



Helping wheat beat fusarium

The fungus fusarium causes two of Australia's most serious wheat diseases – 'Crown Rot' and 'Head Blight'. CSIRO Plant Industry researchers in Brisbane are tackling fusarium in a unique way and making significant progress to both understanding the fungus and developing resistant wheat varieties.

The cost of fusarium

Crown Rot ranks in the top five most damaging wheat diseases in Australia.

According to the NSW Department of Primary Industries (NSW DPI), Crown Rot causes scattered white heads, pinched or no grain, browning of crown and a pinkish colour in lower leaf sheaths. Crown Rot is a chronic problem throughout the Australian wheat belt and costs about \$50 million in lost yield to the industry each year. It thrives if plants suffer from water stress after flowering – so does very well across most of the Australian wheat belt, particularly in northern NSW and Queensland.

Head Blight is a particular problem in the northern wheat belt of eastern Australia. NSW DPI lists its symptoms as premature bleaching and discolouration of head and chalky white grains that may be tinged with pink. Head Blight can reduce yield but more notably it produces a fungal toxin that seriously damages grain quality for human and animal consumption. In bad years it costs growers and the export oriented industry heavily in lost yield and downgraded quality.

Addressing fusarium

Fusarium occurs across most of the wheat belt flaring up when conditions are right. It is difficult to completely eradicate.

Minimum till practices used to conserve soil water unfortunately encourage fusarium as it survives in cereal stubbles. In dry weather high levels of fusarium can survive in stubble for many years. Stubble can be burnt to reduce fusarium, but burning exposes the top soil to erosion and loss of soil moisture.

Cereal crop rotations have limited success in reducing fusarium as it infects, and survives on, many grasses and other weeds commonly found throughout the wheat belt that remain when cereals are rotated. Using crops other than cereals in long rotations or spraying fungicides to control fusarium are not economically viable options.

Fusarium intelligence – knowing the enemy

There are a number of fusarium species that can cause Crown Rot and Head Blight. Some cause severe disease and others only cause mild disease. Two fusarium species present in Australia are the main problem – *Fusarium pseudograminearum* that most commonly causes Crown Rot and *Fusarium graminearum* that causes Head Blight. The species of fusarium present in a paddock greatly affects the severity of disease outbreak. CSIRO Plant Industry's Dr Sukumar Chakraborty is



Dr Sukumar Chakraborty is testing the effectiveness of fusarium-resistant wheats in the field.

studying these species to find the most virulent individuals to gather 'enemy intelligence' about them. By looking at how fusarium infects and spreads in a plant it may be possible to identify and develop effective control strategies.

By analysing fusarium strains from around the world Dr Chakraborty's team has revealed that most individuals of *Fusarium pseudograminearum* belong to a single family-group of promiscuous inter-breeding members. The family tree provides insights into the risk of new virulent strains developing.

Because of its global importance the team is working with researchers in other countries to better understand fusarium biology under different farming systems and climate. Important findings on toxin production, virulence and the type of fusarium spore that starts Head Blight epidemics can be applied to better manage fusarium in Australia.

Breeding resistant wheat varieties

Currently there are no fusarium-resistant wheat varieties in Australia, but some as yet unidentified resistance may be present in existing wheat plants.



A number of wheats with promising resistance to fusarium have been identified in glasshouse trials.

Up until two years ago only a small number of wheats had been screened for fusarium resistance. In the last two years however, Dr Chakraborty and his team have developed a high-throughput screening method that has allowed them to screen over 1,500 wheats from all around the world.

As a result some wheats with resistance to highly virulent *Fusarium pseudograminearum* have been identified from glasshouse screening. These are now being screened against fusarium in field trials. If resistant wheats are found then the team will look at identifying the genes involved in conferring the resistance and develop DNA markers to help introduce this resistance into new wheat varieties.

In parallel work the CSIRO Plant Industry team is also looking at how plants resist fusarium infection and what genes may be involved in defending the plant against fusarium or reducing its affect on yield.

Some potential fusarium resistance genes have already been identified in the model plant – *Arabidopsis*. These *Arabidopsis* resistance genes could provide clues about where to look for fusarium resistance genes in wheat.

Scientific references

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