CAN WHEAT YIELDS WITHSTAND OUR CHANGING SOILS?

DSW
DELIVERING SUSTAINABLE WHEAT

THE CHALLENGE

Intensive agricultural practices have caused unprecedented damage to the world's soils.

Soil degradation is increasing globally and 35% of agricultural land, which equates to 1,660 million hectares, is affected.

To protect soils, future management must prioritise soil conservation. This can be achieved through the adoption of sustainable agricultural practices such as reduced or no tillage, and cover cropping.

These practices will make future soils more heterogenous in structure. However, new wheat varieties are not tested under variable soil conditions before certification.

Erosion carries away over

20 billion tonnes

of nutrient-rich topsoil annually

OUR RESEARCH

We performed an extensive bibliometric analysis of over 650,000 published papers. This revealed that 90% of plant breeding-related research did not consider the effect of soils. Currently, no seed certification agency test the performance of new varieties under variable soil conditions. This raises important questions, including whether modern varieties can achieve potential yields under soil conditions like reduced tillage.

To address this, we are analysing the effect of cultivation practices on crop performance. This includes comparisons between conventional tillage and zero tillage, their effect on soil structure and wheat root architecture. The work involves scanning soil cores using X-ray computed tomography and our early research confirms that soils are denser and less porous in reduced tillage systems, while soils which are loosened prior to drilling are more porous, but less stable.

Identifying wheat root traits that enable penetration into hard soils and efficient use of water and nutrients could contribute to developing a more sustainable wheat crop. Not only do roots function to acquire water and nutrients for the plant, but they are also crucial for the recruitment of beneficial microorganisms to the rhizosphere.

By analysing the Watkins collection of wheat, we have found that the assembly of microorganisms in the rhizospheres of landraces are distinct from those found in the rhizospheres of elite varieties. Significant differences were detected in the abundance of microbial taxa involved in nitrogen and carbon turnover. We also detected a genotype-specific ability to recruit or suppress particular microbial taxa to the rhizosphere.

Breeding root traits that influence microbial functions involved in nitrogen and carbon turnover could improve crop performance under sustainable agricultural practices.

SCAN FOR MORE INFO

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The Delivering Sustainable Wheat research programme aims to address critical challenges in wheat health, yield, and production in order to safeguard the future of this vital crop.

It is a collaboration between the John Innes Centre, Rothamsted Research, Quadram Institute, and Earlham Institute, with the universities of Bristol, Lancaster, Leeds, Imperial College London, and Nottingham, NIAB, and NISD-UEA.

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