

Less power, water – but more milk

When a Canterbury couple joined an irrigation study, they not only saved thousands on electricity as well as water, they also lifted milk production.



Owners: Stu and Gayle Litchfield
Area: 180ha, 173ha effective
Soils: 90ha Chertsey (heavier), 90ha Lismore (light)
Cows: 650 Friesians
Production: 1800kg of milksolids (MS)/ha
Supplements: 400kg dry matter (DM)/cow grass silage, 395kg DM/cow barley
Irrigation: Three Briggs Roto-Rainers M200
Return interval: 11 days
Pumps, 130m depth: 130kW variable speed, 75kW fixed
Labour efficiency: 1.4 hours/ha/year including maintenance, 1.5 hours/day for operation



Stu and Gayle Litchfield – without irrigation there would be no dairying in their area.

Finding simple ways to cut more than \$10,000/year off the power bill, saving 15 percent of their annual water allocation and potentially producing an extra \$72,000 worth of milk was a welcome spinoff to joining an irrigation efficiency study for Stu and Gayle Litchfield.

The couple have been dairying at Te Pirita in Canterbury since 2001, when they moved from Waitoa in Waikato and converted the 180ha, dryland sheep farm to lush, productive dairy country.

Good, mature shelter and layout of the property meant they settled on the common irrigation of the day, using three Briggs Roto-Rainer M200 irrigators capable of irrigating 5.3ha/run.

They now milk 650 cows and produce 1800kg milksolids (MS)/ha/year, using up to 400kg dry matter (DM)/cow of grass silage and 395kg DM/cow of barley.

Stu and Gayle have placed a high priority on good irrigation management and are acutely aware how critical every last drop

of water – pumped from 130m below the ground – is to the sustainability of their business.

The cost of pumping water from that depth helps drive efficiency.

“No one wants to waste water,” Stu said.

“It costs us \$580/day.”

Three years ago they deepened one of their two wells from 90m and at the same time installed a variable speed pump, innovatively linked with a smaller 75kW pump at their second well.

Shut-off

As irrigators finish their runs, the variable-speed pump picks up the increase in pressure and shuts the smaller pump off to save power. When the next irrigator finishes, the pump cuts itself down to half power and then shuts off altogether once the third irrigator finishes.

Soil-moisture monitoring has been used to help determine irrigation timing to minimise water use and maximise pasture

production.

“During the shoulder times, spring and autumn, that’s where we can make big savings by not having the irrigators on unless we need them,” Stu said.

They have used Tony Davoren’s Hydro Services for four years. The company uses neutron probes to measure soil moisture down the profile taking measurements on a weekly or longer interval. Reports are completed on each visit.

They have also recently installed Aquaflex technology which gives continuous readings, uploaded to the farm computer.

All help

Their on-farm practices, training of staff and attention to the system all help to lift its performance and efficiency.

“We thought our system was working pretty well, but we put up our hands to be involved in the study because we wanted to check just how well it was working,” Stu said.

The study (pages 34-36) is part of a two-year project to improve dairy irrigation practices.

It has involved five farms in Canterbury being assessed by experts, who suggest how each can make improvements using existing best practice.

For Stu and Gayle, the suggested improvements come at almost no extra capital outlay but could cut their power use by \$10,250/year and create water savings of around 145,500 cu m/year or 970 cu m/day.

Sue Cumberworth from the AgriBusiness Group, which is overseeing the study, said the additional water could irrigate 24ha. It has the potential, if it could be stored and used in a time of shortage, to provide an extra \$72,000 in milk income for a 150-day irrigation season at \$5/kg MS payout or \$30,000 to \$40,000 for a 75-80 day irrigation season.

The calculation was based on water savings of 970 cu m/day, and every 10 cumecs of water/ha is equivalent to 1mm application depth.

She used conversion factors of 1mm of water to grow 15kg DM/ha, producing 1kg MS.

Five farms

Canterbury specialist water research and consultancy company Aqualinc assessed the systems on all five farms. Aqualinc consultant Neal Borrie said that while most of the seven key performance indicators evaluated were at a high level, the Roto-Rainers were sitting stationary at the end of runs, as staff were often unable to attend to them straight away.

By simply installing automatic cut-offs, the power saving from not pumping unnecessary water for an average one hour/day was around \$30/day or \$4500/year, he estimated.

It also meant a water saving of 650 cu m/day or around 97,000 cu m/year.

Assessment of application rates and observation of the system in action found some water was being wasted on lanes.

By shortening the runs by 10m, he said Stu and Gayle could save about half an hour of irrigation time/day, equating to around \$15/day or \$2250/year in power costs. Around 48,500 cu m/year also would be saved from wastage.

Checking pressures and flow rates revealed



Stu and Gayle Litchfield and one of their Briggs Roto-Rainers – bringing life-giving water to their highly productive Te Piritā dairy farm.

“By simply installing automatic cut-offs, the power saving from not pumping unnecessary water was around \$30/day or \$4500/year...”

the pumps were performing to specification but the irrigators were receiving more pressure than needed for optimal performance.

Pressure cut

Neal suggested lowering the mainline pressure to the irrigators so that inlet pressure dropped from 33m or 330 kPa to the ideal 28m (280kPa).

For every one metre drop in pressure, a saving of around 1.5kW in energy can be achieved, so by reducing mainline pressure on the Litchfield farm by 5m, they could save around \$3500/year in power.

Energy costs for pumping water from the deep wells is \$510/ha/year, of the \$630/ha/year total irrigation costs on the farm.

In spray irrigation systems, any modification to reduce energy use is likely to provide the greatest potential for savings.

The couple have had water meters for some years to help calculate seasonal use.

Neal said many of the calculations of key

performance indicators of an irrigation system include water meter readings. His advice to all irrigators is to install meters straight away whether or not they're required as part of the consent, as a useful management tool.

Like all dairy farmers, Stu and Gayle are looking for any cost savings they can find, and the total \$10,250 identified in the study was welcome. Equally as welcome are any water savings, particularly as the Litchfield's farm lies in the Rakaia-Selwyn groundwater zone, where Environment Canterbury (ECan) is reviewing all consents to take water.

The Litchfields' consent is to take 109 litres/second.

Instantaneous

The consents are allocated by instantaneous rate (litres/second) but the review process will result in annual volume limits being set.

Converting their instantaneous rate allocation to an application depth (mm) gives a better understanding of the watering ability – it is the same measure used when considering rainfall.

On that basis, the proposed volume for Litchfields' consent would provide them with 540mm/year of irrigation which supplements their average rainfall of around 600mm/year.

Total water savings identified in the study equate to 84mm/year, or 15 percent of the Litchfields' current take.

“It's pretty important when you look at it that way, especially if we're going to have these volume limits put on us,” Stu said.

The couple had already heeded advice from the evaluation in installing the automatic cut-offs.

“It's been a very worthwhile exercise.” **D**



Field day talk – Stu Litchfield outlines his system for improving irrigation practices on dairy farms, with Agribusiness Group consultant Sue Cumberworth, left, and Aqualinc's Neal Borrie.

On-farm checks pay handsomely

Getting an expert to give your farm irrigation systems the once-over could pay handsome dividends, according to findings from a two-year project aimed at improving dairy irrigation practices.

The biggest savings, of more than \$10,000/year, have come from reducing electricity use, often by simply ensuring pumps and pressures within the system are performing at specified levels.

Sue Cumberworth from the AgriBusiness Group, overseeing the project, said the intention was to show farmers how they could use existing technologies and practices to improve their irrigation efficiency.

To do that, five dairy farming families in Canterbury and North Otago have opened their properties to scrutiny from irrigation and water experts. The results have been shared through well-attended field days (page 32).

The project has been farmer-driven, using cluster groups of around 10 farmers within five irrigation areas, including a variety of irrigation systems involving both groundwater and surface water schemes.

They've all had systems believed to be at a good standard already, but the project has shown significant savings in water and money can still be made with what sometimes have been relatively cheap changes.

Seven points

Specialist water research and consultancy company Aqualinc has assessed the systems, looking at seven specific criteria:

- Pressure and flow rates
- System capacity
- Application rates
- Uniformity of application
- Energy efficiency
- Labour efficiency
- Operating costs.

Aqualinc consultant Neal Borrie said it was important to assess all factors, as each could signal where significant savings could be made.



Joe Powers measures water out of plastic buckets to check an irrigator's efficiency while AgribusinessGroup consultant Geoff Dunham, left and Tony Davoren record the information.

"You may have very good uniformity of application but, if pumps aren't working well or pressure isn't right, you could be wasting a lot of money and water," he said.

system was delivering to the specifications promised, even if new.

Savings in annual energy costs and water use were identified in several pumps in the study.

“... extra pasture production gained from reducing return intervals could go a long way towards covering the cost of an additional irrigator.”

Having accurate flowrate data was key to being able to make many of the calculations, and he urged farmers to install water meters without delay.

It was important to check the

Some were below recommended pumping efficiencies.

In one case, if repairs lifted the efficiency of two pumps by 10 percent, the farmer could save around \$5600/year in electricity

costs. Sometimes the energy savings came at a one-off capital cost of replacing the pumps. These could be \$15,000-45,000 depending on size of pumps involved on the project farms.

Bucket test

At the field days, farmers were shown a simple bucket-based field test to measure how evenly water is being applied across the length of the irrigator.

For pivots, lateral booms and Roto-Rainers, the buckets are set out in a line across the paddock, and water is measured after the irrigator's pass. For K-Line or pod-style irrigators, the buckets are set up in a grid within the area covered by the pod.

The water from each 10-litre bucket can be converted to give a depth of application in millimetres – as with rainfall.

It gives farmers a quick check of variation in application depth across the irrigator.

Using more detailed calculations, Aqualinc also found application uniformity was below par for several of the systems tested, including one large centre pivot where some nozzles were broken and flow to a corner arm was too high when the arm was retracted.

K-Line irrigation on one farm was also found to be well below recommended minimum uniformity, many areas being under- or over-watered.

The pod lines were set at 18m apart and, to lift the evenness of water application, the farmer was advised that, instead of placing the lines in the same location on every rotation, staff should move them 9m on each round. This would help fill gaps left by the wide spacing, without additional shifts.

As well as reviewing the farm's evaluation, the field days also featured soil moisture monitoring technology and its benefits in water and cost savings. The aim was to keep soil moisture levels

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between field capacity – the point at which the soil is “full of water” – and refill point, below which plants become stressed.

Hydro-Services managing director Tony Davoren explained that for every 1mm drop in soil moisture below stress point, pasture and/or crop production could potentially fall by about 0.3 percent.

“That means if you’re late getting started with your irrigation – and it’s been seven days since soil moisture levels have fallen below the stress point – and evapotranspiration is 5mm/day, you’ll potentially be 35mm below stress point,” he said.

“Multiply that by 0.3 and you’ve got a 10 percent drop in production.”

Stress point

While it was unlikely someone would allow their grass or crop to go seven days without water when it had already reached stress point, it was possible cumulatively, over a season, that soil moisture could drop to that level.

It also illustrated that extra pasture production gained from reducing return intervals could go a long way towards covering the cost of an additional irrigator.

Aquaflex irrigation management consultant Blair Miller said soil temperature was also an important factor in pasture growth

and needed to be taken into account in making timing decisions throughout in the season. Irrigating when soil temperature was at the low end of the range could depress pasture growth.

“That’s because it takes five times more energy to raise water temperature by one degree than it does soil,” he said.

“Drier soils warm more quickly than wetter soils.”

Gentle soak

Davoren explained that applying water at the low instantaneous rates of application (around 12-15mm/hour) allowed the moisture to soak more gently into the soil and be retained in the micropores within the rooting zone.

At higher instantaneous rates, studies had shown the water ran down through the profile quickly, creating drainage and reducing the even spread and storage of moisture within the plant’s rooting zone.

Centre pivot irrigators are capable of applying the lowest instantaneous rates but even they have shortfalls, Davoren said.

“Once you get out to the ends of these very long pivots, around 1km long, you can be getting rates up to 100mm/hour.”

This is because it requires a larger volume of water to apply the same depth of water at the speed the end of the pivot is travelling at.



Blair Miller, Tony Davoren and Sue Cumberworth show farmers how irrigation and more intensive pastoral farming have significantly improved the light Te Piritā soil

Cumberworth said the next stage of the two-year project would be determined by the farmer cluster groups. The project has backing from DairyNZ, the Ministry of Agriculture and For-

estry (MAF) Sustainable Farming Fund (SFF), Climate Change, Meridian Energy, the Energy Efficiency and Conservation Authority (EECA) and PGG Wrightson. **D**

Greens hail Landcorp ‘example’

Green Party co-leader Russel Norman has cited Landcorp as an example of what other farmers could do to clean up waterways.

During a check on Landcorp’s environmental performance, the Greens asked the company about compliance on effluent consents. The response was that Landcorp had one infringement notice in 2008 and two in 2007. As it has 37 dairy farms, Norman pointed out in an item on a party blog, its non-compliance rate in 2008 was three percent.

It had also ensured that the earlier breaches were not repeated, significantly better than the 11

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percent nationwide non-compliance rate among the 10,000 Fonterra dairy farms as reported in the Clean Streams Accord (CSA) report.

While compliance itself was not enough to clean up the country’s polluted waterways, Norman said, “it is an important baby-step to a

grown-up solution”.

Other Landcorp efforts to protect waterways and wetlands had drawn praise from Department of Conservation (DOC) in Southland.

Norman also said regional councils are charged with keeping up standards, but often strug-

gle for the will and resources to do the job thoroughly, although some are leading the way – Horizon’s One Plan in particular.

Secondly, the Key Government seems set on weakening the laws on which the councils and responsible farmers’ efforts are based.

Concerning whether regulation is excessive, he said the question is not how much or how little government we have, but “does it work?”

Landcorp, he believed, was showing it could work.

“We just need the Government to require the others to follow.” **D**