High yield crops keep carbon emissions low

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The Green Revolution of the late 20th century increased crop yields worldwide and helped feed an expanding global population. According to a new report published in the *Proceedings of the National Academy of Sciences,* it also has helped keep greenhouse gas emissions at bay. The researchers estimate that since 1961 higher yields per acre have avoided the release of nearly 600 billion tons of carbon dioxide to the atmosphere.

"That's about 20 years of fossil fuel burning at present rates," says study co-author Steven Davis of the Carnegie Institution's Department of Global Ecology. "Our results dispel the notion that industrial agricultural with its petrochemicals are inherently worse for the climate than a more 'old-fashioned' way of doing things."

Agriculture is a major source of greenhouse gases. The high-yield crop varieties developed during the Green Revolution produced a bounty of food, but they also increased agriculture's reliance on pesticides, fertilizers, and mechanization. The research team, which also included lead author Jennifer Burney and David Lobell of Stanford University, investigated the net effect of Green Revolution crops on greenhouse gas emissions during the period between 1961 and 2005.

They found that although the various inputs to modern farms require more energy and greenhouse gas emissions per unit of food output than did the lower-input methods of the past, crop yields have increased by 135%, reducing the amount of cropland needed to produce the same amount of food. Without these advances, the conversion of vast natural

areas to agriculture would have caused much more greenhouse gas emissions—the equivalent of nearly 600 billion tons of CO2 since 1961.

"Converting a forest or some scrubland to an agricultural area causes a lot of natural carbon in that ecosystem to be oxidized and lost to the atmosphere" says Davis ."What our study shows is that these indirect impacts from converting land to agriculture outweigh the direct emissions that come from the modern, intensive style of agriculture."

The researchers also calculated the benefits of investing in agricultural research as a strategy for reducing greenhouse gas emissions. They estimate that since 1961 agricultural research has averted carbon dioxide emissions at a cost of about $4 per ton of CO2. The potential for emissions reduction compares favorably with other strategies. Agricultural advances have prevented about 13 billion tons of carbon dioxide emissions each year, much more than the estimated 1.8 billion tons obtainable by improvements in energy supply or the estimated 1.7 billion from improved transportation systems.

"Agricultural research is one of the cheapest ways of preventing greenhouse gas emissions," says Davis. "And if the past few decades are a guide, it is also a large source of potential reduction."

Provided by Carnegie Institution