Early sowing systems can boost Australian grain industry

February 25 2019

Dr James Hunt, agronomist, La Trobe University. Credit: La Trobe University

New findings from research by La Trobe University and CSIRO made possible with GRDC investment could lead to a significant increase in the Australian wheat crop yield—adding potentially around $1.8 billion

to the national economy and improving global food security.

Published today in *Nature Climate Change*, the research has found that Australian wheat crop yields could be substantially increased by early sowing of winter wheats—despite recent declines in autumn rainfall caused by climate change.

The time at which grain crops flower is critical to yield and lead La Trobe researcher Dr. James Hunt said that a sharp decline in autumn rainfall in south eastern Australia since the 1990s has led to a significant reduction in wheat crop yields, in part because the crops are being established and flowering too late.

"A combination of less reliable season opening rains and hot and dry springs has led to a stagnation in national wheat crop yields," Dr. Hunt said.

"The approach Australian growers have used for more than a century—of sowing spring wheats sometime in late May or June following autumn rains is no longer reliable. Growers have been able to increase yields by pushing sowing into a narrow window in early May—but this is getting harder to achieve."

For the past seven years, the research team has been investigating alternatives to the sowing of spring wheats in May and has discovered that sowing winter wheats from March increases the window of opportunity for sowing because it potentially uses stored soil water from summer rains, which haven't declined and have increased in some areas.

"We needed to find a genotype of wheat in which development is slowed so that sowing could be moved earlier but flowering still occur during the optimal window," Dr. Hunt said.

"This needed to be slowed either by slower flowering caused by short days (photoperiod) or through the need to experience cold winter weather (vernalisation)."

The research team used almost genetically identical (near-isogenic) lines of wheat developed by Dr. Ben Trevaskis at CSIRO that varied in vernalisation and photoperiod sensitivity to evaluate the yield performance at sowing times much earlier than previously researched.

They discovered that one of the wheat lines, never widely used or tested before in Australia, has a novel 'fast' winter development pattern.

"Winter wheats are mostly grown in high latitude environments with very cold winters such as northern Europe and are too slow for Australian conditions," Dr. Hunt said.

"However, we found that in the Mediterranean environments of the southern and western wheat belt, where most of the wheat in Australia is grown, the fast winter line sown early (up to 40 days earlier than traditional sowing times) could yield as well as or better than the fast spring sown at its optimal time.

"And in the temperate regions of south eastern Australia, a mid-winter line (development slowed by both vernalisation and photoperiod) sown up to 40 days earlier yielded as well as the fast spring sown at its optimal time."

The research team then used crop simulation to estimate what growers adopting one of these lines might mean for farm yields.

"We found that national yields could increase by 0.54 tonnes per hectare, which is about 20 per cent of the current national yield," Dr. Hunt said.

"This would produce an additional 7.1 million tonnes of wheat worth up to $1.8 billion to the national economy.

"If appropriate winter cultivars can be bred for Australian growers, farm yields will be increased with little additional investment by growers required.

CSIRO Chief Research Scientist Dr. John Kirkegaard said the research by Dr. Hunt and the CSIRO team is a remarkable example of multidisciplinary crop genetics and agronomy teams working together to drive productivity gains on-farm in the face of a changing climate.

"Further gains are likely as ongoing research optimises the approach regionally, and it moves into other crops," Dr. Kirkegaard said.

The next step is in breeding appropriate winter cultivars and making them available to growers. As a result of this research, a number of cultivars have been developed by commercial breeding companies and are under evaluation in trials across lower rainfall areas of South Australia, Victoria and New South Wales.

Andrew Etherton, GRDC Manager, Farming Systems and Agronomy—Southern Region can see the agronomic advantages of incorporating these optimised cultivars in to current systems.

"The outcomes from this research conducted in the lower rainfall zones will deliver new wheat varieties to growers in these regions, providing different phenology options, allowing timely seeding and matching of plant flowering times to maximise yield potentials."

More information: Early sowing systems can boost Australian wheat yields despite recent climate change, *Nature Climate Change* (2019). DOI: 10.1038/s41558-019-0417-9 ,

www.nature.com/articles/s41558-019-0417-9

Provided by La Trobe University