

Irrigation Auditing

What is Irrigation Auditing?

There are two main aspects to a typical irrigation audit, checking performance of the system, and checking how well the system is being managed.

Irrigation management checks focus on the timing and depth of irrigations, and system maintenance. They may include verifying that regulatory requirements are met.

System checks should include an assessment of the uniformity of water distribution as this, and irrigation scheduling decisions account for almost all the variation in water use efficiency.

System checks will typically also consider filtration, pump performance and other factors that affect uniformity or add to power costs.

Why have irrigation audits?

Irrigation audits provide information for decision makers. The first of these to benefit is the farmer, who receives a review of their irrigation performance and if relevant, recommendations for making improvements.

Farmers may want an audit of a brand new system, to check that it meets contract specifications. In that case, the auditor needs to know the details of the contract so suitable assessments can be made.

Performance reports allow irrigators to better manage their system. With knowledge of actual application rates and uniformities, they are more able to determine the actual volume of water required to adequately irrigate their crops.

Audits allow wastage to be minimised. This, along with direct system checks, highlights potential savings from reduced energy and or water charges. Less obvious savings are obtained through reduced yield losses and

less leaching of nutrients. A fourth reason for such an audit is to satisfy markets and regulatory authorities that environmental performance levels are satisfactory.

System Checks

An irrigation audit will review the system in terms of its performance. While the main focus is usually on evenness and rates of application, a number of other factors may be considered. There are many 'typical problems' that show up time and time again, so these are often targeted in a review of systems.

Energy Efficiency

One of the biggest power wasters are incorrectly sized pumps and motors. It is common for these to be bigger than needed, so they operate outside their best efficiency range. The efficiency of the pump and motor multiply for overall efficiency:

That means an 80% efficient pump coupled to a 60% efficient motor is only 48% efficient. Half the power consumed is actually wasted.

Over sized pumps also lead to other losses as excess pressure must be reduced to suit the system. A very common feature of such systems is a partly closed gate valve used to throttle the pump back. If you have one, you are burning off pressure, energy and dollars.

Similarly, many systems include pressure regulators that are not needed, and sometimes several pressure regulators in the same line. Unless there is a good reason, perhaps very variable topography, pressure regulators are energy wasters.

Other power losses occur when mainlines or fittings are too small or partially blocked, giving high head losses. In particular, check filters regularly to make sure they are kept

clean. This is absolutely critical if drip or micro irrigation is used.

Also check high pressure loss fertiliser injectors – typically those that require mainline throttling to operate.

Water Use Efficiency

On farm irrigation efficiency is best described by Application Efficiency (AE).

This is a ratio that compares the amount of irrigation water beneficially used to the amount that was applied (less the change in soil moisture storage).

An on-farm irrigation audit can make an assessment of one-off application efficiency. To get a good seasonal review, farmers must keep good irrigation records.

Critical information includes irrigation event dates, durations, water volume applied and rainfall figures. The better the records, the better the information an audit can provide.

Two of the biggest influences on water use efficiency are Distribution Uniformity and Irrigation Scheduling.

DISTRIBUTION UNIFORMITY

When we irrigate we typically assume the irrigator applies water evenly across the whole paddock, and we assume this water soaks evenly into the soil. Irrigation evaluations measure the system in the field using collectors or catch cans (like rain gauges) to assess distribution uniformity. This is a critical factor in determining the potential efficiency of any irrigation system.

If a system has low uniformity, some areas can be over-watered while others do not receive enough. Both under and over watered areas will lose yield and have reduced crop quality. In the over watered areas there is also increased risk of soil

diseases, water will be wasted and valuable nutrients may be leached.

The first cause of non-uniform watering is system design and installation. A poor system can never work efficiently. The design of solid set systems is particularly critical, as any non-uniformity will be repeated at each irrigation. A tree under watered once will be under watered every time. In moving systems, such as travelling irrigators or hand move pipes, the low or high applications may affect a different area each time, at least partly cancelling out.

Spray or sprinkler systems will also be affected by wind. The biggest problem is not blowing the water away or evaporating it, but causing excess dumps in some areas and not enough in others – again, non-uniformity and drainage losses.

Other causes include obstructions that interfere with sprinkler patterns, excess application rates and sealed soils. Ponding is a sure sign of low irrigation efficiency.

SCHEDULING

A poor system will always be poor, regardless of management. Conversely, even a good system will have poor efficiency if not managed well. For example, an irrigation system may be very uniform (say $DUI_q = 0.90$) but if excessive amounts of water are applied the efficiency may be low (Application Efficiency = 50%).

Scheduling is the final aspect of a typical audit. When to irrigate, and how much water to apply are also critical decisions if best performance is to be achieved. Soil moisture monitoring is essential.

SUMMARY

Remember that under-watering reduces yields and invariably crop returns.