Closed water loop saves re

Growers have to deal with the fact that there is chronic water shortage in a growing number of regions. Besides, worldwide fertiliser prices are increasing. Closed water loops can lead to important savings of both water and fertiliser. The investments will be earned back within a couple of years.

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Global changes such as pollution growth, climate variability and expanding urbanisation have severely affected the availability of water in a growing number of regions (*see Figure 1*). It has been estimated that within 25 years, two thirds of the world's inhabitants will live in countries with serious water problems. So it is clear that wasting water is no longer acceptable in agriculture.

Another development are fertiliser prices. These continue to surge according to data released by the World Bank. Although prices have leveled off for the five main fertilisers in the past few months, they are still 22% higher than in March 2008 (*see Figure 2*).

Intensive growing methods in greenhouses can offer solutions to water scarcity and to savings in the use of fertilisers. The main principle is to try to make closed loops. Non-soil bound horticulture makes this possible. When growing on substrate and an estimated drain percentage of thirty, it should be possible to save about one third on water and fertilisers. Automation can play an important role in making closed water loops. The investments will be earned back within a couple of years thanks to the savings. Closing the water loop and increasing the water quality at the same time is possible by taking the following measurements.

FIGURE 1. WORLD WATER STOCK

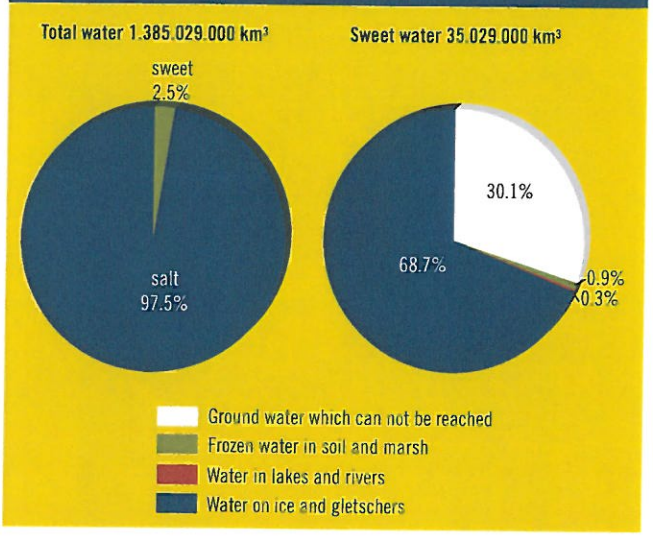
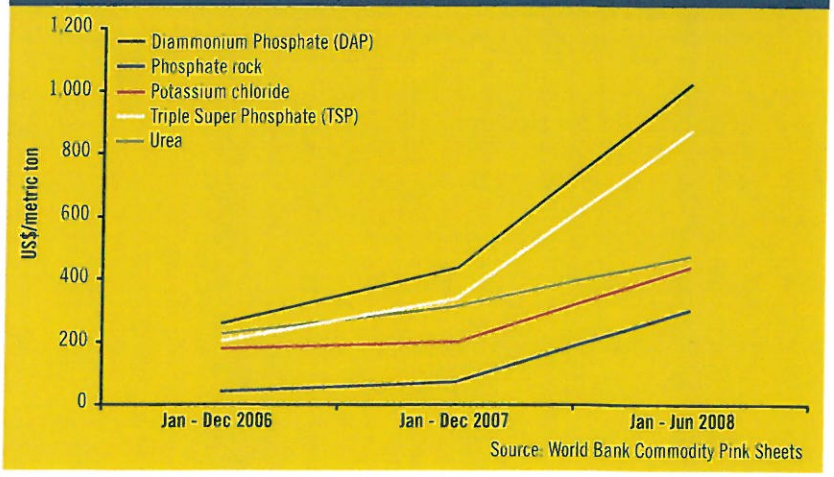


FIGURE 2. GLOBAL FERTILISER PRICES, 2006-2008



Avoid blockage of drippers

Growing on a substrate makes the use of drippers necessary. With existing systems, growers often notice blockages of the irrigation system and wasting of water. Blockage of the system can have a huge impact on profitability by depressing yields, reducing the value of decorative plants, and even resulting in the loss of plants altogether.

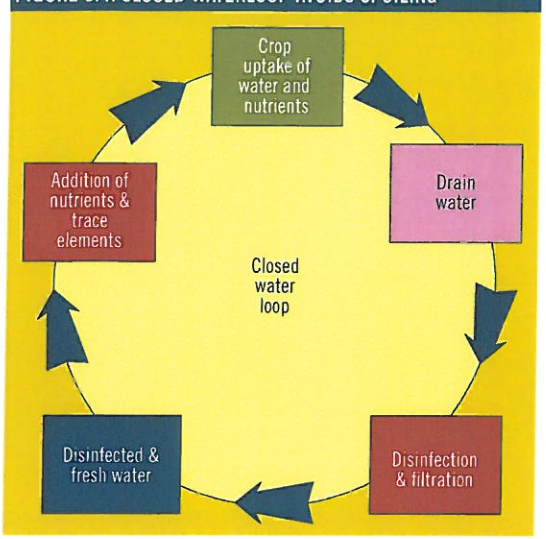
An important cause often is that the pH of the water seems to be higher than it should be. Especially bicarbonate can cause a whole host of problems in irrigation water: unsightly chalk deposits on leaves, blocked irrigation nozzles and nutritional deficiencies due to high pH. Nitric acid dosage is a long-established way to combat these problems. However, it takes time for the acid to neutralise the bicarbonate. Therefore, it is necessary to pre-treat the water at the storage tank by injecting and mixing acid and subsequently aerating the incoming water to stable the irrigation system.

Efficient fertilisation

An accurate mixing of fertiliser stock solutions with irrigation water is important to ensure a constant EC and pH. Precise application of water and nutrients is critical to good crop performance and to prevent blockage of the irrigation system. Modern industrial design methods have been developed which result in compact, reliable and affordable nutrient delivery systems. These sys-

sources

FIGURE 3. A CLOSED WATERLOOP AVOIDS SPOILING



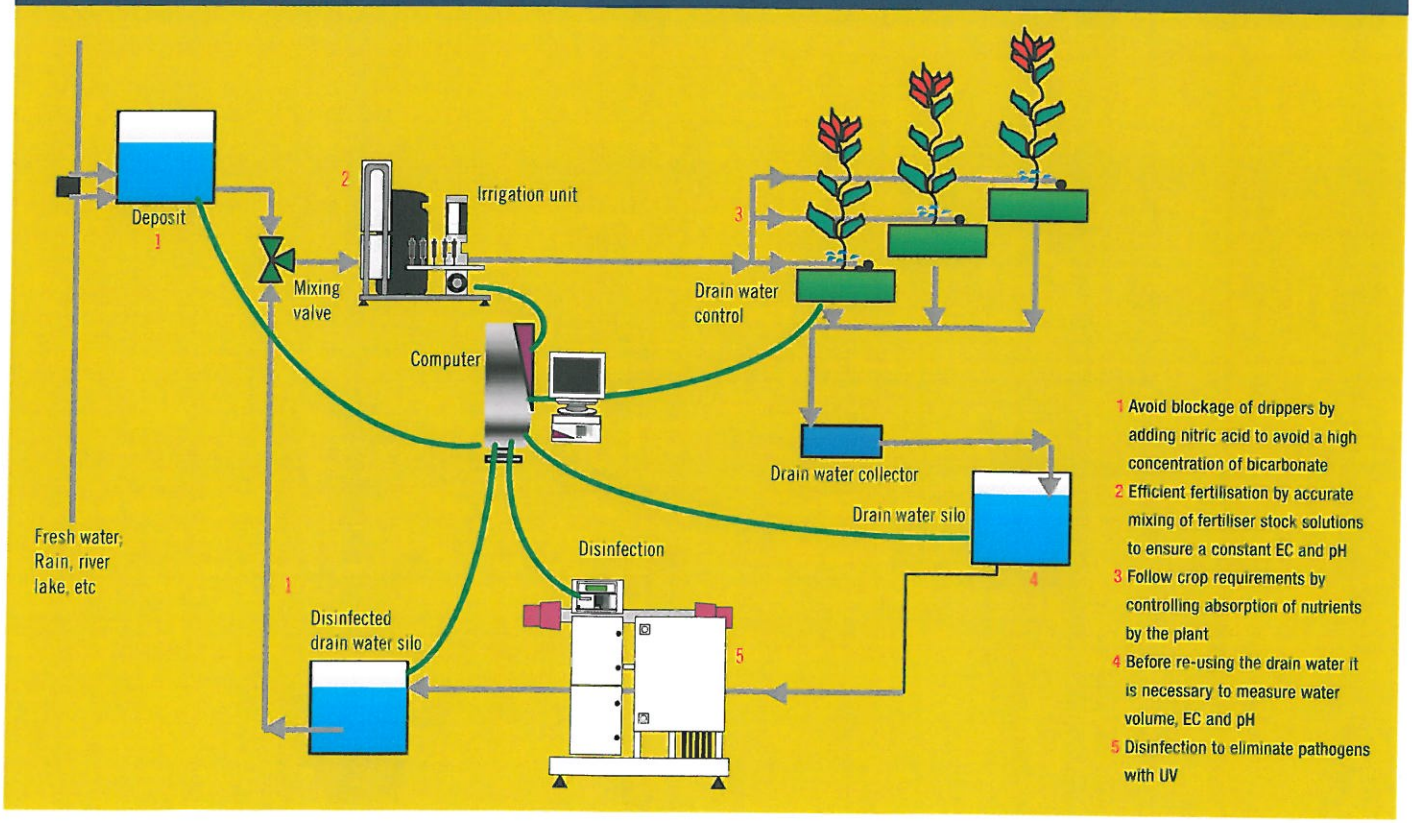
tems ensure that crops are provided with the correct fertiliser recepy at every plant watering including accurate and stable pH control. The latter is of major importance for efficient nutrient uptake in substrate cultures. The result is an optimum growth: higher yields, improved colour and flavour, longer shelf life and increased disease resistance.

The control of the application of fertilisers can be either integrated with a dedicated irrigation computer or can be connected to the process computer also controlling other parameters on site, such as heating and ventilation. An alternative to mixing tank fertiliser dosing systems, is a system which injects the fertiliser solution directly into the mainstream irrigation water. A major advantage of these systems is that a feeding pump is not necessary.

Crop requirements

Determination of the water and nutrient absorption by the plant makes it possible to meet the needs of the crop and to avoid wasting of water and fertilisers. There are advanced systems available to register the water absorption based on a measuring set-up which contains a representative number of plants. The module consists of a slab-weigher and a sensor, and determines every irrigation cycle based on the quantity of water absorbed and the water content of the substrate. The system cal-

FIGURE 4. CLOSED CULTIVATION SYSTEM



culates the absorption and determines the optimal water dosing in line with the conditions, the state of the crop and the type of substrate. Optimal water dosing ensures a healthy root system, which in turn increases production.

Drain water control

Before re-using the drain water it is necessary to know the water volume and the EC and pH.
With a drain sensor system it is possible to measure the quantity and the EC value of drain water. This is quite a simple device which forwards the information directly to the process computer. This enables the grower to vary the amount of drain water for instance in relation to the outside conditions.
The drain sensor system electronically monitors the collected cc's drain and the EC value. The systems consists of a 2.0 or 2.8 metre long stainless steel collection tray (for the Rockwool) and a measuring unit. By mounting the tray in a slight slope, the drain water will flow to one point. The measuring unit is located here and consists of a mechanical quantity sensor and an EC sensor. The measuring of the drain quantity sensor is based on calibrated pulse counting.
The computer calculates the drain percentage per group, using the relation between total water supply (per group) and that part which has ended up in the slabs of the sensor. At midnight the drain quantity measuring will automatically set on zero.

Elimination of pathogens

Re-using the drain water demands an effective disinfection of the water. There are several UV systems, which are specially designed to provide effective and efficient disinfection of irrigation water in horticulture. UV stands for ultra-violet light. The active UV-C, which has a wavelength of approximately 154 nanometers, alters DNA of mirco-organisms, such as microbes, bacteria and moulds, and destroys them during the process. UV-C also makes viruses inactive.
The UV-disinfection systems are available either for large or small quantities of water. Disinfection of drain water and surface water enables expensive water and/or fertilisers to be recycled. The disinfection unit has to be completed by addition of a water filter (for example a sand filter).

Process control

The process computer is an essential link in the greenhouse horticulture chain. The computer is the intelligent brain of your business management; the solution for numerous automation issues within the whole business. It concludes all functions for efficient fertigation, recycle and disinfection management. ■