

# MODELLING DAIRY FARMING SYSTEMS

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*Providing robust analysis of the impact of potential changes on the profitability of dairy farm systems*

## AUTOMATED IRRIGATION – DOES IT PAY?

### Economic Benefits of Automatic Flood Irrigation for Dairy Farms in Northern Victoria

The labour saving and lifestyle benefits of automated flood irrigation have long been recognised in northern Victoria. In an irrigation farm survey completed in 2006, 11% of dairy farms in the Central Goulburn area had some form of automatic irrigation with an average of 25 ha serviced by automation. What is not as well known is:

- Is auto flood irrigation a good investment?
- How does the profitability of different automated systems compare?

To gain a better insight into this, an economic analysis of three of the most commonly installed automatic flood irrigation systems was conducted.

The three systems compared were:

1. A pneumatic system, which is a permanent system activated by a bay sensor located at the irrigation cut-off point. The bay sensor is connected to the irrigation structures by a small polythene pipe buried in the ground. When water enters the sensor it pressurises the air which



Pneumatic system



Portable timer system



SCADA system

activates the opening and closing of the irrigation structures. This system could be described as semi-automatic as it needs to set up prior to each irrigation event.

2. A portable timer system using battery operated clocks to open and close bays on a time basis. The portable nature of this system means that it could also be described as semi-automatic, as labour is still required to set up and move the timers. The flexibility and portability mean that this system can be used on a range of pasture and crop types.
3. The supervisory control and data acquisition (SCADA) system, which uses a personal computer and software package to control irrigation via a radio link. Signals are sent from the computer to control modules in the paddock that open and close irrigation structures with linear actuators. Bays are opened and closed on a time basis, but the system has the capacity to automatically alter the time a bay outlet is open if the channel supply is inconsistent. This is basically a permanent system with minimal labour required.

**AUTOMATED IRRIGATION – DOES IT PAY?**

The initial analysis involved comparing the profitability of these three systems on an area of 16.5 ha of perennial pasture that received 20 irrigations in a season. These irrigations took just over 21 hours each to irrigate 10 bays at a labour cost of \$25/hr. Labour savings as a result of automation by the timer, pneumatic and SCADA systems were 4 hours, 5 hours and 5.5 hours per irrigation, respectively. The capital cost for the 16.5 ha, including both equipment and installation, ranged from \$5,170 for the timers, \$7,650 for the pneumatic system and up to \$18,100 for the SCADA system. For further details on the assumptions used, refer to the full report titled ‘Economic analysis of automatic flood irrigation for dairy farms in northern Victoria’ (Armstrong 2008).

**Is auto flood irrigation a good investment?**

**How does the economics of the different systems compare?**

Given the area and labour savings indicated above, both the pneumatic and timer systems appeared to be very good investments (Table 1). In contrast, the poorer results for the SCADA system demonstrated why this system would generally only be installed on a larger area.

**Table 1. Years to break-even and internal rate of return for investments in three types of automatic irrigation in various situations.**

	Pneumatic	Timer	SCADA	Pneumatic	Timer	SCADA	Pneumatic	Timer	SCADA
Area serviced by automation (ha)	16.5			50			100		
Yrs to break even (before interest)	3	2	8	2	1	5	2	1	4
Internal rate of return (IRR)	47	54	7	57	>100	19	57	>100	23

**Does it depend on the area automated?**

To examine a larger scale of development, the economics of each automatic system was then compared for perennial pasture areas of 50 and 100 ha.

Again, both the pneumatic and timer systems were shown to be good investments over these larger areas. The economic performance of the pneumatic system did not appear to be affected significantly by the area installed. In all situations analysed, the pneumatic system took 2 to 3 years to break even (before interest). Although this system performed well economically, it is designed to be installed in bays that receive regular irrigation, as the cut-off point for water on the bay is fixed. With changing irrigation practices due to low water allocations, this system is not as flexible as the other two options.

For the two larger areas, the results from the analysis appear to be too good to be true for the

timer system. Anecdotal evidence does not support these large benefits as timer systems are generally used for smaller areas. Farmers often change from a timer system to a permanent system, such as the SCADA system when they increase the area automated. It is rare that a farmer would purchase more than about six timers as a large number of timers makes the correct sequencing of individual units difficult. The timer units are also relatively bulky, which makes transport of a large number of units difficult on a motor-bike.

The SCADA system appeared to be a good investment when more than 50 ha was serviced by the system. This was due to the high initial set up cost being spread across a greater area. Changing the irrigation layout of the area, by doubling the average bay size and halving the number of bay outlets also enabled the capital cost to be substantially decreased. However, the economic advantages under this scenario were reduced, as the labour savings were roughly halved. A similar reduction in benefit was also observed for the pneumatic and timer systems when bay size and number of outlets were changed.

**What if I save more/less labour?**

As would be expected, the attractiveness of each of the alternative systems relied heavily on the amount of labour saved as a result of automation. If the number of hours saved per irrigation were only half of that assumed, the SCADA system was not a good investment in any of the situations analysed. The pneumatic and timer systems also become marginal investments for the 16.5 ha area when labour savings were halved.



**AUTOMATED IRRIGATION – DOES IT PAY?**

**What if I place a higher value on the labour saved?**

Halving the value of the labour saved had the same effect as halving the number of hours saved. In contrast, a 50% increase in the value of the labour saved increased the attractiveness of all types of automatic irrigation. In this situation, the SCADA system appeared to be a reasonable investment, even for the 16.5 ha area.

**How important are the water savings?**

When the price of water reached \$100/ML, the benefits of saving water through using automatic irrigation were also evident. At this price, a 10% water saving had a substantial impact, with the SCADA system being a reasonable investment on even 16.5 ha. A 10% water saving from automatic irrigation, however, is unlikely and a saving of less than 10% would be more common (Lavis 2007). It should also be noted that the timer system is less likely to provide a 10% water saving than the other systems, particularly if the supply is inconsistent.



**Other potential benefits**

Other assumptions made in the analysis also mean that the potential benefits may be different for an individual farm business. For example, it was assumed there was no change in pasture consumption as a result of installing automatic irrigation, whereas some farmers perceive that there is an increase in pasture consumption (Maskey & Lawler 2002). The actual improvement is yet to be quantified and would vary between farms.

**Conclusion**

From the analysis undertaken, it appears that automatic flood irrigation can be a profitable labour saving investment in many cases. However, the magnitude of the benefits are very sensitive to the amount and value of the labour saved.

Of the three systems examined, the pneumatic and timer systems were good investments regardless of the area they were installed to service. However, practical issues exist when automating large areas, which mean that a system such as SCADA may be implemented on larger areas. The SCADA system was found to be a good investment when more than 50 ha was serviced by the installation of the system.

**References**

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