

ADAPTING TO A CHANGING CLIMATE: CASE STUDY 29

HAWKE'S BAY CROPPING FARM

Optimising irrigation efficiency in a drought prone region

THE FARM

- Drumpeel Farms, Otane, Hawke's Bay.
- 1960 effective hectares (including leased land) taking in breeding stock, finishing lambs and cattle, with 700 hectares cropped each year. About 310 hectares are irrigated.
- Main crops include wheat, barley, herbage seed, maize, peas, sweetcorn and squash, and some vegetable seed crops are also grown.
- Soils range from clays to sands, loams and peat.
- 20 000 stock units wintered, 1000 R2 bulls and 20 000 trading lambs.
- Annual rainfall of 800–850mm.

THE FAMILY

- Drumpeel Station is owned by the Drumpeel partnership and farmed by Hugh and Sharon Ritchie.
- Hugh is Chairman of the Primary Sector Water Partnership, and a founding member and Chairman of LandWISE, a sustainable cropping group in Hawke's Bay. Hugh was previously a Federated Farmers board member with responsibility for water issues at a national level.

A multi-strand approach to irrigation management is being adopted at Drumpeel Station, including water use efficiency, crop rotation, crop prioritisation and energy efficiency.

Hugh Ritchie farms Drumpeel Station, part of a large mixed-cropping operation. In all, some 1960 hectares are farmed, much of it rolling hill country. About 700 hectares of crops are planted each year on flats. The main crops include wheat, barley, herbage seed, sweetcorn, maize, peas and squash, and some specialist seed crops such as coriander and carrots are also grown.

The main cropping area is at Drumpeel itself, where soils range from clays to sands, loams and peat. The area is summer dry and irrigation was introduced to the cropping operation in the mid-1990s. Irrigation guarantees crop quality and increases production. The extra water also allows double summer crops such as early peas followed by process sweetcorn.

The main part of Drumpeel is irrigated by a 450-metre linear move irrigator covering about 160 hectares. Water is supplied from an on-site bore. Additional odd-shaped areas are irrigated with travelling guns when sufficient water is available.

CLIMATE CHANGE PROJECTIONS FOR THE HAWKE'S BAY

The East Coast of the North Island is expected to warm by about 1.0°C by mid-century, and more than 2.0°C by late century. Scenarios suggest that temperature increases will be the highest in summer and autumn. Annual rainfall is likely to decrease overall, dominated by 10–15 percent less rain in winter and spring. In contrast, summer could become up to 10 percent wetter, although this is less certain.

The greatest issue for arable and vegetable cropping on the eastern side of the North Island will be the availability of water. This will be strongly influenced by the continued increase in demand, coupled with possible decreases in supply arising from warmer, drier conditions.

PLANNING AROUND CLIMATE CHANGE PROJECTIONS

The introduction of irrigation followed an assessment of the existing climatic conditions and cost benefit analyses. The climate change projection of increased drought, and rainfall in more concentrated bursts, only increases the case for supplemental irrigation. Climate change also projects the reduced availability of water for irrigation.

Hugh is a strong advocate for efficient water use and the effective performance of irrigation systems. There is not enough water at Drumpeel to fully meet current irrigation demand, no additional resources which can be tapped and little opportunity for storage. Higher demand and reduced supply serve to increase the pressure to use every drop well.

OPTIMISING WATER AND ENERGY USE

Hugh has a multi-strand approach to irrigation under climate change. He focuses on water use efficiency, crop rotation, crop prioritisation and energy efficiency. He has reviewed and changed his irrigation system, places high priority on having the best information for scheduling, and will review crops and crop rotations on an ongoing basis.

MAXIMISING WATER USE EFFICIENCY

The linear move is a potentially efficient irrigator. It offers flexibility in applied depth, is less affected by wind, and is not subject to overlap variations. It was supplied with spray nozzles and tested using the Code of Practice for Irrigation Evaluation protocols. This highlighted a lower than anticipated distribution uniformity, which has been shown to reduce potential irrigation efficiency, especially in arid conditions.

Extensive use of neutron probe soil moisture measurement guides irrigation scheduling and saves water and energy.

In 2006, he trialled changing the nozzles from sprays to spinners and found uniformity increased from 0.72 to 0.89. In theory, this allows the same quality of irrigation with 30 percent less water (and energy), freeing the excess for additional crops. In a relatively wet season, the trial did not show yield advantage. However, faced with the prospect of increased drought, Hugh has converted the rest of the irrigator. With restricted water, he wants maximum potential efficiency.

With the equipment optimised, the focus can be on management and scheduling, in particular. Extensive use of soil moisture monitoring services allows Hugh to track and predict crop water status accurately. This gives him the confidence to avoid unnecessary irrigation while obtaining maximum yields. When irrigation is required, a small moisture deficit is maintained to allow any rain to be captured. One trial at Drumpeel showed that moisture monitoring saved 25 percent of potential irrigation on one studied crop.

CROP PRIORITISATION

The strategic and tactical planning of water use is part of crop rotation design for Drumpeel. Even with maximum irrigation efficiency, the system relies on crop rotations to help manage water supply.

Selecting crops with different planting and maturity dates reduces

A 450 metre linear move irrigator is carefully managed to apply water only as required.

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

Published by Ministry of Agriculture and Forestry
PO Box 2526, Wellington 6140.
Freephone: 0800 008 333
Web: www.maf.govt.nz

competition for limited irrigation capacity. Tools such as the Wheat Calculator and the Maize Calculator allow Hugh to determine the relative value of water for different crops and to prioritise accordingly. A level of "redundancy" allows lower irrigation response or lower value crops to be dropped from the irrigation rotation in peak stress times.

To further future proof irrigation, Hugh is pushing for research into crop manipulation using controlled water stress. He has noted that some crops yield higher when the canopy is smaller – seemingly suffering from seasonal water deficits. He hopes to use strategic water deficit to control flowering, compress maturity and maximise harvested crop yield and quality.

ENERGY EFFICIENCY

Energy efficiency doesn't just help reduce climate change impacts, it makes immediate economic sense. To give flexibility, Hugh has fitted variable speed drive technology which accommodates varying flow demands while maximising power efficiency.

The linear move irrigator is a relatively low pressure machine so the required pumping energy is minimised.

The travelling gun irrigators require high pressure to operate correctly. Rather than pressurise the whole system (most of which is low pressure for the linear move), Hugh uses mobile booster pumps for the guns.

Next on the list is an update to the farm mainline system. A design audit showed that a short pipeline addition would convert the system to a ring-main and provide up to 18 percent savings in energy through reduced friction losses.

SUPPLEMENTARY PLANS TO MITIGATE CLIMATE CHANGE INDUCED DROUGHT EFFECTS

Irrigation system design and management, and crop prioritising, are direct responses to climate change threats. Hugh is going further, adopting new cropping technologies and practices that ensure his soils are in the best possible condition.

A leader in the development of strip-tillage systems, Hugh has minimised cultivation at Drumpeel and is moving to controlled traffic farming. He sees healthy soil as key to capturing limited summer rains as well as coping with the predicted extreme rain events. Healthy, well-structured soil will have higher infiltration capacity, better internal drainage and minimum limitations to root growth. All three will optimise growth conditions and maximise potential yields.

Key points

1. **Optimising irrigation efficiency results in optimum energy and water use whilst maintaining crop production and financial sustainability.**
2. **Healthy, well-structured soil will have higher infiltration capacity, better internal drainage and minimum limitations to root growth. All three will optimise growth conditions and maximise potential yields.**
3. **This approach helps future proof your business against extreme climatic events.**

Crop rotations select crops with different planting and maturity dates to reduce competition for limited irrigation capacity.

Existing nozzles were tested and replaced to increase application uniformity.

FOR MORE INFORMATION

- The Irrigation Code of Practice and Design Standards is available from the Irrigation New Zealand website: **www.irrigationnz.co.nz**
- For free Wheat and Maize Calculators and contact information for Arable Research **www.far.org.nz**

New Zealand Government

November 2010