The adverse effects of over-irrigation

In the November 2015 edition of *Stockfarm* we discussed the factors that can cause water loss during irrigation. In this edition we continue with the subject, by looking at the problem of over-irrigation.

The loss of water deeper into the soil profile is inevitable. Perfect distribution of water is never achieved with irrigation. If ample water is provided in the drier areas of the field, some water in wetter areas will pass below the root zone of the crop and become unavailable to plants.

Systems are designed to keep these losses to a minimum. Distribution patterns will, however, change as emitters wear out or become clogged. The way in which water moves through and is stored in the soil, is also affected by tillage and land use practices.

There are different scheduling methods and devices that can be used to monitor the degree of over- or under-irrigation. One such device is a wetting front detector.

**Drainage problems**

Drainage problems and yield losses are some of the consequences of over-irrigation. The problem of over- and under-irrigation can be greatly overcome by scheduling water use.

A high water table with salt accumulation results in a severe decrease of the productive capacity of the soil, and thus a reduced income from the crop production. In order to restore soil productivity, a drainage system would have to be installed at a high cost.
Scheduling water use
Scheduling is the management of irrigation applications, supplying the correct amount of water at the right time, and ensuring that sufficient water is available to the plant. Scheduling involves the planned replacement of water in the soil profile that has been drawn off by the crop.

Methods that can be used to schedule irrigation include:
- A fixed irrigation cycle.
- Determining the soil moisture.

Fixed irrigation cycle
Early in the cropping season enough water is applied to fill the soil profile. It is accepted that a lot of the water used by the plant will be provided by rainfall. The seasonal estimated irrigation requirement (crop usage minus effective rainfall) is divided into daily or weekly increments. Fixed amounts of water (approximately 20 to 30mm/week) are applied on a fixed cycle. It is assumed that temporary supply shortfalls during periods of peak demand will be met by water stored in the soil profile at the start of the season.

A fixed irrigation cycle can work well for a number of crops. Specific crops do, however, have critical growth stages. For example, any water stress in maize during the critical tasselling period will result in a significant reduction in crop production.

A common error is to overdesign the fixed cycle application, rather than making provision for additional irrigation at critical growth stages. In most cases where a fixed irrigation cycle is used, the crop is over-irrigated. Water, energy, labour and fertiliser are then wasted and crop production can also decrease.

Determining soil moisture
There are several devices, such as wetting indicators (Figure 1), available in the irrigation industry to assist the farmer in obtaining an indication of the available moisture in the soil.

In addition to wetting indicators, the ‘hand-feel method’ gives an indication of the clay percentage of the soil and thus also of the water-holding capacity per meter of soil depth.

By digging soil profile holes, or by drilling holes with a soil auger, as well as with the installation of wetting front detectors or other measurement devices, the status of the soil moisture can be determined. The irrigation application can then be adjusted accordingly.

It is crucial to keep proper record of the amount of water applied to the crop in every irrigation or rainfall event. It is also important that the farmer knows how much water a crop uses weekly in the different growth stages and to then irrigate accordingly.

Non-uniform application
Irrigation efficiency is a term used to describe ensuring that the amount of water applied through an irrigation system, does in fact get stored in the soil within the root zone of the plant and becomes available to the plant. Efficiency is determined by how well water is distributed across the irrigated area.

The distribution of water across an area will be influenced by the design and day-to-day management of the system, as well as the maintenance done on it.

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 then has an equal chance of getting the water it needs. Irrigation tries to mimic evenly distributed rainfall, but no irrigation system can achieve this perfectly.

Efficient water distribution
Plant growth and crop production is largely determined by the effort that the plant must put into absorbing the required water.

Plants that receive different amounts of water will grow at different rates. Only plants that receive sufficient water for their needs, will produce abundantly.

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