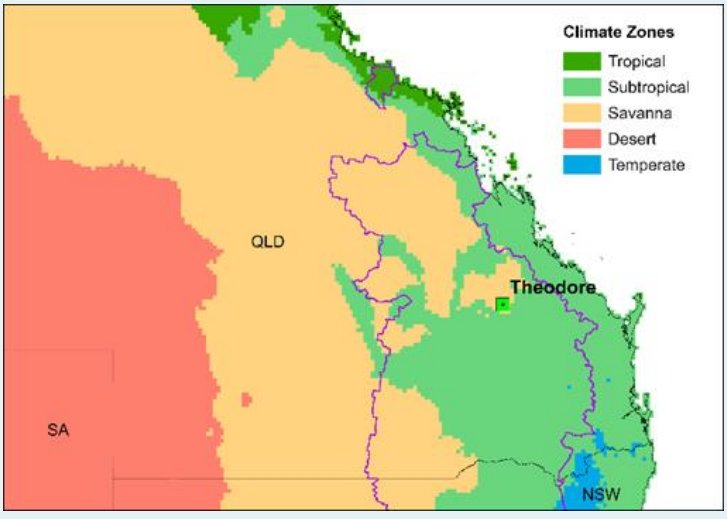
Integrating rainfall index-based insurance with optimal crop management strategies can reduce financial risks for Australian dryland cotton farmers

A case study for Theodore prepared by the University of Southern Queensland

Problem

Drought is a significant risk for farmers, which is further compounded by climate change. To mitigate drought-related risks, farmers adopt various technologies and management practices. One such practice is adjusting the planting date to ensure better growing conditions and reduce the impact of drought. However, changing the planting date can also mean altering the subsequent cropping windows, which might expose the farmers to risks later in the season, such as insufficient rainfall during crucial crop stages. Such risks may make some farmers hesitant to shift their planting date and instead opt for a 'safer' planting date that is not exposed to these risks, even if it results in lower average yields.



Solution

Index-based agriculture insurance products allow farmers to offset "acceptable risk" by changing their planting dates for higher crop yields. Often, farmers hesitate to undertake such a change due to other risks later in the season. To improve income stability in response to drought and climate variability and change, our strategy includes integrating index-based insurance with changes to sowing dates for dryland cotton producers.

Study Location

Figure 1: The Theodore study site, as located within Australian agro-environmental zones, selected for cotton yield simulations and insurance analysis.

References

Nguyen-Huy et al. (2024). Integrating rainfall index-based insurance with optimal crop management strategies can reduce financial risks for Australian dryland cotton farmers. *Sustainable Futures* (8) 1000249. doi: 10.1016/j.sftr.2024.100249.

Acknowledgement

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Approach

The research combined simulations of cotton lint yield with rainfall index-based insurance designs. To simulate cotton lint yields, we utilized the Agricultural Production Systems Simulator (APSIM)-Cotton model and considered different management strategies for various planting dates. The index-based insurance payout is structured to trigger when the average rainfall during the growing season falls below a predefined level, such as the 5th, 10th, or 20th percentile.

Key results

Figure 2 compares the income of cotton farmers who bought rainfall index-based insurance and those who did not. The comparison is based on different sowing dates and extreme drought conditions at the 5th percentile level of insurance coverage. Each element in the matrix shows the percentage change in income between insured farmers on the vertical axis and uninsured farmers on the horizontal axis for each sowing date.

For example, if farmers sow cotton on 22 September and purchase rainfall index-based insurance, they could potentially earn around 0.4% more income compared to those who sow at the same time without insurance. The result indicates that in Theodore, income can increase up to +4.5% in the case of a new planting date on 22 September with insurance vs. the current planting date on 22 October with no insurance. The information presented in Figure 3 compares farmers' income with and without insurance during drought years only. It is important to note that at Theodore, cotton farmers who purchase insurance have significantly higher income than those who do not, regardless of the sowing dates. Combining the optimal sowing dates with rainfall index-based insurance can improve income by up to 39.8%, especially in the case of new planting dates on 15 November with insurance compared to other current planting dates without insurance.

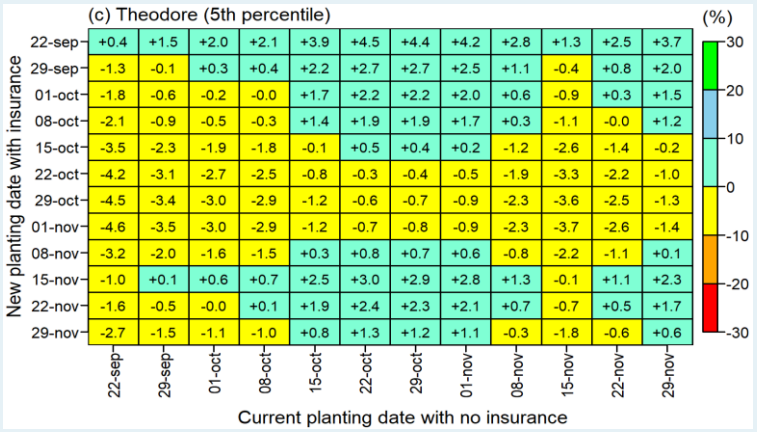

Figure 2. Comparison of income percentage change between cotton farmers with and without rainfall index-based insurance given different sowing dates at the 5th percentile level (extreme drought) of insurance coverage.

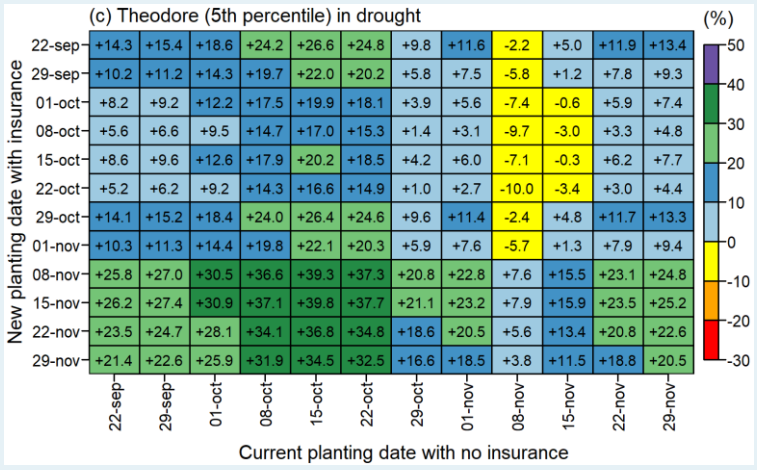

Figure 3. Comparison of income percentage change under drought years between cotton farmers with and without rainfall index-based insurance given different sowing dates at the 5th percentile level (extreme drought) of insurance

Conclusion

The proposed approach will facilitate the financial transformation of farming during extreme climate conditions by providing integrated crop management and insurance options that i) provide information about the crop management actions that will increase farmer profitability and ii) give farmers the confidence to invest in the profitable and resilience increasing management actions without suffering financial losses if severe drought conditions occur.