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Food and Energy Security will be hosting a drinks reception at the Plant Biology Congress Freiburg 2012. Come and visit the Wiley-Blackwell stand no.14 from 4pm on 2 August. Free drinks, snacks and T-shirts while stocks last. Come and introduce yourself to Martin Parry or to one of the Associate Editors to find out more about the journal.

Bill and Melinda Gates foundation funding at the John Innes Centre to "persuade bacteria to help cereals self-fertilise"

BILL & MELINDA GATES *foundation*

John Innes Centre

The John Innes Centre will lead a $9.8m research project to investigate whether it is possible to initiate a symbiosis between cereal crops and bacteria. The symbiosis could help cereals access nitrogen from the air to improve yields. The five-year research project, funded by the Bill & Melinda Gates Foundation, could have most immediate benefit for subsistence farmers.

"During the Green Revolution, nitrogen fertilisers helped triple cereal yields in some areas," said Professor Giles Oldroyd from JIC. "But these chemicals are unaffordable for small-scale farmers in the developing world."

As a result, yields are 15 to 20 per cent of their potential. Nitrogen fertilisers also come with an environmental cost. Making and applying them contributes half the carbon footprint of agriculture and causes environmental pollution. "A new method of nitrogen fertilisation is needed for the African Green Revolution," said Professor Oldroyd. "Delivering new technology within the seed of crops has many benefits for farmers as well as the environment, such as self-reliance and equity," said Professor Oldroyd.

The new research will investigate the possibility of engineering cereals to associate with nitrogen-fixing bacteria and of delivering this technology through the seed.

If it is found to work, farmers would be able to share the technology by sharing seed. And the research opens the door to the use of grasses as rotational crops to enhance soil nitrogen. "We're excited about the long-term potential of this research to transform the lives of small farmers who depend on agriculture for their food and livelihoods," said Katherine Kahn, senior program officer of Agricultural Development at the Bill & Melinda Gates Foundation. "We need innovation for farmers to increase their productivity in a sustainable way so that they can lift themselves and their families out of poverty. Improving access to nitrogen could dramatically boost the crop yields of farmers in Africa."

The focus of the investigation will be maize, the most important staple crop for small-scale farmers in sub-Saharan Africa. Parallel studies in the wild grass *Setaria viridis*, which has a smaller genome and shorter life cycle, will speed up the rate of discovery. Discoveries will be applicable to all cereal crops including wheat, barley and rice.

The research will start by attempting to engineer in maize the ability to sense nitrogen-fixing soil bacteria. This may be enough to activate a symbiosis that provides some fixed nitrogen. Even slight increases could improve yields for farmers who do not have access to fertilisers. "We have developed a pretty good understanding of how legumes such as peas and beans evolved the ability to recruit soil bacteria to access the nitrogen they need," said Professor Oldroyd. "Even the most primitive symbiotic relationship with bacteria benefited the plant, and this is where we hope to start in cereals." In the most basic symbiosis, bacteria are housed in simple swellings on the root of the plant, providing the low oxygen environment needed. In more highly evolved legumes, the plant produces a specialised organ, the nodule, to house bacteria.

Bacteria can infect the plant through cracks or through more complex tunnels built by the plant called infection threads. As the complexity of the interaction increases, so does the efficiency with which bacteria fix nitrogen for the plant.

"In the long term, we anticipate that the research will follow the evolutionary path, building up the level of complexity and improving the benefits to the plant," said Professor Oldroyd.

The project will also help highlight where more research is needed. It will run in parallel to ongoing research funded by the Biotechnology and Biological Science Research Council into how nitrogen fixation works in legumes. It will also run in parallel to an existing Gates-funded project, N2Africa, to improve nitrogen management in African farming systems more immediately.