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## Biochar knowledge slowly builds



**DAFWA's Paul Blackwell (left) with Moonyoonooka grower Graham Royce in the GRDC-supported biochar trial.** Photo: Nicole Baxter

By Nicole Baxter

Preliminary trial results in Western Australia show a low rate of banded biochar applied with an intermediate level of starter fertiliser may be sufficient to increase wheat yields on sandy soils by 10 per cent or more.

Dr Paul Blackwell, of the Department of Agriculture and Food, Western Australia (DAFWA), says adding a small amount of biochar (about one tonne per hectare at a paddock rate) appears to improve the efficiency of starter fertiliser.

In one example, a trial at Walkaway had 1t/ha of biochar placed in the row by banding. The subsequent grain yield increased by 17 per cent (210 kilograms a hectare) when combined with 50kg/ha of starter fertiliser. By comparison, doubling the fertiliser rate with no biochar gave no yield increase.

"In this case, adding biochar at 1t/ha increased yield more efficiently with half the fertiliser rate than the full fertiliser rate," Dr Blackwell says. "In another trial at Moora, banded biochar application enabled 65 per cent less fertiliser to be used for the same grain yield."

However, Dr Blackwell says not all soils respond the same way. In trials at Wongan Hills in WA and another at She-Oak Log in South Australia, the addition of biochar produced no yield advantage.

"When applied at very high rates (10 to 100t/ha), biochar may hang on to water like clay, which could be problematic in dry seasons," he says. "The other worry is that at very low rates of biochar (about 0.2t/ha) we have seen a yield depression, perhaps due to nitrogen tie-up, but this needs much more investigation."

Dr Blackwell feels the application rate may need to be low enough to minimise moisture stress yet high enough to overcome any nitrogen limitation, as well as stimulate increased activity from beneficial soil micro-organisms, such as arbuscular mycorrhizal fungi.

Laboratory research by University of Western Australia soil microbiologist Dr Zakaria Solaimain shows the addition of biochar increases the colonisation of arbuscular mycorrhizal fungi around plant roots, which improves the plant's ability to take up nutrients and tolerate drought.

His work has shown that these benefits can persist through a drought year and assist nutrient and moisture uptake in the subsequent crop.

But for biochar to offer an economic benefit for grain growers, Dr Blackwell says the break-even cost for purchase and application needs to be less than about \$100/ha for many regions of the WA wheatbelt.

To better understand the possible role that biochar could play, Dr Blackwell and Dr Solaimain are working with Associate Professor Daniel Murphy of the University of Western Australia and Dr Evelyn Krull at CSIRO's laboratories in Adelaide, South Australia.

At a biochar and biology field walk near Mingenew in 2010, growers had the opportunity to view how wheat on sandy soils can respond to biochar.

The GRDC-supported trial (with a topsoil Colwell P of 7.5 milligrams a kilogram) – on Carl and Rachel Forward’s farm at Irwin – is comparing four rates of diammonium phosphate (DAP) (nil, 25kg/ha, 50kg/ha and 100kg/ha) with a wheat hay biochar and a chicken manure biochar applied at nil, 0.5t/ha or 1.6t/ha at a plot rate (2.5t/ha or 7.5t/ha in a 50mm wide band on 220mm rows).

Dr Blackwell says early growth measurements have been encouraging.

“Keeping water-soluble phosphorus at low levels and adding a small amount of biochar seems to give the arbuscular mycorrhizal fungi a habitat to escape from predators and benefit the crop,” he says.

The GRDC research project is also using lysimeters – large containers to grow plants – to establish whether biochar changes the way soil adsorbs and releases nutrients, such as nitrogen and phosphates, and some herbicides.

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