

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

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 sowing time to ensure better growing conditions and reduce the effects of drought. However, changing the sowing dates can also mean altering the 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 sowing dates and instead opt for a 'safer' sowing date that is not exposed to these risks, even if it results in lower overall yields on average.

Solution

Index-based agriculture insurance programs allow farmers to take "acceptable risk" by changing their sowing 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.

Approach

We 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 sowing dates. The index-based insurance payout is designed to

trigger when the average rainfall during the growing season falls below a predefined level, such as the 5th, 10th, or 20th percentile.

Study location

Figure 1 depicts the Dalby study site, located within Australian agro-environmental zones, selected for cotton yield simulations and insurance analysis.

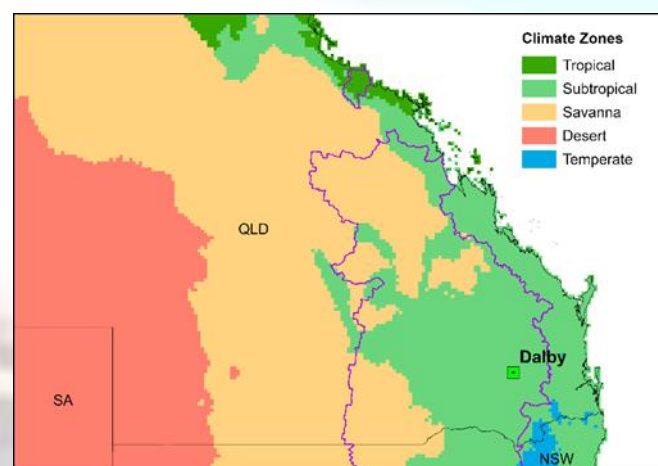


Figure 1. The study site selected for cotton simulations.

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 1.4% more income compared to those who sow at the same time without insurance. The result indicates that in Dalby, income can increase up to +3.3% in the case of a new planting date on 22 October with insurance vs. the current planting date on 29 November with no insurance.

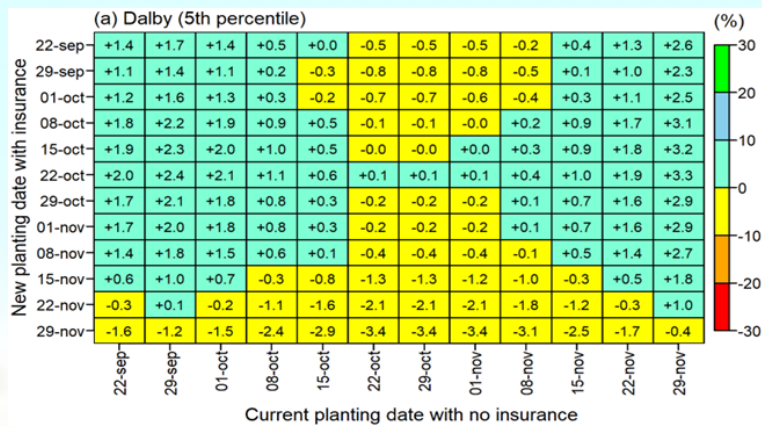


Figure 2. Comparison of income percentage change between cotton farmers with and without rainfall index-based insurance given different sowing dates at the 5th percentile level (extreme drought) of insurance coverage.

The information presented in Figure 3 compares farmers' income with and without insurance during drought years only. It is important to note that at Dalby, 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 24.4%, especially in the case of new planting dates on 22 or 29 September with insurance compared to other current planting dates without insurance.

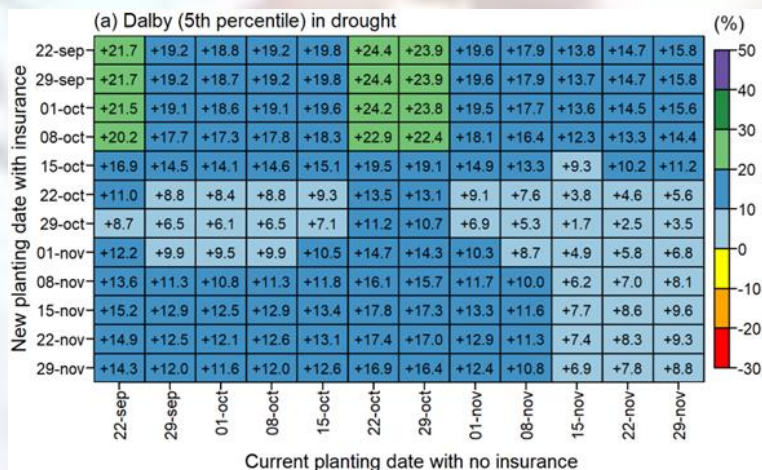


Figure 3. Comparison of income percentage change under drought years between cotton farmers with and without rainfall index-based insurance given different sowing dates at the 5th percentile level (extreme drought) of insurance coverage, which is considered as under extreme drought condition.

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.

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.sfr.2024.100249.

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