Drought and climate adaptation program

Case Study

Key Facts

Farm / Industry:	Horticulture
Risk:	Drought
Location:	Bundaberg, Queensland
Solution:	Assess viability of a parametric insurance solution based on low soil moisture to offset lost revenue

About the project

Insurance can be an important part of a farm risk management strategy to tackle natural disaster events and drought. In this case study, the project team examine low soil moisture effects on planting decisions, crop yield and income stability.

The project investigates the viability of crop insurance products for agriculture businesses, applying a parametric index value to a risk event.

Parametric index solutions provide an alternative way of transferring the revenue or cost impact of natural catastrophes. These solutions differ from traditional insurance policies. Flexible policies designed and calibrated to reflect the specific locations, exposures and risk management objectives of the farmer. Loss payments respond to the occurrence of a pre-agreed trigger event index.

Products can have a flexible structure: single season, annual or multi-year arrangement. Claims are settled very quickly after the occurrence of the policy trigger – usually 14 days.

Farm Profile

The farm is located in Moorlands, near Bundaberg, Queensland. The farm grows approximately 74 ha of pineapple crop, with an average yield of 40–50 tonnes per hectare, with a production value of approximately $100,000 per hectare. The farm is planting and harvesting year-round.

Risk

The farm experiences peak weather impacts in the March to September period, with drought being a priority risk. Over a 4 year period during the current drought, the farm has only received 20–30% of its average annual rainfall.

This lack of rainfall has led to a decrease in pineapple production, and a loss in revenue. The farm owners assessed the viability of a parametric insurance solution based on low soil moisture to offset their loss of revenue during particularly dry years.

Action

Consultation with the farm owners included a discussion on determining if a low soil moisture parametric solution could be developed from satellite-derived data map and measure soil moisture levels for the site.

The owners considered approximately $200,000 of cover for about $10,000 gross premium.

The project team applied “reanalysis data”, which is the output of a computer simulations that are constricted by observations on the ground and by satellite imagery. This reanalysis data has a resolution of 25 km × 25 km and is computed for soil depths between 0–7 cm.

It is easily obtainable and frequently used in insurance markets to settle contracts.

Methodology

Assessment of soil moisture levels included a 5 step analysis.

1. Calculate Average Soil Moisture on each day of year between 1979–2021.
2. Calculate the Soil Moisture Deficit as the cumulative soil moisture below the Average Soil Moisture (when soil moisture is above the average this does not offset from the deficit).
3. Analyse sensitive Soil Moisture Deficit months (here July, August and September).
4. Choose Soil Moisture Deficit in “sensitive” months between 1979–2021.
5. Apply insurance parameters (e.g. maximum pay-out, soil moisture deficit at which to start paying out) to the Soil Moisture Deficit index.

Result

The analysis demonstrated a clear Risk profile for the farm on soil moisture deficit:

- 2017, 2018 and 2019 stand out as years with a high soil moisture deficit (i.e. low soil moisture) when considering July, August and September.
- Historically, the years 2004, 1991, and 1982 also have similarly high levels of soil moisture deficit.
- 6 out of the last 41 years have had high soil moisture deficits that may have benefitted from insurance.

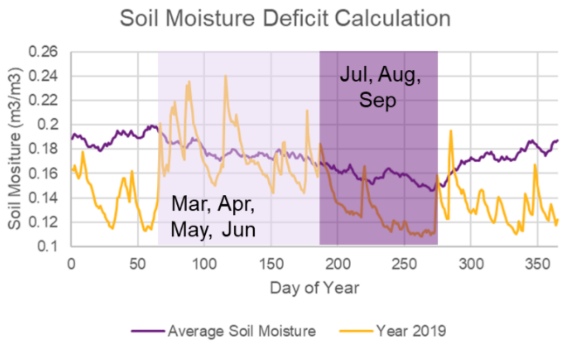
Structuring a Solution

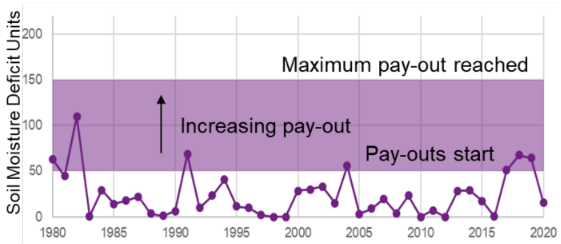
Two pricing options were developed for the owners to consider based on their anticipated payout and premium. A rough estimate is that the rate-on-line (the premium compared to the limit of insurance) for a standard structure that would pay out in these 6 years would be about:

$$6 \text{ years} / 41 \text{ years} \times 100 = 14\%$$

For $200,000 of limit, this would mean a premium equal to about 14% of $200,000, which is $28,000.

Therefore, to achieve the target premium of $10,000 for $200,000 of limit, separating the limit into two levels has been considered.





For example, these levels could be evenly split as a lower level of $100,000 that pays out more frequently for less severe losses, and a higher level of $100,000 that pays out less frequently during more severe losses.

Option 1

- More suitable to cover large and rare losses.
- Hits target premium for total limit of liability.
- Pays out less frequently and lower sums.
- Optimised for AUD 10k premium.

Option 2

- More suitable to cover moderate severity and frequency losses.
- Goes above target premium.
- Pays out more considerably in 2017, 2018 and 2019.
- Optimised for maximum pay-out in 2017-19 for AUD 28k premium.

Demonstrated

The process demonstrates capacity for the viability of a parametric insurance solution based on low soil moisture to offset loss of crop revenue during particularly dry years.

This low soil moisture parametric solution could be from satellite-derived data or "reanalysis data", which is the output of a computer simulation which is constricted by observations on the ground and by satellite imagery.

With a resolution of 25 km × 25 km, it is easily obtainable and frequently used in insurance markets to settle contracts.

The farm risk profile was identified that could benefit from insurance, with specific years and months identified in the analysis.

From the results, two options were delivered to the primary producer to consider taking up parametric index insurance for low soil moisture levels.

Acknowledgements

The team thanks the primary producer participating in the project for the purposes of testing the site and providing evidence to form this case study.

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The project is a collaboration between the University of Southern Queensland, Queensland Farmers' Federation, Willis Towers Watson and CelsiusPro.