Soils offer new hope as carbon sink

June 1 2007

Trials of agrichar using pyrolysis
The huge potential of agricultural soils to reduce greenhouse gases and increase production at the same time has been reinforced by new research findings at NSW Department of Primary Industries' (DPI) Wollongbar Agricultural Institute.

Trials of agrichar - a product hailed as a saviour of Australia's carbon-depleted soils and the environment - have doubled and, in one case, tripled crop growth when applied at the rate of 10 tonnes per hectare.

Agrichar is a black carbon byproduct of a process called pyrolysis, which involves heating green waste or other biomass without oxygen to generate renewable energy. Tim Flannery, Australian of the Year and renowned scientist, conservationist, writer and explorer, is a major advocate of agrichar and pyrolysis. In The Bulletin magazine, Flannery recently ranked "fostering pyrolysis-based technologies" fourth among his five steps for saving the planet, because they convert crop waste into fuel and agrichar which can be used to enhance soil fertility and store carbon long-term.

NSW DPI senior research scientist Dr Lukas Van Zwieten said soils naturally emit about 10 times more greenhouse gas on a global scale than the burning of fossil fuels. "So it is not surprising there is so much interest in a technology to create clean energy that also locks up carbon in the soil for the long term and lifts agricultural production," he said. The trials at Wollongbar have focused on the benefits of agrichar to agricultural productivity. "When applied at 10t/ha, the biomass of wheat

was tripled and of soybeans was more than doubled," said Dr Van Zwieten. "This percentage increase remained the same when applications of nitrogen fertiliser were added to both the agrichar and the control plots. "For the wheat, agrichar alone was about as beneficial for yields as using nitrogen fertiliser only. "And that is without considering the other benefits of agrichar."

Regarding soil chemistry, Dr Van Zwieten said agrichar raised soil pH at about one-third the rate of lime, lifted calcium levels and reduced aluminium toxicity on the red ferrosol soils of the trial.

"Soil biology improved, the need for added fertiliser reduced and water holding capacity was raised," he said. The trials also measured gases given off from the soils and found significantly lower emissions of carbon dioxide and nitrous oxide (a greenhouse gas more than 300 times as potent as carbon dioxide).

NSW DPI environmental scientist Steve Kimber said an added benefit for both the farmer who applies agrichar and the environment is that the carbon in agrichar remains locked up in the soil for many years longer than, for example, carbon applied as compost, mulch or crop residue.

"We broadly categorise carbon in the soil as being labile (liable to change quickly) or stable – depending on how quickly they break down and convert into carbon dioxide," he said.

"Labile carbon like crop residue, mulch and compost is likely to last two or three years, while stable carbon like agrichar will last up to hundreds of years.

"This is significant for farmer costs because one application of agrichar may be the equivalent of compost applications of the same weight every year for decades.

"For the environment, it means soil carbon emissions can be reduced because rapidly decomposing carbon forms are being replaced by stable ones in the form of agrichar."

Unfortunately, agrichar is not widely available. BEST Energies Australia, a company involved with NSW DPI in the trials, has a pilot plant at Gosford which is producing minimal amounts for research purposes.

"We are hoping the technology will take hold and pyrolysis plants will be built where there is a steady stream of green or other biomass waste providing clean energy that is carbon negative," Dr Van Zwieten said. "But until pyrolysis plants are up and running, the availability of agrichar for farmers will be scarce."

Source: New South Wales Department of Primary Industries