

**Irrigation Efficiency**

**What is Irrigation Efficiency?**

Irrigation efficiency is measured in many ways. Where water is very short, efficiency may be measured as crop yield per cubic metre of water used, or profit per millimetre of irrigation. It depends what you want to know.

One very common measure of on-farm irrigation efficiency is **application efficiency**. This asks: How much of the water applied to the crop is actually used for crop growth or other beneficial uses?

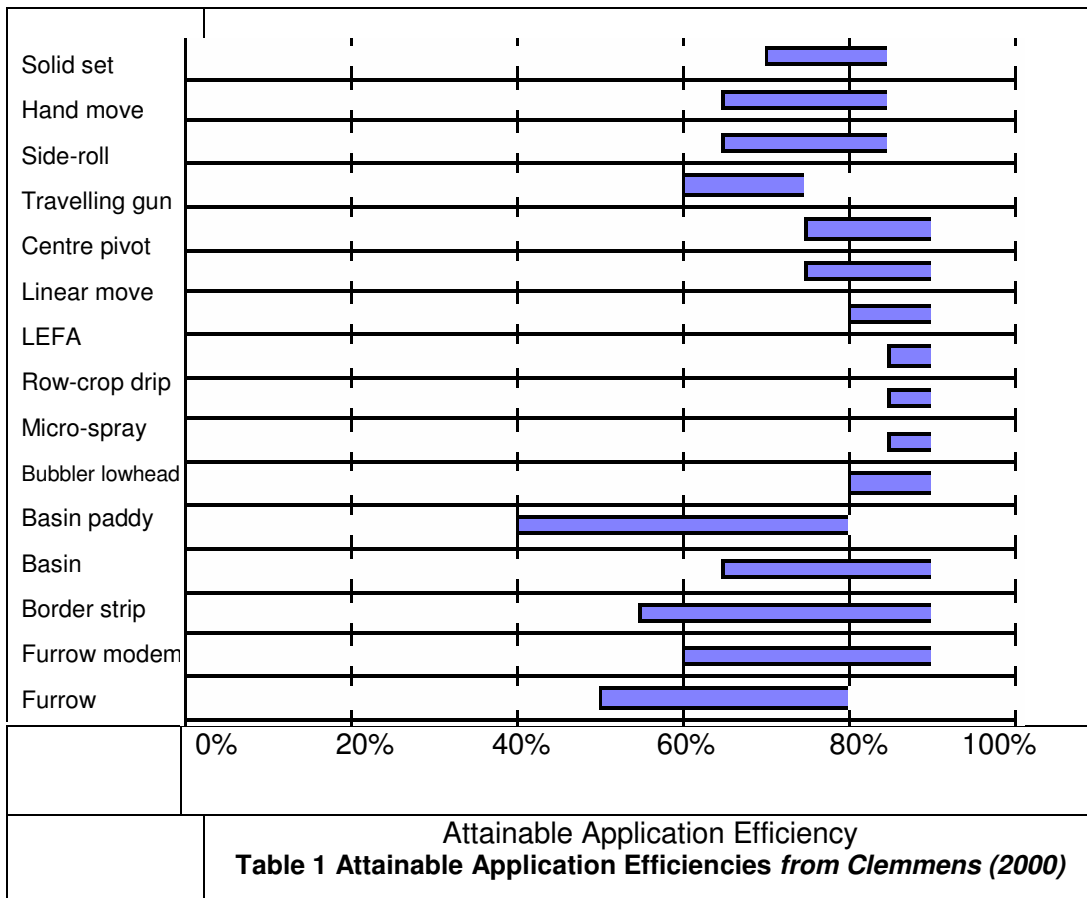
We should aim to be 100% efficient, but this might not always be the best option. In fact, if your application efficiency is 100%, at

least some areas of the crop are most probably under-watered.

The actual application efficiency that should be achievable varies with different types of irrigation. Potential application efficiencies for a number of systems are given in Table 1. Note that many of the bars are open ended – it is possible to make a system even more efficient than shown.

The two main factors that affect application efficiency are:

- distribution uniformity (how evenly is that water applied) and,
- irrigation scheduling (how much water is applied, and when).



### **Distribution Uniformity**

Distribution uniformity describes how evenly irrigation is applied to the crop. 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. This is never completely true.

As part of a typical irrigation audit, distribution uniformity is assessed by setting collectors or catch cans out in the field. This is a critical factor in determining the potential efficiency of any irrigation system.

It is necessary to measure distribution in the field. It cannot be assessed by eye and varies from system to system, field to field and even event to event in some cases.

### **Implications of non-uniformity**

Uniformity should be considered when calculating irrigation depths to apply. If your average application just meets crop needs, half the orchard is over watered, and half is under-watered. A reasonable balance is to adjust the application so the average needs of the lowest quarter are met. This means 1/8th of the crop is under-watered (if only slightly), and 7/8ths over-watered.

### **Irrigation scheduling**

Irrigation scheduling considers when to apply water, and how much to apply. With the system providing high distribution uniformity, attention paid to excellent scheduling pays dividends.

Proper scheduling requires knowledge of the soil's available moisture status, how fast the available water is being used up, and how much water is effectively applied by the irrigation system.

Soil moisture status can be estimated by water budgets or by direct soil measurement. Water use is determined from published ET figures or other records. How

much water the system is applying is determined from the water meter adjusted according to the uniformity results from the irrigation audit.

### **A useful check**

A useful check to make is to compare application efficiency to distribution uniformity.

- If the application efficiency is greater than the distribution uniformity, you can be pretty sure the crop has been under-watered.
- If the application efficiency is less than the distribution uniformity you can be pretty sure the crop was over-watered.

Why?

### **SUMMARY**

Application efficiency (AE) shows how much of the water applied to a crop as irrigation is held in the root zone where it can be beneficially used by the crop.

If irrigations are too close together, or the amount applied is too high, the application efficiency will be lower than it could be. This will indicate low irrigation efficiency, and show that water is being wasted as deep drainage.

Application efficiency does not show if the crop has been under-irrigated. If not enough water is applied, none will drain out so application efficiency will be 100%. However potential yield will have been lost as the crop experienced drought stress.

Distribution uniformity describes how evenly irrigation is applied to the crop. This needs to be measured in the field.

A system with low distribution uniformity cannot have high application efficiency and still adequately water crops.