Resilient Cropping

Energy

Resilience is the ability to cope with adverse events. Farms handle adverse events better if the soil is healthy, water available, and infrastructure (and capital) in place.

FAR Horticulture New Zealand Tahuri Whenua National Māori Vegetable Growers Collective Ministry for Primary Industries Manatū Ahu Matua LandWISE INCORPORATED

About Resilient Cropping

Resilience is the ability to cope with adverse events.

When we are generally happy and healthy we can handle most things nature (or life) throws at us. If we are run down, tired and sick, the slightest thing seems to knock us for six.

Farms are very much the same. They handle adverse events better if the soil is healthy, water available, and infrastructure (and capital) in place. And the reverse is true too. Beaten up soils, lack of water, inadequate or poorly maintained infrastructure and high gearing leaves a farm (and its people) at higher risk when bad things happen.

The “Resilient Cropping” initiative aims to build resilience into crop farming. It is a joint venture between LandWISE, the Foundation for Arable Research, Horticulture NZ and Tahuri Whenua the Maori Vegetable Growers Collective. The work is funded by the Ministry for Primary Industries.

Events

The main focus of “Resilient Cropping” is preparing for adversity such as extreme weather events, fuel cost spikes and restricted access to irrigation water.

In-field workshops across the country allow local growers to share experience and ideas and propose local solutions for local conditions. Among the topics are soil quality, irrigation efficiency, nutrient management and energy use.

A common question is, “How can we best prepare for uncertainty?”

An alternative is, “How should we farm knowing with certainty that adverse events will happen, and possibly more often?”

Energy and Resilient Cropping

This booklet discusses the use of energy in cropping, giving a breakdown of relative consumption and areas where efforts to make reductions might have greatest effect.

Total energy includes direct and indirect uses. Direct energy consumption includes fuel for driving tractors and electricity for pumping irrigation. Indirect uses include the energy in extraction, manufacture and delivery of that fuel, along with the embodied energy in fertiliser, agrichemicals and capital items such as tractors and other equipment.

How is energy measured?

On-farm, energy is often thought of in terms of litres of diesel or kilowatt hours (kWh) of electricity.

A common unit for energy statistics is the megajoule (MJ). Converting diesel volume into MJ equivalents and doing the same for electricity, gas and solar allows total energy to be determined and comparisons made.

1kWh = 3.6 MJ OR 1 MJ = 0.28 kWh

Energy use is often measured on a per hectare base which does allow comparison of different production systems such as wheat versus potatoes or milk.

It is also useful to measure energy use per tonne of yield, known as energy use efficiency. That allows comparisons of systems used to produce the same crop.

Converting values for typical fossil fuels to usable energy values

In New Zealand:

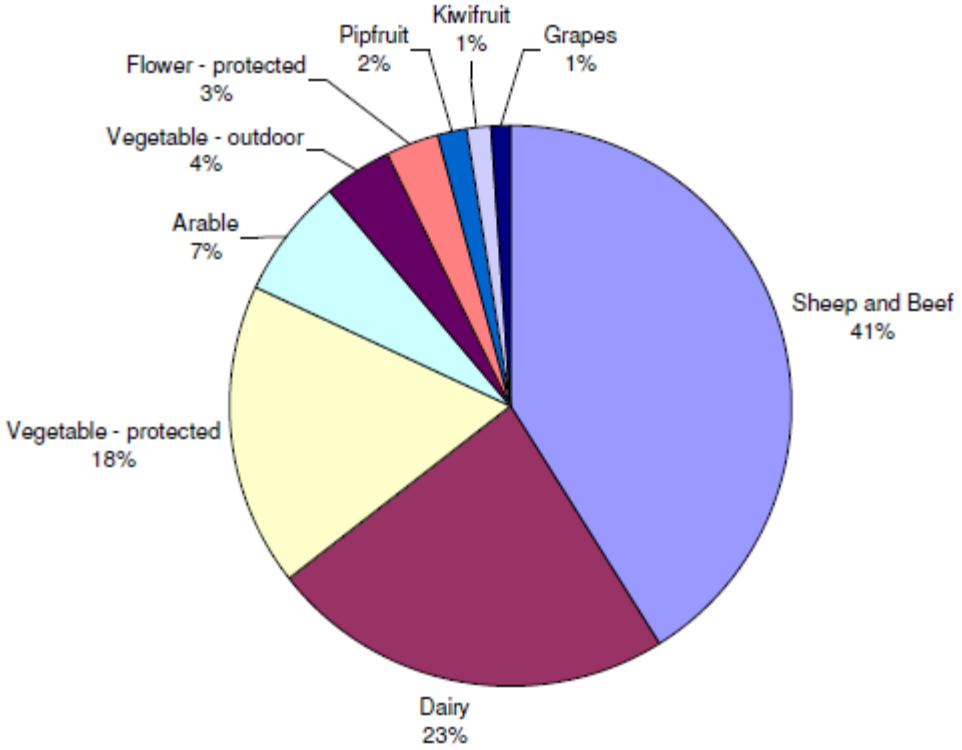
- diesel contains 10.4 kWh per litre, but only about 3.5 - 4.0kWh/L of useful energy are generated.
- 91 petrol contains 9.69 kWh per litre but only about 2.5 - 2.8kWh/L of useful energy is generated.

[These *usable energy* values for diesel and petrol are already adjusted for engine efficiency.]

How much energy is used?

By national standards agriculture is a low energy consumer. In 2004 New Zealand agriculture consumed approximately 13.6 million MJ to the farm gate, or only 2.6% of national consumption.

Most on-farm energy was used in the pastoral sector. Arable used only about 7% and outdoor vegetables about 4% of the total agricultural use.



Relative energy use by agricultural sectors (from Barber)

Total energy use

Total energy considers that used to make agrichemicals and fertilisers, produce seeds and transport everything to the farm. These can account for four times as much energy as the fuel used for cultivation.

A generic herbicide uses the equivalent of about 7L of diesel per kg of active ingredient. Nitrogen fertiliser needs the equivalent of 0.7 - 1.7 L diesel/kg N.

What is energy used for?

Cultivation

Cultivation is often the largest use of on-farm direct energy on a dry land farm.

The energy consumption ranges widely depending on what systems are used. Full cultivation requires much more than no-till.

Cultivation is the largest user of energy on dry land cropping

Irrigation

Irrigation can account for a large part of total cropping energy use especially in drier seasons.

Consumption varies widely with deep wells requiring a lot of energy to get water to the ground surface. High pressure systems also use more energy – double the pressure, double the demand. Estimates suggest 400 kWh/ha for a single 35mm irrigation application. This equates to about 100L of diesel.

Transport

Energy for transporting crops depends on farm layout and locations. In Pukekohe where fields can be spread over a large area, Barber suggested 25% of vegetable growing fuel use was transporting crop from field to shed. In the South Island with mostly single large properties, much less fuel is used for internal transport.

Post-harvest processes can use high amounts of energy for drying or cooling produce. Grain drying arable seeds uses 2,500 – 5,600 MJ per tonne of water removed, depending on drying system used.

Where can savings be made?

Energy optimisation measures range from reduced tillage and tractor driver education to irrigation efficiency and split fertiliser applications.

While direct energy use is often less than 5% of expenditure, cost savings from a 15% improvement in diesel and electricity use can boost profits significantly. Beside direct cost savings other benefits include lower labour costs, reduced repairs and less capital depreciation.

Cultivation

Cultivation energy can be reduced through correct tractor set up, including ballast and tire pressure. Modern tractors seek to optimise engine management automatically.

Controlled traffic and minimum cultivation offer major money, energy and time savings

The biggest savings are made by reducing cultivation operations, especially high draft activities such as deep ripping and powered cultivators. Moving to controlled-traffic or minimum or no-till systems offers major savings.

Irrigation

Irrigation energy use is highly variable, depending on location and season.

Save energy by:

- selecting the correct pump and pipe size
- running lower pressure systems
- only applying water when needed (careful scheduling)
- maximising capture and use of rain (free irrigation)

Further information

Energy efficiency is an important aspect of many profitable and sustainable cropping systems.

Horticulture NZ/Foundation for Arable Research Report

Barber, A. 2004. *Seven Case Study Farms: Total Energy & Carbon Indicators for New Zealand Arable & Outdoor Vegetable Production.* AgriLink

Publication

Bloomer, D.J. and J. Powrie. 2011. *A Guide to Smart Farming.* LandWISE Inc.

Web Resources

Resilient Cropping

Available as downloads *www.landwise.org.nz/projects/resilience*

- Resilient Cropping Fact Sheets
    - Energy Use in Irrigation
- LandWISE Fact Sheets
    - Controlled Traffic Farming
    - Strip-Tillage

Page Bloomer

Downloads from *www.pagebloomer.co.nz*

- EECA Energy efficiency in irrigation
    - Pump efficiency – Guidelines and Worksheet
    - Delivery system efficiency – Guidelines and Worksheet

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Web Resources

www.landwise.org.nz/projects/resilience

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