Efficient pumps: keeping your costs down

Marian Davis
Development Officer – Irrigation
Professional Extension and Communication Unit

As irrigation commences on plant and ratoon cane, it is a good time to consider the actual cost of applying that water. Poorly performing pumps could be adding substantially to your bill.

Knowing how much a pump costs to run and how efficiently it is pumping makes it easier to decide what to change. Replacing a pump is a significant investment, but poorly performing pumps could be costing more to run than the cost of replacement.

Irrigation management has traditionally focused on water use efficiency; that is, applying the right amount of water in the right place at the right time. However, the Rural Water Use Efficiency (RWUE) program found that one of the major impediments to good irrigation efficiency was poor pump performance.

Pumping costs are a major component of irrigation costs and energy use, with costs of over $120 per megalitre being recorded (Jessen, 2011). Pump evaluations conducted in the Burdekin in 2011 calculated that for an energy cost of $0.20/kWh, pumping costs were between $8 and $23 per megalitre (**see Table 1**).

With energy costs constantly increasing, growers should be assessing their systems to determine whether their pumps are operating at peak efficiency.

Pump evaluations conducted throughout Queensland under the RWUE program found that efficiencies ranged from 23 per cent to 73 per cent, with the average being just 48 per cent. It is generally accepted that pump efficiencies should be greater than 70 per cent.

Poor pump performance can be as a result of age and wear of the pump and its components or it could be because the wrong pump has been installed. Some pumps, because of design and manufacturing limitations, are also simply less efficient.

Table One: Burdekin pump evaluation figures.

Pump	Type	TDH (m)	Flow rate (L/s)	Energy use		Pump efficiency per cent	$/ML	kWh/ML/m head
				kW	kWh/ML			
1	River	18.5	123	44	100	56	20.0	5.4
2	River	22.8	46	17	102	73	20.5	4.5
3	Bore	13.0	46	19	115	34	22.9	8.8
4	Well	12.2	56	11	55	67	11.0	4.5
5	Well	10.7	68	11	45	72	9.0	4.2
6	Lagoon	8.2	103	18	47	53	9.5	5.8
7	Dam	6.9	133	19	41	50	8.2	5.9
8	Well	8.4	80	25	88	29	17.7	10.5

How pump performance is assessed

Pumps are always tested when they are operating under normal conditions. Obtaining a copy of the correct pump curve is also important. This will show the best efficiency point (BEP) for that pump.

When pumps are assessed, the following steps are followed:

1. Flow rate (L/s) is measured. This is easily done if a meter is fitted. If it's not, an external ultrasonic flow meter can be used.
2. Power consumption is measured. For electric pumps, this is the number of kilowatts (kW) consumed per hour of operation. For diesel pumps, it is the number of litres of diesel used per hour of operation.
3. Total dynamic head (m head) is calculated from the pressure at the outlet and the suction at the inlet.
4. When flow rate and total dynamic head are known, they can be plotted on the pump curve to compare the pump's operating point with its best efficiency point.

Another measure of pump efficiency is the amount of power it takes to move a megalitre per metre of head (kWh/ML/m head).

It is calculated by multiplying the time (in hours) that it takes to pump 1 ML by the pump or motor's power consumption (kW) for that time and then dividing the answer by the total dynamic head. A number less than 5 is considered a good result.

Left: Furrow irrigation. **Center:** Centrifugal pump on a well. **Right:** Poorly performing pumps have high electricity costs.

Causes of inefficient pump operations

If a pump is performing poorly, the cause must be found.

> Is the pump worn? Will it operate more efficiently if the worn parts are replaced or should the whole pump be replaced?

> Is it the 'right pump for the job'? One of the worst performing pumps tested under the RWUE program was a new pump that had been installed in the wrong situation (Jessen, 2011).

> If the pump is performing well but still costing a lot to run, is it on the correct tariff?

Reference

Jessen, M. 2011. On-farm pump testing for energy efficiency. Irrigation Australia Journal, Volume 26, Winter 2011.

Other reading

Irrigation Australia Journal, Winter 2011. Energy and Irrigation Feature. www.irrigation.org.au/publications-resources/irrigation-australia-journal

1. Pumping water is a major cost on most irrigated farms. Costs of over $120/ML have been recorded (Jessen, 2011).
2. Poor pump performance is one of the main causes of poor irrigation efficiency.
3. Pumps tested under the RWUE program had an average efficiency of just 48 per cent, whereas the nominal benchmark is 70 per cent.