CHANGES AND IMPROVEMENTS IN IRRIGATION PRACTISES
MELROSE FARM

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Since 2011 the property has undergone extensive development from flood irrigation (border-dyke) to spray irrigation (90% centre pivot).

Total production in 2013/14 was 1,275,000 kg milksolids (MS)

The property has three dairy sheds, one 50 bail rotary and two 60 bail rotary sheds. Each farm milking 880 cows on a seasonal milk supply calving in August and drying off in late May.

What changed in the last 15 years?

Border Dyke to Centre Pivots

- Centre pivots are currently one of the most efficient ways to irrigate.
- Overhead spray irrigation has improved our water efficiency greatly. Previously border-dyke was applying approximately 100mm/application today we can apply rates as low as 5mm / application if necessary but generally about 15mm is applied at each application.
- Soil water holding capacity has been estimated at 50- 60mm PAW (Potential available water) so under border-dyke irrigation 40 of the 100mm applied was unable to be held and was pushed directly into underground aquifers taking valuable Nitrogen (N) and Sulphur(S) with it.
- Centre Pivots have also brought the advantages of
    - using relatively low pressurised water other forms of spray irrigation which also reduces energy costs
    - No labour requirement compared to other labour intensive systems e.g. border-dyke & k-line

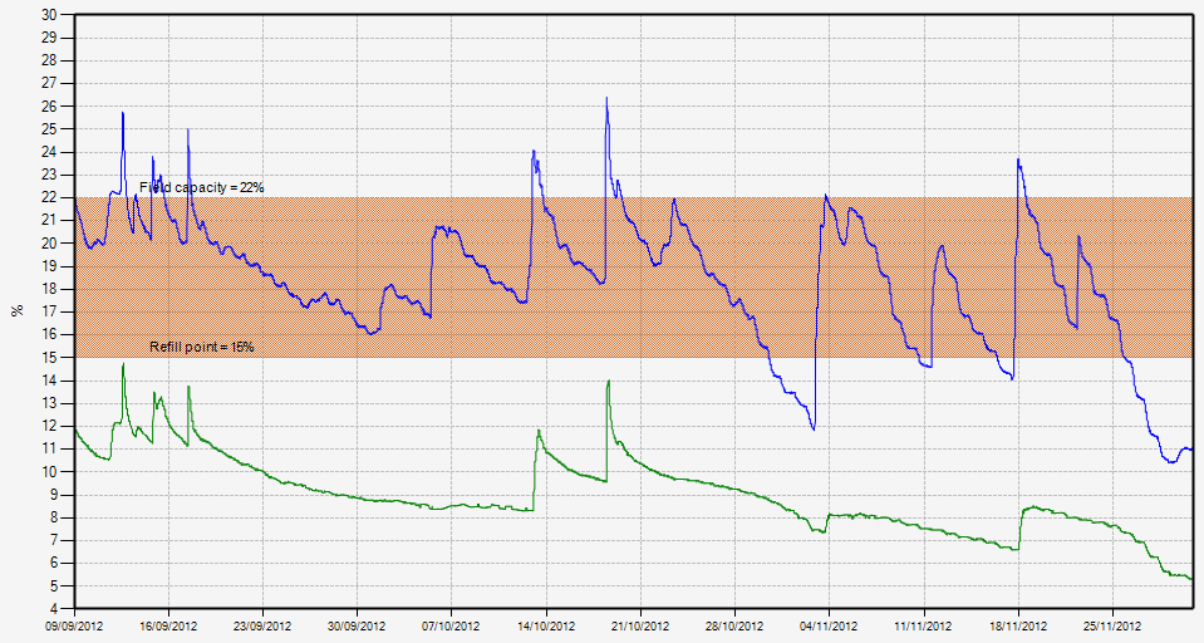
Soil Moisture Monitoring

We have been monitoring and measuring soil moisture for the past 8 years,

To do this we use a system called Aquaflex which uses conductivity of the soil to measure soil moisture. Flowing electrons in the soil are measured at different rates to determine the soil moisture.

This information is then graphed (see figure1) and then used to determine when we ar3e at the optimum level to maintain soil moisture to maximise plant growth.

Figure 1



Field capacity is the point when the soil moisture is full and cannot hold any more water without runoff or drainage occurring. After this point livestock can also cause pasture damage by pugging.

Refill point – Is the point where soil moisture is low enough to reduce pasture growth and restrict plants from obtaining enough moisture to grow at an optimum level.

By monitoring our soil moisture and adding irrigation we aim to maintain the soil moisture between field capacity and the refill point.

We have eight sites on the farm that we are monitoring to give us an average over the property to make these decisions.

We are now on our 3rd generation in eight years of this system from a palm pilot hand held data gathering device to telemetry to a computer server and now web based which can be picked up by my smart phone.

There are now over 4,000 sites using Aquaflex to monitor soil moisture in New Zealand.

The green line on the graph (fig 1) is a second soil moisture strip reading soil moisture drainage which is below the soil profile. The spikes on this graph indicate water moving to drainage which directly relates to the soil moisture exceeding field capacity this can be caused by excessive irrigation or high rainfall events.

Global Positioning Systems (GPS)

GPS is used widely today in many farming application. It is used for proof of placement of our fertiliser and effluent spreading to measure and monitor correct application and placement on paddocks during the irrigation season we use effluent from the dairy sheds as a fertiliser and is spread with the use of centre pivots. When the conditions are suitable we stop irrigating with water and use the centre pivots to spread the stored effluent evenly over the paddocks.

The effluent system at each of our dairy sheds has a two stage pond system. The first pond acts as a large septic tank breaking down the solids in an aerobic environment. The liquid then flows into the second pond effectively creating greenwater which is able to be pumped out through the centre pivot irrigator without blocking any of the componentry. This gives us the ability to apply low rates of green water through the pivots at a depth of 5mm application to minimise any environmental impacts.

GPS is also used for the placement of individual irrigation sprinklers on the corners where the centre pivots do not reach. This reduces over wat3ering as the placement of sprinklers are shifted to different position each day without overlapping until they have completely the area required and returned to the start again.

Environmental Awareness

Today farmers are much more aware of future requirements of any environmental impacts there farms may be having. And future changes farm in Regional Plans will determine water quality limits for all catchments. Each catchment will be affected differently. Emphasis in some catchments will be on N lo9ss while others will (phosphorus loss). In the Hinds Plains catchment our main environmental concern is the increase concentration of Nitrate in the groundwater rising.

Figure 2 shows that the increases in productivity over the last 20 years has been attained while reducing environmental impact.

The kgN Leached (Overseer number) in Figure 2 does not take into account any benefits from the improved water and effluent management and improved soil water capacity.

Figure 2

Year	Cows	Production	Irrigation	kgMS/mm water *	Total N Inputs	kgN Leached **	kgMS/kgN input	kgMS/kgN leached
1992	2.2/ha	704kgMS/ha	800 mm/ha	0.469	168 kg/ha	48	4.2	14.7
2002	3.0/ha	1170kgMS/ha	675 mm/ha	0.851	286 kg/ha	56	4.1	20.9
2014	3.8/ha	1805 kgMS/ha	383 mm/ha	1.666	382 kg/ha	47	4.7	38.4
* As a measure of total water used including rainfall at 700mm/ha/year								
** Excludes wintering crops, calculated using Overseer V 6.1.2								

Summary

In the Hinds Plains catchment where we farm, nitrate leaching has become an issue due to the intensification of land use, predominately under dairying.

As farmers develop a better understanding of their N losses by the likes of Overseer, investment in new technologies alongside good management practises will help reduce N losses in the Hinds Catchment.

Other tools may also be required i.e. MAR (Managed Aquifer Recharge). This is where low nitrate river water is recharged back into the aquifers to manage N levels. Although this is a new concept it has been adopted successfully overseas. MAR is presently being trialled in the Hinds Plains catchment.

"If we are efficient in the way we use resources it will be more sustainable for our business and the environment"