HOT AND COLD RUNNING WEATHER

New research aims to help growers avoid the short, sharp shock of temperature extremes

TEMPERATURE EXTREMES, be they heat or frost, can result in considerable crop damage and in some cases catastrophic yield losses. Three new projects are trying to understand the combinations of meteorological drivers behind these shock temperatures, how their frequency might be affected by global warming and how risk of crop damage associated with these extremes may be reduced.

In Western Australia, Dr Ian Foster, of the Department of Food and Agriculture, WA, aims to establish if, in future, WA wheatbelt growers will need to make sowing and variety choices to not only minimise frost risk but also to avoid high temperatures during grain fill.

"There is a trend to expand grain production in higher-rainfall regions in response to recent dry years," Dr Foster says. "However, some of the new areas being considered have a higher incidence of frost, which can pose a significant risk to cropping."

Historical data on extreme cold and hot days is being analysed to determine how the frequency and timing of frost and heat episodes will change over different regions in the future.

Results from the trials will not only be conveyed to growers but also to plant breeders, especially wheat breeders, to help in the production of better-adapted varieties.

PHOTO: SARDI

SARDI's Bronya Alexander sets up the fan heater ready to impose the heat treatment on wheat to replicate an extreme heat day.

Higher temperatures in spring are the focus of the aligned work in South Australia. In addition to studying the weather patterns and long-term climate factors that cause these events, this project – led by Dr Peter Hayman, from the SA Research and Development Institute (SARDI) – is running field trials manipulating growing temperature in the field.

University of Adelaide PhD student Hasim Talukder and his supervisors Dr Glenn McDonald and Dr Gurjeet Gill are working with SARDI to examine the physiological response of wheat to short-term heat stress during reproductive development. By enclosing small areas of crop in a chamber in the field and introducing hot air to the canopy, the temperature can be increased through the day to simulate a heat event. At the end of the day the chamber is removed and the plants are tagged so that the impact of the heat event can be compared with an adjacent plot that was not heated.

In preliminary results, Hasim Talukder found that a single day when the temperature was ramped up to a maximum of 35°C just prior to flowering led to yield loss of 20 to 30 per cent. As part of his GRDC-funded PhD program, he will repeat the field work and continue with controlled-environment experiments to further understand the impact of these hot spring days on wheat.

Dr Hayman notes that 12 October 2004 and the mid-November heat event in 2009 have raised questions among growers and agronomists including:

- How damaging are these events?
- What is the interaction of extreme heat and soil water?
- Will these extreme days be more common in the future?

Although there is often a focus on heat events in low-rainfall regions, such as the upper Eyre Peninsula, Dr Hayman points out that a November heat event is of little concern to farmers in this region. This is because by this time cereals are being harvested or are past the sensitive stages. In higher-rainfall environments, which are often cooler, the crop is at sensitive stages later in the year and extremely hot days in early summer bring extra risk.

In the east, CSIRO's Steven Crimp is about to embark on a project aimed at understanding the changing nature of frost risk to grain and grape growers.

As mean temperatures increase, plant growth and maturity are accelerated, which can result in plants being at a more vulnerable stage when frost occurs. Coupled with dry sowing and one-pass seeding with large equipment, vast areas of crop are sown very early and in a narrow sowing window. These practices expose grain crops to a greater frost risk.

In many regions, despite increases in maximum and minimum temperatures, the number of spring frosts has increased, as has the date of the last frost. Mr Crimp's work aims to understand what is driving this change in frost frequency and occurrence and if this will persist into the future.

In consultation with the Bureau of Meteorology, it is hoped this project will develop and deliver a system to predict frost seasonally for on-farm application. □

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