CottonInfo Information when you need it

Economic benefits of performance evaluation

This fact sheet has been adapted for CottonInfo from a former Cotton Catchment Communities CRC publication, authored by Michael Reynolds M&M Project Management and Rod Jackson NSW DPI, in September 2007.

Background

Oakville Pastoral Company in the Narrabri district, NSW, is a leading edge farming enterprise aiming to undertake industry best management practice in all facets of its business. An indication of this commitment is the fact that Oakville Pastoral Company was the first farm in the world to gain AS/ NZS ISO 14001 certification – recognition of its compliance with world's best practice principles for environmental management.

Owner-Manager, Mike Logan's main enterprise is cotton with rotation and opportunity cropping of wheat, sunflower and soybean. Water for irrigation is sourced from both the Namoi River and the groundwater system depending on availability.

The investment

In 2001, Mike made a decision to further improve the irrigation performance of the farm by engaging Aquatech Consulting Pty Ltd, Narrabri to undertake the irrigation efficiency analyses using Irrimate™ equipment. Mike also combined these efficiency evaluations with GPS yield monitoring to constantly evolve the layout and operation of the farm.

What is Irrimate™ surface irrigation performance evaluation?

Irrimate™ is an assortment of electronic tools to measure water on and off fields, and water advancement timing. The data collected enables an assessment of how much water has infiltrated the field. Software is then used to simulate different management options to minimise losses and improve irrigation efficiency.

Table 1 – Measurements of water savings through Irrimate™ Optimisation (Field 1).

	BEFORE CHANGE MEASURED	AFTER CHANGE OPTIMISED
Field Length (m)	885	408
Flow Rate (L/s)	2.7	3.8
Time Water Applied (hrs)	20	6
Deficit (mm)	60	60
Inflow (mm)	110	83
Tailwater (mm)	27	21
Water Infiltrated (mm)	83	62
Application Efficiency (85% tailwater recycling)	69%	92%
Distribution Uniformity (DU)	92%	92%
Potential Water Saving (ML/ha)		0.22

Irrigation system evaluation – results and changes

In 2001 a series of Irrimate™ evaluations were undertaken on a number of 'Oakville' fields to determine irrigation efficiencies, and to establish whether management change or field redesign could save water. In field 1, initial evaluation

identified that efficiencies could be optimised by halving the field length. Based on this advice, in 2002 Mike undertook the necessary earthworks to split the 66Ha field into 2x33Ha fields.

To gauge both the success of the field redevelopment and fine tune his water management, Mike then undertook another Irrimate™ evaluation during the 2003 season. Table 1 depicts the relative efficiencies of pre and post field redevelopment, and the water savings achieved.

Monitoring results in table 1 indicated that by decreasing the field length from 885 metres to approximately 408 metres, and increasing head ditch and tail drain capacities to get the water on and off faster, Mike is potentially saving approximately 0.22ML/Ha/irrigation. This data forms the basis for the subsequent cash flow budget analysis.

Irrigation evaluation – benefits ($)

N.B The following BENEFITS & COSTS are associated with the changes and water savings made to field 1 only. The costs of the monitoring and evaluation are spread across the entire irrigation area of Oakville as they assisted with other gains.

Water savings are calculated using the pumping costs associated with furrow irrigation using diesel power as per NSW DPI gross margin budgets 2007. Price per ML increases as fixed water charges and diesel prices increase. Pumping costs will also be dependant upon pumping head where groundwater

Table 2 – Benefits of Monitoring and Change.

ACTIVITY	DESCRIPTION	TOTAL COST	$/HA
Yield Improvement	Average increase of 1.2 bales/ha/year @ $450/bale (variable costs unchanged)	$35,424	$540
Water Savings	0.22ML/ha/per irrigation savings @ $18.39/ML	$1,592	$24
TOTAL		$37,016	$564

is used. For the subsequent analysis it has also been assumed that potential water savings as identified by Irrimate™ are the same for all in crop irrigations.

"I regularly yielded 8 to 8.5 bales/ hectare but with more precise irrigations I have been able to decrease waterlogging on this field and achieve yields of 9.5 bales/ha. This improvement has also resulted in an average increase of 0.23 bales per megalitre of water applied".

As indicated by table 2 the main benefits to the change in field length has been the improvement in yield and water savings.

Through yield monitoring, Mike has seen a dramatic increase in cotton bales per hectare.

Irrigation evaluation – costs ($)

The cost of redeveloping field 1 was approximately $358 per hectare (Table 3). The construction of higher capacity head ditches and tail drains contributed to 44 per cent of the total development cost. Changes to field slope and direction were not necessary, and no additional pumps and siphons were required as Mike also changed from running double siphons to single siphons with the improvement in head ditch capacity. Hence the remaining siphons were transferred to the new development.

Table 3 – Costs of Monitoring and Change.

ACTIVITY	DESCRIPTION	TOTAL COST	$/HA
Irrimate™ Evaluation Service	Surface irrigation efficiency assessed. Field 1.	$787	12
Land survey – Head ditch & Taildrain only	Field 1 – 65.6ha	$328	$5.00
Irrigation Design	Planned new works	$680	$10.40
Earthworks/ Landforming	Not required	$0	$0
Channel Development	800 metre new channel	$7,400	$112.80
Taildrain Development	Expansion of existing system	$3,000	$45.73
Culverts	1 new addition	$1,800	$27.44
Irrigation Equipment eg. Pumps & siphons	No change	$0	$0
System Maintenance	New head ditch & tailwater	$1,000	15.24
Labour	Additional 2 employees averaging 5 weeks/year @ $850/week	$8,500	$129.57
TOTAL		$23,495	$358.18

Table 4 – Data for Analysis.

Area of Land	65.6 ha
Cost of Changes to the System	$228.61/ha
Ongoing Monitoring Cost	$500.00 pa
Increased Labour Cost	$129.57/ha
Seasonal Water Use	6 ML/ha
Water App. Efficiency Improvement	22%
Pumping Costs	$18.39 /ML
Improved Gross Margin	$540 /ha
Interest on Debt	9%
Interest on Credit	4%

Another major cost Mike has incurred is the increase in labour costs of running the new system. He no longer changes siphons in sets but changes siphons individually as required.

“This has seen the need to employ an extra two people averaging an additional 10 weeks per year but it has been worth it,”Mike said.

Results

Table 4 categorises the improvements made on ‘Oakville’ through the investment in irrigation monitoring and redevelopment.

The investment of approximately $358/ha to improve water use efficiency on field 1 has resulted in an increase in yield of approximately $540/ha per year and water savings of $24/ha per year. From the cashflow budget (ie. Figure 1) it is evident that this type of investment paid for itself in the first year and could potentially add up to $270,000 to the overall farm budget in 10 years if these types of results continue.

Figure 1 also indicates that even if yield improvements were only $250/ha, there would be still a positive return on investment in one to three years. However, if the yield induced benefit decreases below $210/ha, the returns on investment will be negative.

Table 5 indicates the impact yield improvement and irrigation development costs have on the payback period of the investment. These figures are based on the water savings experienced at 'Oakville', and an average conservative pumping cost of $18/ha. It must be noted that this cost is the cost of pumping (fixed and variable costs) and does not include buying or selling water at the market price.

At low yield improvement (<$100/ha) the payback period is approximately two years at costs (<$150/ha) but as costs increase above $750/ha the payback period increases beyond a logical investment timeframe of 13 years or higher. However as yield improvement increases above $400/ha the payback period is four years or less for all costs of change up to $900/ha which indicates worthwhile investment in technology.

Table 5 – Effect of Yield Improvement ($/ha) and Irrigation System Change ($/ha) on Payback Period (years).

	COST OF CHANGE ($/HA)					
	150	300	450	600	750	900
YIELD IMPROVEMENT ($/HA)	PAYBACK PERIOD (YEARS)					
100	2	4	6	9	13	>30
200	1	2	3	4	5	7
300	1	2	2	3	4	4
400	1	1	2	2	3	3
500	1	1*	2	2	2	3
600	1	1	1	2	2	2

*Indicates Oakville's investment payback period.

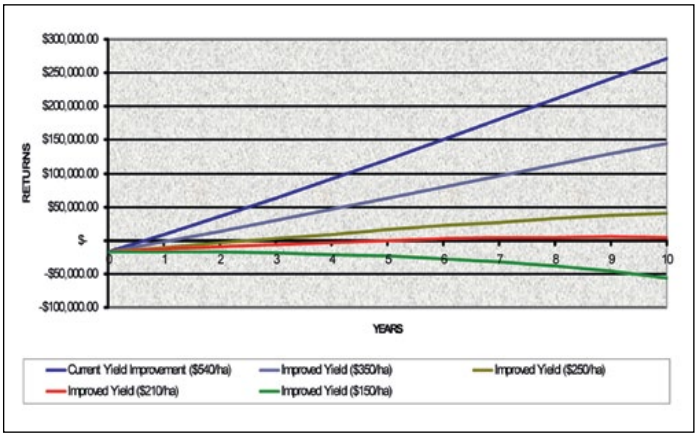

Figure 1 – The Sensitivity of Yield Change 'Oakville'.

For more information:

Visit www.cottoninfo.com.au/water-management

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