



The art of small-scale irrigation

By Fanie Vorster, ARC Institute for Agricultural Engineering

Southern Africa is a region in which water is scarce for most of the year. It rains for only four to five months of the year with frequent dry spells in between, while the rest of the year is hot and dry. Anyone with an ornamental or vegetable garden can get the most out of their garden by following a few simple water usage tips. These tips are also applicable to irrigation farming.

Optimal water usage means that potential water loss is minimised, while plants still receive the water they need for optimal growth. This article discusses types of water loss, measures that can be taken to use water more efficiently and methods of small-scale irrigation.

Evaporation losses

As much as 50% of water can be lost to the atmosphere. In the presence of heat and wind, water that is sprayed or held in water bodies such as ponds, reservoirs or swimming pools, evaporates into the atmosphere. In order to minimise evaporation losses, irrigation should be scheduled early morning or late afternoon.

Micro- and sprinkler irrigation systems should be operated at the correct

pressure to minimise wind drift of spray mist, which occurs when the pressure is too high. Water bodies should preferably be covered to minimise evaporation losses.

Unnecessary evaporation loss occurs from bare soil surfaces or in cases where the leaf canopy does not cover the soil sufficiently. This loss could be as much as 3mm on a hot day. For example, if 3mm soil surface is irrigated, the loss is 100%, and if 10mm is irrigated, the loss equates to 30%.

This loss can be minimised by placing a layer of organic mulch on the bare patches and by irrigating late afternoon or at night. Using indigenous trees to provide partial shade for ornamental gardens or a shade net structure for

vegetable gardens, can also limit evaporation.

Preventing run-off losses

Run-off occurs when the application rate of irrigation exceeds the rate at which water can infiltrate the soil. It is evident in cases where an emitter or irrigation system irrigates the same spot for too long.

Valuable topsoil and plant nutrients could be lost in addition to the water loss, which could range from 10 to 30%. Care should be taken when selecting an emitter with an application rate that is higher than the soil's infiltration rate. Automating the irrigation system will help prevent irrigating the same spot for too long.

Irrigation systems that are not planned or placed properly, can cause water losses of between 10 to 30% by irrigating unnecessary areas. Leakages are also a major cause of water loss and should be repaired as soon as possible.

The effects of over-irrigation

Over-irrigation occurs when more water is applied to an area than what is needed to fill the root zone of the crop. The average root depth of vegetables and garden plants is 300mm. The water infiltrates too deeply and replenishes the groundwater, which means that it is lost to the crop. This type of loss can constitute up to 20% of the water applied and is more applicable to sandy and rocky soil.

It is almost impossible to achieve the perfect distribution of water with irrigation. Luckily, irrigation systems are designed to keep these losses to a minimum. Distribution patterns will, however, change as emitters wear or clog. Tillage and land-use practices also affect how water infiltrates and is stored in the soil. Several scheduling devices on the market can measure the soil's moisture status at different soil depths, thereby allowing more effective irrigation management.

Non-uniform water application

Irrigation efficiency is a term used to describe how much of the water that is applied through an irrigation system is stored within the root zone of the plant

and becomes available to the plant. This efficiency is determined by how well water is distributed across the irrigated area. The system's design and day-to-day management, as well as the maintenance that is done on it, will influence the distribution of water across an area.

Soft, even rainfall over a field with a uniform soil type, will allow water to penetrate the soil to the same depth at each point in the field. Each plant has an equal chance of getting the water it needs. Irrigation aims to mimic evenly distributed rainfall, but no irrigation system can do it perfectly, which is why specialists must design irrigation systems in order to achieve the highest possible water distribution efficiency.

Uneven irrigation results in over-irrigation in some places and under-irrigation in others. Plants that receive different amounts of water will grow at different rates, and only plants that receive sufficient water for their needs, will produce abundantly. Non-uniform irrigation typically occurs when an installed irrigation system is not planned or managed properly, when the emitters are moved haphazardly, or the valve is left open in manually controlled irrigation systems.

Small-scale irrigation methods

Using a watering can or bucket is only practical for single, potted plants or a small number of plants, as it is very time-consuming. The most effective watering

method is to make small ponds around the plants and to spread the water as evenly as possible. Take care to avoid the overflowing of ponds or containers. Greywater from showers can be applied to plants in this way.

When using a garden hose without a spray nozzle, small ponds should be made around plants to contain the water. Use a valve at the front end of the hose to close the water flow when moving between plants. This method is also time-consuming, which is why it is only practical for small gardens, as the hosepipe must be not be left unattended to prevent overflowing ponds or run-off. It is also used where the water pressure is low or when greywater is conveyed directly to the garden with a hose.

Another method is to connect a single sprinkler to the hose and move it manually over the area that is to be watered at set intervals. Care should be taken with the placement of sprinklers to avoid unnecessary overlapping of the wetted areas or leaving dry patches. It is also very important to move the sprinkler timeously in order to avoid over-irrigating an area and run-off loss.

A timer could be connected to the valve or to the borehole pump to avoid irrigating the same area for too long. When a greywater collection and pump system is installed it can also be applied to the garden with a hose and sprinkler.

When a permanent irrigation system is installed, it is important to adhere to the manufacturer's recommendations relating to installation, spacing and operating pressure. Care should be taken in the placement and orientation of the emitters to avoid unnecessarily irrigating certain areas. The number of emitters that operate simultaneously is determined by the available flow rate from the pump or municipal supply at the optimum operating pressure of the emitters.

Such a system is suitable for sprinklers, turf sprayers, micro-irrigation and drip irrigation, depending on the relevant application. It can be controlled manually, but it should preferably be managed automatically with an irrigation controller to achieve maximum water savings. ■



Installation, spacing and operating pressure are some of the important aspects that require attention when installing an irrigation system.

For more information and references, contact Fanie Vorster on 012 842 4017.