

Friendly fungi: How they could help barley growers feed the world without chemicals

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Botanists from Trinity College Dublin have made a breakthrough discovery that could save barley farmers sleepless nights and millions of Euro each year: naturally occurring plant-friendly fungi prevent crop-ravishing diseases from spreading, and also aid plant survival in testing environmental conditions.

Importantly, these amazing little organisms cause no harm to the plant roots in which they take up their abode. However, their gift of immunity against common seed diseases greatly reduces the need for farmers to spray environmentally damaging chemicals, which can affect ecosystems in a plethora of negative ways.

Barley is the fourth most important global cereal crop and, as a hardy plant, is often grown in relatively poor [environmental conditions](#). For many farmers across the world, it is a vital source of food and income.

However, barley crops are subject to many diseases, which can cause huge losses if they become established. Growers, engaged in an 'arms race' against these diseases, have until now resorted to using continually changing chemical and pesticide cocktails in an attempt to stay one step ahead.

PhD Researcher in Botany in the School of Natural Sciences at Trinity, Brian Murphy, is the lead author of the breakthrough paper, which was recently published in the international peer-reviewed journal *BioControl*.

He said: "Irish farmers spend over €99 million annually on chemical crop inputs for barley, 70% of which is spent on nitrogenous fertilisers. As well as being expensive, these chemicals can cause serious environmental damage and even biodiversity loss. Our innovative crop treatment has the potential to significantly reduce these costs and contribute to sustainable and organic agricultural practices."

Fungal 'endophytes' such as those that proved effective in suppressing seed diseases in the Trinity team's laboratory experiments appear to have a 'symbiotic' relationship with barley. This means that both species gain some positive benefit from their biological union.

As well as warding off seed diseases, it seems that the endophytes confer other significant benefits to keep barley farmers smiling; plants that faced multiple stresses at the same time (such as heat, drought, poor nutrient soils, and pests) were around six times as likely to survive if they were housing their fungal friends than those flying solo.

"These symbiotic relationships are therefore a real case of life and death for the plants, as well as for many of the farmers relying on these crops," added Brian Murphy.

The endophytes occur naturally in agricultural soils, and in some cases, plants might already be exposed to them by chance. However, due to their relative inability to move from field to field, and to regular crop rotation and pesticide use, the chance of a union occurring naturally between barley and the most effective endophytes is likely very small. As a result, the Trinity team are looking into ways of inoculating crops preferentially.

The next step is to see whether the results from the laboratory hold true in the natural laboratory of the barley farmers' fields. If applying the endophytes to crops in the wild does prove as successful, the Trinity

team will have contributed to one of the burning questions facing policy makers across the globe: How do we feed a rapidly growing, hungry world?

Associate Professor in Botany in Trinity's School of Natural Sciences, Dr Trevor Hodkinson, added: "The major challenge for agriculture is to increase crop yields while moving towards more sustainable farming systems. These naturally occurring fungal root endophytes offer huge potential to reduce agriculture's reliance on environmentally damaging chemical inputs. We are looking to scale up the research into the field and commercialise the technology."

Provided by Trinity College Dublin

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