

ADAPTING TO A CHANGING CLIMATE: CASE STUDY 32

RANGITIKEI CROPPING FARM

Optimising energy efficiency and improving soil productivity

THE FARM

- Waitatapia Station, near Bulls, Rangitikei.
- 2610 hectares, split into five blocks with 1500 hectares in pasture, 652 hectares in cropping and 400 hectares in forestry. The balance is in lakes, wetlands and a comprehensive laneway system.
- Sandy soils, prone to erosion.
- Stock policy aligned with summer dry conditions, trading up to 35 000 lambs and 3000 steers each year.
- Maize is the main crop covering about 250 hectares each year. Squash, potatoes, onions and wheat are produced on the remaining 400 hectares.
- The property has a good source of water, including artesian bores and a gallery take from the Rangitikei river.

THE FAMILY

- Brothers Hew and Roger Dalrymple are partners of Waitatapia Station, bought by their grandfather John in 1880.
- The work load is divided between arable (Hew) and the drystock (Roger). Hew is a long-term member of the LandWISE board.
- The farm is a past winner of the Ballance Farm Environment award.

Precision farming systems are being used to protect the fragile soils of Waitatapia Station and future proof the farm against extreme weather events.

Hew and Roger Dalrymple farm Waitatapia Station on Rangitikei sand country. The 2610-hectare farm has cropping, pasture and forestry enterprises. It is low-lying with rolling sand dunes, and both excessive dryness and excessive wetness can be present within individual paddocks.

The Dalrymples have adopted advanced farming systems including Real Time Kinematic (RTK) GPS and tractor guidance as well as smart equipment controls and yield monitoring. They have introduced reduced tillage systems including minimum-till, strip-till and no-till and have removed most high-power demand cultivation equipment.

The farm has converted to irrigation, with a number of centre pivot irrigators installed in recent years. The energy cost of these is relatively low as they run at moderate pressures. In addition, advantage was taken of surface water from the Rangitikei River and the topography provides some fall from the water source.

In dry conditions the sandy soil dries rapidly and can be somewhat hydrophobic. This is noticeable on the higher areas that may have lower water-holding capacity and also shed applied irrigation and natural rain. At the same time, some lower lying areas cause crop loss through excessive wetness, a problem made worse in wet conditions and by runoff from high spots during irrigation.

PLANNING AROUND CLIMATE CHANGE PROJECTIONS

The climate change projections for western areas of the North Island include increased wetness and possibly more extreme rainfall events. Wet soils already affect spring crop establishment some seasons and may become more common. Wet areas within paddocks may be more damaging to crops than currently the case.

Land reshaping guided by high accuracy GPS will avoid crop loss in high drought and low wet areas – yield maximised for given energy and nutrient inputs.

However, crop water deficit (temporary drought) is also likely. Climate change indicates weather unpredictability and may increase drought as well as wetness. Seasonal drought is already common at Waitatapia because the soils have very low water-holding capacities.

Many parts of the farm cannot sustain growth in summer as sandy soils do not hold sufficient water reserves. While irrigation has been introduced, it is not sufficient alone. High spots shed water and drought stress is evident even in pivot irrigated crops.

Conversely, low areas are excessively wet. Crop establishment can be poor in spring, and growth limited in wetter seasons. Climate change indicates an increased need for both irrigation and drainage to withstand adverse climatic events.

Because the soils are relatively unstructured sands, they can be prone to wind erosion if unprotected. Maintaining some form of vegetative cover is one of the most reliable methods of avoiding crop damage and soil loss.

RESPONDING TO CLIMATE CHANGE

Minimum tillage and strip-tillage have been adopted and where possible full no-till is used. This reduces contributions to greenhouse gas emissions by reducing fuel consumption and also mitigates wind erosion by avoiding bare soil.

The Dalrymples have been yield monitoring for several years. The yield database has provided clear evidence that paddock topography and related soil moisture variations are significantly affecting crop yields. Within individual fields with good average yields there are areas that are very low yielding and not economic to farm.

Consistently, the low yield areas are found to be the higher and lower areas in the paddock with drought and wetness respectively driving yield loss. The fuel, seed, agrichemical and fertiliser inputs to these areas are the same, so with low yields, energy and fertiliser efficiency is greatly reduced.

Economic analysis showed the Dalrymples that land contouring was a viable option. Capitalising on their investment in high accuracy GPS and machine guidance, the Dalrymples have begun a major land reshaping exercise at Waitatapia. Using surface optimisation software, they are developing cut and fill maps that will automatically manage tractors and scrapers to reduce paddock elevation variability.

Minimum tillage including strip tillage is key to enhancing soil quality at Waitatapia.

FOR MORE INFORMATION

- Further information on minimum tillage and advanced farming systems can be found on **www.landwise.org.nz**
- *The Irrigation Code of Practice and Design Standards* is available from the Irrigation New Zealand website **www.irrigationnz.co.nz**

Key points

1. **Advanced farming systems have the potential to future proof businesses against extreme events – drought, flood and wind.**
2. **Field contouring can ameliorate soil moisture problems through enhanced infiltration and reduced water logging. Energy, fertiliser and water efficiencies increase as yields are increased for the same inputs.**
3. **Reduced tillage reduces energy use while maintaining soil condition, crop production and financial sustainability.**
4. **Minimum tillage, strip-tillage and full no-till reduce greenhouse gas emissions by reducing fuel consumption. These practices reduce soil erosion, maintain soil condition, crop production and financial sustainability.**

ENERGY EFFICIENCY

The land reshaping programme requires an up-front energy investment. This will be recouped as yield losses are reduced and the marketable crop increases for each seasonal energy input. The energy waste on non-productive areas will be avoided.

Combined with a steady move towards tramlining and eventually controlled traffic farming, Hew anticipates reshaping will reduce overall farm horsepower and seasonal fuel consumption. More crop will be produced per litre of fuel used, and per kW of installed machinery capacity.

SUMMARY

Reshaping land at Waitatapia will repay energy and financial investment by reducing yield losses and increasing operational efficiency in future years. Adoption of reduced tillage systems is protecting soil resources and preventing erosion. These steps are an integral part of Waitatapia preparing for climate change.

THIS IS ONE IN A SERIES OF CASE STUDIES CALLED ADAPTING TO A CHANGING CLIMATE

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