LITERATURE CITED

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Irrigation Systems for Soilless Media©

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INTRODUCTION

Greenhouse irrigation and cooling technologies for intensive growing are highly specialised. With growers under increasing pressure to deliver higher quality crops, to reduce costs by shortening the growth cycle, and to be able to market it on time all around the world, an irrigation strategy must be robust and efficient in order to maintain the growers' competitiveness and profitability.

SPRINKLER IRRIGATION

The application of sprinkler irrigation is still commonly used in many crops, particularly for germination and rooting irrigation after planting. Sprinkler irrigation must take in to account all types of structures, gable width, bed width, and whether the sprinkler will be placed in an upright position or suspended overhead in an upside down (UD) mode. In greenhouses or shade-houses in which plants are grown in small pots, sprinkler irrigation can provide a most cost-effective option. For this application, a bridgeless micro-sprinkler constructed from acid resistant materials (for chemical application) with a flat trajectory offers a good solution. There are various brands and models of micro sprinklers suitable for UD operation with a range of flow options available (Fig. 1).

Figure 1. Example of an upside down (UD) sprinkler with anti drain Valve and stabilizer for UD operation.

Spacing, heights, flows, and pressures are selected to provide the highest level of uniformity according to specialized sprinkler design software. The levels of uniformity are measurable and the parameters that industry recommends are:

- Christiansen's Coefficient of Uniformity (CU) = +84%
- Distribution Uniformity (DU) = +75%
- Scheduling Coefficient (SC) = < 1.2

One or all of the above measures of uniformity should be considered when designing a sprinkler system. The growers in The Netherlands for example insist on an SC of 1.1 or less. Another device that is can be recommended for sprinkler irrigation in greenhouses with short irrigation cycles is a "non-drain" or "anti-drain" (AD) valve. This is fitted inline with the riser tube and will only open at a certain pressure and then close at a certain pressure. This ensures instantaneous operation and no leakage, both of which minimizes or eradicates uniformity distribution problems and damage to plants and media.

CROP COOLING AND HUMIDITY CONTROL

In hot climate zones, cooling down the temperature inside the greenhouse becomes a critical factor for achieving higher and better yields. One of the more recent solutions utilises a super-fine mist sprayer, often known as a mister or fogger (Fig. 3). Due to the micron-sized droplets that are formed, the emitted water doesn't actually wet the foliage, while the emitter can still operate at normal working pressure. Operating pressures are 300 to 400 kPa. The presence of an AD valve not only prevents dripping or draining of the laterals, but also offers greater uniformity during the short cooling cycles due to instant opening and closure of all emitters.

Figure 2 gives examples of AD valves on the right with male/female press fit and connection options. Pressure settings can be varied to suit the emitters operating pressure.

Used in extremely short water bursts, superfine mist sprayers can reduce the ambient temperature by 5 -10 °C, depending on relative humidity and temperature, without wetting the leaves of the crop.

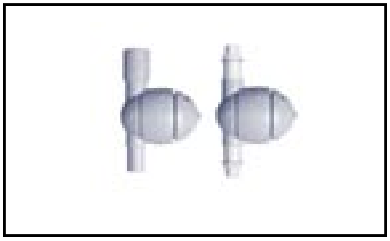

Figure 2. Anti-drain valves.

DRIP IRRIGATION

One of the most effective methods of targeted water delivery to crops and avoiding the wetting of the foliage, is via a series of drippers. A solution that allows efficient irrigation with maximum precision involves the use of pressure compensated non-leakage (CNL) drippers. When using frequent appli-

Figure 3. A super-fine mist sprayer. A fogger/mister 4 way cross option on left. Other options include single nozzle and dual nozzle on Tee — seen on right.

cation and pulse irrigation, it becomes desirable to use this mechanism to prevent the leakage and the emptying of the tubes in between the short irrigation cycles in order to maintain uniform flow rate and even distribution of water and fertilisers. Placing the drippers at short intervals to accommodate the soilless substrate with a low buffer capacity, led to the development of low-flow drippers with large turbulent labyrinth and self-cleaning mechanism to prevent operational blockages. Over the years a wide range of solutions have emerged for various applications in soil-less media: from irrigating in laterals along the growing container, through to the irrigation of rock wool cubes and pots with a separate dripper for each plant.

By having a separate CNL dripper to each plant, it ensures we get an independent growing unit, and permits uniform irrigation, with equal and precise amounts of water and nutrients to each plant or flower. The most suitable irrigation solution for this growing technology is the on-line CNL drippers with a tube and angled barbed stake (Fig. 4). With the addition of the angled barbed stake, the grower is assured that the application of each drop of water takes place according to the type and size of the pot, the age of the plant and irrigation regime.

The irrigation regime is normally derived from the plant demands, climate conditions, type of substrate and type and size of the growing container (Fig. 5).

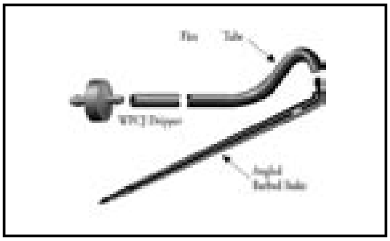

Figure 4. Single CNL dripper assembly per plant.

SUMMARY AND CONCLUSION

A wide variety of technology exists to effectively irrigate soilless media crops. This also includes the climate and irrigation/fertigation controllers, in order to maintain the right climate conditions and the precise mixture of water and fertilizers with the appropriate water pH and electrical conductivity.

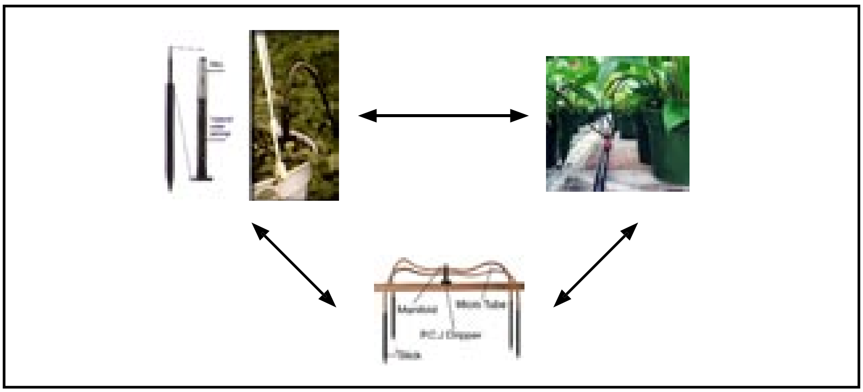

Figure 5. Four-way CNL dripper assembly with arrow drippers for four plants.