Impact of climate change on *wheat production* opportunities for growers

summary

Modelling indicates that increased temperatures and CO_2 levels will lead to earlier maturing wheat.

Yields may potentially increase if water and nitrogen requirements are met.

Later maturing cultivars may be used to take advantage of a longer growing season.

In recent years, Tasmania has experienced some of the warmest years on record. It is highly likely that average minimum and maximum temperatures will continue to increase in the future.

What does this mean for Tasmania's wheat production?

wheat production

Dealing with climate

Over the past decade, Tasmanian farmers have experienced extremely wet years, and some of the warmest and driest years on record. Scientists suggest that climate will be even more variable in the future.

This information sheet provides management actions that are available to wheat producers to maximise production in response to changes in climate.

Wheat production and changing temperature

Projections from Climate Futures for Tasmania indicate minimal change in annual rainfall in the future. However, average temperatures across Tasmania are projected to increase by approximately 2.9 °C by 2100.

Relatively small changes in climate can have large impacts on agricultural production.

Assessing the impact of increasing temperatures on annual crops such as wheat is complex as there are many interactions between planting date, nitrogen management, water availability and crop variety, all of which influence growth production and final yields.

Modelling Impacts of the Tasmanian Climate

Climate Futures for Tasmania projections were used with data about typical wheat management practices and local soil characteristics. Changes in biomass, yield and flowering time under warmer temperatures and elevated carbon dioxide (CO_2) levels were modelled. Five agricultural regions (Cressy, Port Sorell, Oatlands, Bothwell and Richmond) were the focus for the study for the period 2010-2100.

The trends were similar among regions and the results from modelling rainfed wheat at Cressy are presented below as an example.

Effects of changing climate on wheat production

Using a crop model, the wheat cultivar Tennant was sown on 15 May, with a fertiliser rate of 25 kg N/ha and a further 50 kg N/ha applied in early September.

Modelling results suggest;

- Crops will develop more rapidly in response to the projected increase in temperature and growing degree days (Figure 1). Flowering and maturation of wheat will be advanced by approximately 13-18 days during the 21st century.
- Increases in atmospheric CO_2 will lead to higher rates of photosynthesis and gains in water use efficiency. Crop water stress is projected to decline, resulting in increased crop biomass. (Figure 2).
- Greater biomass will increase the demand for soil nitrogen. As available soil nitrogen is depleted to support the higher biomass, nitrogen stress is increasingly likely to be present later in the growing season. As a result, future yields are projected to decline under current nitrogen fertiliser rates (Figure 3).
- Potential yields that are not limited by nitrogen or water supply are projected to increase in the future (Figure 4).

Potential management options

Wheat producers have a number of management options for the short, medium and long-term, involving knowledge-intensive systems of nitrogen and water supply, and cultivar choice.

Between 2008-2013, research at the Tasmanian Institute of Agriculture funded by the Grains Research and Development Corporation (GRDC) compared actual and modelled yields across 27 wheat fields and a 30-year period. Similarity between modelled and actual yield data means that models can be used to assist the develop management strategies for greater yield. Models indicate that best practice management in respect to water-use efficiency and nitrogen supply could result in an increase in yields of up to 2 t/ha.

Short-term

Irrigation has the potential to significantly increase yields, particularly in combination with strategic nitrogen application. Irrigation may also be used to manage hot days (days more than 35 °C).

Growers can start to trial alternative varieties that are better suited to warmer temperatures, later season rainfall and shorter growing seasons.

Photo: Tina Acuna

Projected Changes in Wheat Production

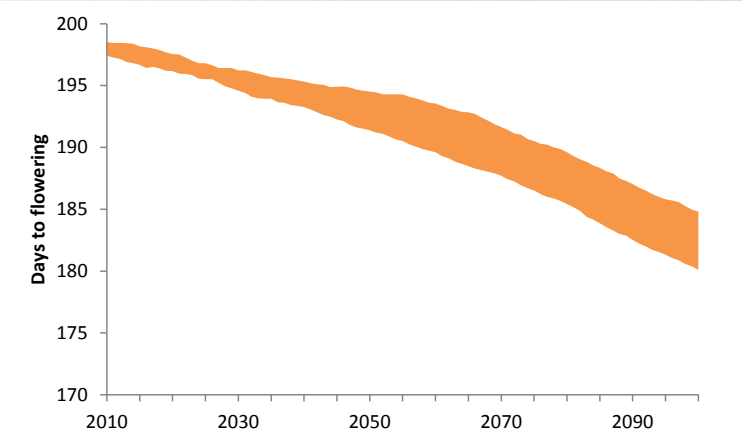

Figure 1
Modelled days to flowering for dryland wheat at Cressy, 2010-2100.

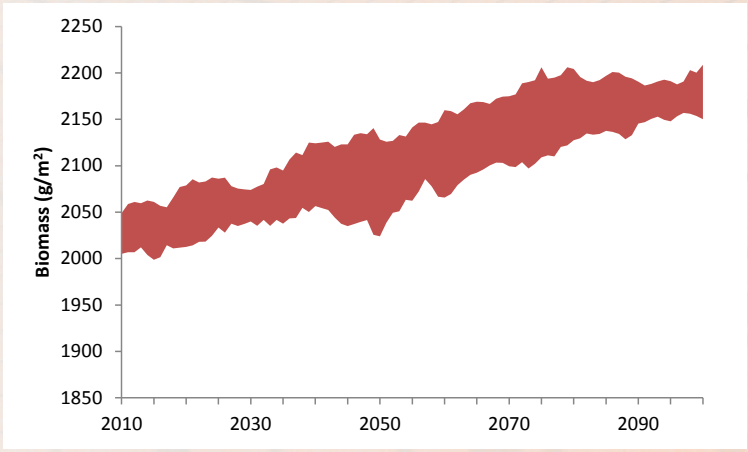

Figure 2
Modelled biomass for dryland wheat at Cressy, 2010 – 2100.

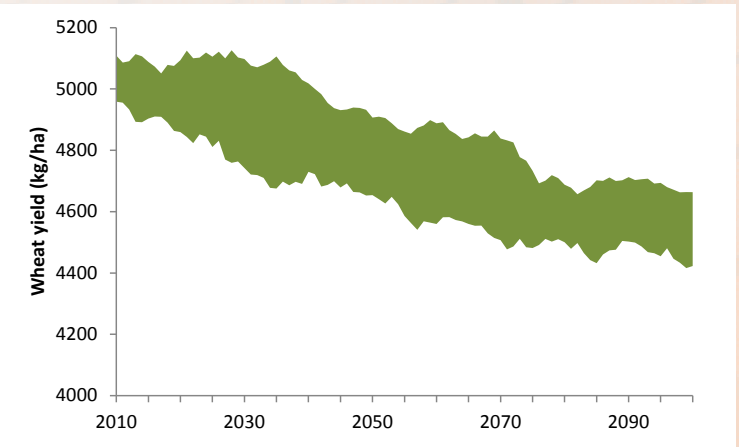

Figure 3
Modelled grain yield for dryland wheat at Cressy, under present-day management, 2010 – 2100.

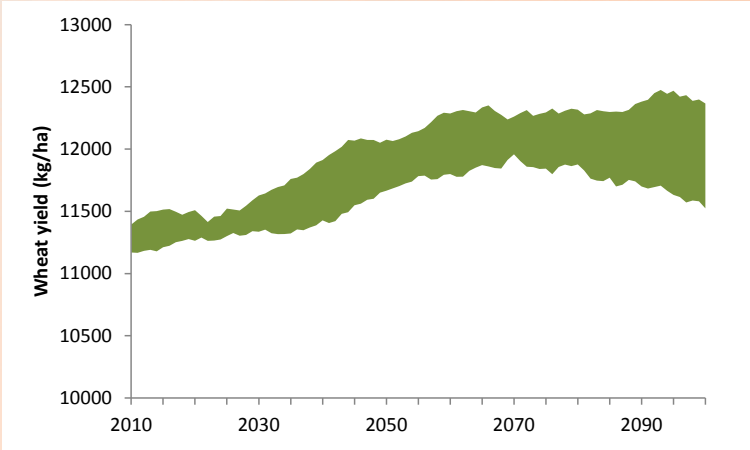

Figure 4
Modelled potential grain yield for dryland wheat at Cressy, unlimited nitrogen and irrigation, 2010 – 2100.

wheat production

wheat production

Medium to Long-term

Growers need to closely match nitrogen application with crop requirements under a changing climate. Maintenance of current yield levels will require higher nitrogen application rates.

Delayed nitrogen applications or leaching as a result of wetter conditions may result in nitrogen deficiency. The use of slow release fertilisers to assist in preventing nitrogen deficit is under investigation.

Flowering and maturation in wheat will be earlier. This trend will likely influence future cultivar selection (eg later maturing) and/or the sowing window.

About Climate Futures for Tasmania

The material in this information sheet was developed from outputs from the Climate Futures for Tasmania project. In particular, from the Impacts on Agriculture Technical Report (Holz et al 2010).

The Climate Futures for Tasmania project was funded primarily by the State Government of Tasmania, the Australian Government's Commonwealth Environment Research Facilities Program and Natural Disaster Mitigation Program. The project also received additional funding support from Hydro Tasmania.

The Climate Futures for Tasmania project was managed by the Antarctic Climate & Ecosystems Cooperative Research Centre (ACE CRC). For more information about the project go to:

www.acecrc.org.au

This information sheet is a joint production of the Tasmanian Government and the Tasmanian Institute of Agriculture.

Further information

This information sheet is part of a series produced by TIA on the impacts of climate change in agriculture. The full suite of information sheets is available at:

www.dpipwe.tas.gov.au/climatechange

The Tasmanian Government's Tasmanian Climate Change Office (TCCO) provides information on climate change mitigation, and adaptation programs and options:

www.climatechange.tas.gov.au

Climate Futures for Tasmania reports provide information on the impacts of climate change in Tasmania on general climate, water and catchments, impacts on agriculture and extreme events:

www.climatechange.tas.gov.au

The Bureau of Meteorology provides data on weather forecasts and climate variability:

www.bom.gov.au

The Grains Research & Development Corporation is one of the world's leading grains research organisations, delivering improvements in production, sustainability and profitability across the Australian grains industry.

www.grdc.com.au

For further information to assist farmers and potential investors to allow comparisons to be made between enterprises including cash crop and livestock enterprise tools visit

www.dpipwe.tas.gov.au/wealthfromwater

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