

Science News

from research organizations

The waste product which could help mitigate climate change

Biochar can boost crop yields in poor soils and help stop the effects of climate change, study finds

Date: August 4, 2021

Source: University of New South Wales

Summary: Biochar can boost crop yields in poor soils and help stop the effects of climate change, study finds.

Share: [!\[\]\(faf942dc3e59ce8eb64b4ac481eca7e0_img.jpg\)](#) [!\[\]\(f6b0299e0b5e4340e509b71914970da0_img.jpg\)](#) [!\[\]\(b5153706f6ea2fc2c42e8803b6804d18_img.jpg\)](#) [!\[\]\(2b8adb27d8c9518333278b6317e2d8a2_img.jpg\)](#) [!\[\]\(a190466037967efc7087885259e58e7a_img.jpg\)](#)

FULL STORY

A product made from urban, agriculture and forestry waste has the added benefit of reducing the carbon footprint of modern farming, an international review involving UNSW has found.

Visiting Professor in the School of Materials Science and Engineering at UNSW Science, Stephen Joseph, says the study published in *GCB Bioenergy* provides strong evidence that biochar can contribute to climate change mitigation.

"Biochar can draw down carbon from the atmosphere into the soil and store it for hundreds to thousands of years," the lead author says. "This study also found that biochar helps build organic carbon in soil by up to 20 per cent (average 3.8 per cent) and can reduce nitrous oxide emissions from soil by 12 to 50 per cent, which increases the climate change mitigation benefits of biochar."

The findings are supported by the Intergovernmental Panel on Climate Change's recent Special Report on Climate Change and Land, which estimated there was important climate change mitigation potential available through biochar. "The intergovernmental panel found that globally, biochar could mitigate between 300 million to 660 million tonnes of carbon dioxide per year by 2050," Prof. Joseph says. "Compare that to Australia's emissions last year -- an estimated 499 million tonnes of carbon dioxide -- and you can see that biochar can absorb a lot of emissions. We just need a will to develop and use it."

Biochar is the product of heating biomass residues such as wood chips, animal manures, sludges, compost and green waste, in an oxygen-starved environment -- a process called pyrolysis. The result is stable charcoal which can cut greenhouse emissions, while boosting soil fertility. The GCB Bioenergy study reviewed approximately 300 papers including 33 meta-analyses that examined many of the 14,000 biochar studies that have been published over the last 20 years.

"It found average crop yields increased from 10 to 42 per cent, concentrations of heavy metals in plant tissue were reduced by 17 to 39 per cent and phosphorus availability to plants increased too," Prof. Joseph says. "Biochar helps plants resist environmental stresses, such as diseases, and helps plants tolerate toxic metals, water stress and organic compounds such as the herbicide atrazine." The study details for the first time how biochar improves the root zone of a plant. In the first three weeks, as biochar reacts with the soil it can stimulate seed germination and seedling growth. During the next six months, reactive surfaces are created on biochar particles, improving nutrient supply to plants. After three to six months, biochar starts to 'age' in the soil and forms microaggregates that protect organic matter from decomposition.

Prof. Joseph says the study found the greatest responses to biochar were in acidic and sandy soils where biochar had been applied together with fertiliser. "We found the positive effects of biochar were dose dependent and also dependent on matching the properties of the biochar to soil constraints and plant nutrient requirements," Prof. Joseph says. "Plants, particularly in low-nutrient, acidic soils common in the tropics and humid subtropics, such as the north coast of NSW and Queensland, could significantly benefit from biochar. "Sandy soils in Western Australia, Victoria and South Australia, particularly in dryland regions increasingly affected by drought under climate change, would also greatly benefit."

Prof. Joseph AM is an expert in producing engineered stable biochar from agriculture, urban and forestry residues. He has been researching the benefits of biochar in promoting healthy soils and addressing climate change since he was introduced to it by Indigenous Australians in the seventies. He says biochar has been used for production of crops and for maintaining healthy soils by Indigenous peoples in Australia, Latin America (especially in the Amazon basin) and Africa for many hundreds of years.

Biochar has also been recorded in the 17th Century as a feed supplement for animals. But while Australian researchers have studied biochar since 2005, it has been relatively slow to take off as a commercial product, with Australia producing around 5000 tonnes a year. "This is in part due to the small number of large-scale demonstration programs that have been funded, as well as farmers' and government advisors' lack of knowledge about biochar, regulatory hurdles, and lack of venture capital and young entrepreneurs to fund and build biochar businesses," Prof. Joseph says.

In comparison, the US is producing about 50,000 tonnes a year, while China is producing more than 500,000 tonnes a year. Prof. Joseph, who has received an Order of Australia for his work in renewable energy and biochar, says to enable widespread adoption of biochar, it needs to be readily integrated with farming operations and be demonstrated to be economically viable. "We've done the science, what we don't have is enough resources to educate and train people, to establish demonstrations so farmers can see the benefits of using biochar, to develop this new industry," he says.

However this is slowly changing as large corporations are purchasing carbon dioxide reduction certificates (CORC's) to offset their emissions, which is boosting the profile of biochar in Australia. Biochar has potential in a range of applications. Prof. Joseph co-authored a recent study in *International Materials Reviews* which detailed the less well-known uses of biochar, such as a construction material, to reduce toxins in soil, grow microorganisms, in animal feed and soil remediation. UNSW has a collaborative grant with a company and a university in Norway to develop a biochar based anti-microbial coating to kill pathogens in water and find use in air filtration systems, he says.

Stephen Joseph is a member of the Australian New Zealand Biochar Industries Group. The Universities where he works have received grants from both state and federal governments and from companies for the development and testing of biochars. He has also assisted companies and farmers develop fit for purpose biochars and equipment to make biochar.

Story Source:

Materials provided by **University of New South Wales**. Original written by Diane Nazaroff. *Note: Content may be edited for style and length.*

Journal Reference:

1. Stephen Joseph, Annette L. Cowie, Lukas Van Zwieten, Nanthi Bolan, Alice Budai, Wolfram Buss, Maria Luz Cayuela, Ellen R. Graber, Jim Ippolito, Yakov Kuzyakov, Yu Luo, Yong Sik Ok, Kumuduni Niroshika Palansooriya, Jessica Shepherd, Scott Stephens, Zhe (Han) Weng, Johannes Lehmann. **How biochar works, and when it doesn't: A review of mechanisms controlling soil and plant responses to biochar.** *GCB Bioenergy*, 2021; DOI: 10.1111/gcbb.12885

Cite This Page:

MLA	APA	Chicago
-----	-----	---------

University of New South Wales. "The waste product which could help mitigate climate change: Biochar can boost crop yields in poor soils and help stop the effects of climate change, study finds." ScienceDaily. ScienceDaily, 4 August 2021. <www.sciencedaily.com/releases/2021/08/210804123613.htm>.

RELATED STORIES

Reducing Reliance on Nitrogen Fertilizers With Biological Nitrogen Fixation

Mar. 26, 2020 — Crop yields have increased substantially over the past decades, occurring alongside the increasing use of nitrogen fertilizer. While nitrogen fertilizer benefits crop growth, it has negative effects ...

Farmer Adjustments Can Offset Climate Change Impacts in Corn Production

Nov. 9, 2018 — New research looks closely at the future of maize crop yields with the effects of climate ...

Integrating Two Types of Crop Models to Predict the Effect of Climate Change on Crop Yields

Jan. 3, 2018 — Scientists now have a new tool to predict the future effects of climate change on crop yields. Researchers are attempting to bridge two types of computational crop models to become more reliable ...

Climate Change to Deplete Some US Water Basins Used for Irrigation

July 12, 2017 — Certain hotspots in the country will experience severe reductions in crop yields by 2050, due to climate change's impact on irrigation, a new study by climate scientists, economists, and agriculture ...

FROM AROUND THE WEB

ScienceDaily shares links with sites in the TrendMD network and earns revenue from third-party advertisers, where indicated.

German industry counts cost of climate ambitions

International Journal of Climate Change Strategies and Management, 2009

Agro-residue biochar and N fertilizer addition mitigates CO₂-C emission and stabilized soil organic carbon pools in a rain-fed agricultural cropland

Segun O. Oladele et al., The International Soil and Water Conservation Research (ISWCR), 2020

The cost of carbon management using ocean nourishment

Ian S.F. Jones, International Journal of Climate Change Strategies and Management, 2014

Soil study finds "flaw" in climate change models

Management of Environmental Quality, 2010

Cradle to grave GHG emissions analysis of shale gas hydraulic fracking in Western Australia

Sangita Bista et al., Renewable Energy and Environmental Sustainability, 2017

Carbon sequestered in the trees on a university campus: a case study

Charl De Villiers et al., Sustainability Accounting, Management and Policy Journal, 2014

Ingenuity Taps Mediterranean, Balkan Distributor

GenomeWeb, 2010

Meridian Bioscience Furthers Push into Molecular Biology with Bioline Buy

GenomeWeb, 2010

Powered by **TREND MD**

Free Subscriptions

Get the latest science news with ScienceDaily's free email newsletters, updated daily and weekly. Or view hourly updated newsfeeds in your RSS reader:

 [Email Newsletters](#)

 [RSS Feeds](#)

Follow Us

Keep up to date with the latest news from ScienceDaily via social networks:

 [Facebook](#)

 [Twitter](#)

 [LinkedIn](#)

Have Feedback?

Tell us what you think of ScienceDaily -- we welcome both positive and negative comments. Have any problems using the site? Questions?

 [Leave Feedback](#)

 [Contact Us](#)

[About This Site](#) | [Staff](#) | [Reviews](#) | [Contribute](#) | [Advertise](#) | [Privacy Policy](#) | [Editorial Policy](#) | [Terms of Use](#)

Copyright 2021 ScienceDaily or by other parties, where indicated. All rights controlled by their respective owners.

Content on this website is for information only. It is not intended to provide medical or other professional advice.

Views expressed here do not necessarily reflect those of ScienceDaily, its staff, its contributors, or its partners.

Financial support for ScienceDaily comes from advertisements and referral programs, where indicated.

— CCPA: Do Not Sell My Information — — GDPR: Privacy Settings —