot make up for deficiencies of other compounds and elements.

What would be the effects of an increase of CO2 on agriculture and plant growth in general?

1. CO2 enhanced plants will need extra water both to maintain their larger growth as well as to compensate for greater moisture evaporation as the heat increases. Where will it come from? In many places rainwater is not sufficient for current agriculture and the aquifers they rely on are running dry throughout the Earth ([1](#), [2](#)).

On the other hand, as predicted by climate research, we are experiencing more intense storms with increased rainfall rates throughout much of the world. One would think that this should be good for agriculture. Unfortunately when rain falls in short, intense bursts it does not have time to soak into the ground. Instead, it quickly floods into creeks, then rivers, and finally out into the ocean, often carrying away large amounts of soil and fertilizer.

2. Unlike Nature, our way of agriculture does not self-fertilize by recycling all dead plants, animals and their waste. Instead we have to constantly add artificial fertilizers produced by energy-intensive processes mostly fed by hydrocarbons, particularly from natural gas which will eventually be depleted. Increasing the need for such fertilizer competes for supplies of natural

gas and oil, creating competition between other needs and the manufacture of fertilizer. This ultimately drives up the price of food.

3. Too high a concentration of CO₂ causes a [reduction of photosynthesis](#) in certain of plants. There is also [evidence from the past of major damage](#) to a wide variety of plants species from a sudden rise in CO₂ (See illustrations below). Higher concentrations of CO₂ also reduce the nutritional quality of some staples, [such as wheat](#).

4. As is confirmed by [long-term experiments](#), plants with exorbitant supplies of CO₂ run up against limited availability of other nutrients. These long term projects show that while some plants exhibit a brief and promising burst of growth upon initial exposure to CO₂, effects such as the ["nitrogen plateau"](#) soon truncate this benefit

5. Plants raised with enhanced CO₂ supplies and strictly isolated from insects behave differently than if the same approach is tried in an otherwise natural setting. For example, when the growth of soybeans is boosted out in the open this creates changes in plant chemistry that makes these specimens more vulnerable to insects, as the illustration below shows.



Figure 1: Plant defenses go down as carbon dioxide levels go up, the researchers found. Soybeans grown at elevated CO₂ levels attract many more adult Japanese beetles than plants grown at current atmospheric carbon dioxide levels. [Science Daily; March 25, 2008](#). (Credit: Photo courtesy of Evan Delucia)



Figure 2: More than 55 million years ago, the Earth experienced a rapid jump in global Carbon Dioxide levels that raised temperatures across the planet. Now, researchers studying plants from that time have found that the rising temperatures may have boosted the foraging of

insects. As modern temperatures continue to rise, the researchers believe the planet could see increasing crop damage and forest devastation. [Science Daily; Feb. 15, 2008.](#)

Figure 3: Global Warming reduces plant productivity. As Carbon Dioxide increases, vegetation in Northern Latitudes also increases. However, this does not compensate for decreases of vegetation in Southern Latitudes. The overall amount of vegetation worldwide declines

6. Likely the worst problem is that increasing CO₂ will increase temperatures throughout the Earth. This will make deserts and other types of dry land grow. While deserts increase in size, other eco-zones, whether tropical, forest or grassland will try to migrate towards the poles. Unfortunately it does not follow that soil conditions will necessarily favor their growth even at optimum temperatures.

In conclusion, it would be reckless to keep adding CO₂ to the atmosphere. Assuming there are any positive impacts on agriculture in the short term, they will be overwhelmed by the negative impacts of climate change.

Added CO₂ will likely shrink the range available to plants while increasing the size of deserts. It will also increase the requirements for water and soil fertility as well as plant damage from insects.

Increasing CO₂ levels would only be beneficial inside of highly controlled, enclosed spaces like greenhouses.

Basic rebuttal written by doug_bostrom

Update July 2015:

Here is a related lecture-video from [Denial101x - Making Sense of Climate Science Denial](#)



Skeptical Science explains the science of global warming and examines climate misinformation through the lens of peer-reviewed research. The website won the Australian Museum 2011 Eureka Prize for the Advancement of Climate Change Knowledge. Members of the Skeptical Science team have authored peer-reviewed papers, a [college textbook on climate change](#) and the book [Climate Change Denial: Heads in the Sand](#). Skeptical Science content has been used in university courses, textbooks, government reports on climate change, television documentaries and numerous books.



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