

Aqua-Hort®

Aksel de Lasson

Aqua-Perl Danmark ApS, Engdalsvej 26, K 8220 Brabrand, Denmark

Werner Bühr

WSG Elektronik GmbH, Hauptstr. 15, D D 17133 Friedland, Denmark

BACKGROUND

Aqua-Hort implements a copper nutrition and electromagnetic treatment of the nutrient solution. Research at the Aarslev Horticultural Research Center has contributed to a basic understanding of the benefits of this equipment.

With Aqua-Hort in your nursery you can achieve the following production improvements:

- Better roots,
- Better plants,
- Prevent attack by pathogenic fungi,
- Stabilize copper supply.

It has been known for a long time that a controlled level of copper ions in the water can contribute considerably to the prevention of attacks from pathogenic fungi, especially from *Pythium* and *Phytophthora*. Both fungi can be very destructive. These two fungi produce zoospores which are spread in watery environments. Laboratory tests show that the zoospores are killed when exposed to Aqua-Hort-treated water.



Figure 1. Aqua-Hort system. The electromagnetic pipe, flow meter, and conductivity sensor are located above the four electrode pipes.

A controlled supply of copper ions has in the past been difficult to achieve because copper is easily bound before it can destroy the zoospores. With Aqua-Hort it is possible to achieve a regulated supply of copper ions at the time of watering. The amount released is within normal fertilizer standards.

The copper ions in the water are charged particles with hydrate layers around them. The Aqua-Hort treatment system uses dynamic electromagnetic pulses to remove the hydrate layers and the ions can then more easily be absorbed by the plants.

Aqua-Hort reduces the consumption of fungicide chemicals, with positive consequence for the economy and for achieving points in the MPS system.

DIMENSIONING

The Aqua-Hort unit yields maximally 8 amperes. For example, 8 m³ of water demands 2.7 ampere with a concentration of 0.4 ppm copper. The Aqua-Hort system adjusts itself according to varying flow rates and conductivity. The built-in flow meter and conductivity sensor automatically takes care of this.

The total system consists of an electrode set and the control box contained on a stainless steel stand. The length is 1.8 m, height is 1.3 m, and depth is 0.4 m. It can also be delivered as a wall model with the pipes placed vertically above each other, and the control box being located at another suitable location. The electrode set, made of PVC, consists of four electrode tubes (each 90 mm in diameter), and a tube for the electromagnetic coil. A conductivity sensor and a flow meter are located at the end of the tubes. A pair of copper electrodes is placed in each of the four electrode tubes. Each electrode is 1.5 m long and has a diameter of 12 mm. The electrodes are supplied with low voltage power, varying from 0 to 20 volt. The electromagnetic coil is transferring the magnetic forces to the water. The dynamic pulse system is part of the patent given to the Aqua-Hort system.

The control box contains the necessary electronics to manage the system. The display shows at all times the amperes flowing. A center knob is used for controlling the output.

The unit is placed after the nutrient mixer. It is important to leave sufficient space to the side for inspection and replacement of the electrodes. The 16 kg of copper will treat 55,000 m³ of nutrient solution.

INSTALLATION

The Aqua-Hort unit is ideally placed right after the fertilizer mixer with the nutrient solution going straight from the mixer into the unit. Normal PVC connections can be utilized for this. It is important to allow space to the side, 1.5 m, for electrode removal.

The control box is placed on top of the stand. It must be supplied with one 230 volt 50/60 hz power source. A start signal, potential free, must come either from the mixer or the flow meter.

DAILY MANAGEMENT

The amount of copper released depends on the voltage on the electrodes and the conductivity of the nutrient solution. As the conductivity for each irrigation is a set value, typically between 1 and 2 mS, the voltage is used to regulate copper concentration. A display shows the resulting current. The conductivity sensor and flow meter automatically compensates for changes in these values, so adjustments are rarely necessary.

The Merck copper test set (#14414) is used to measure the copper level. When sending water to a distant laboratory it is recommended to lower pH with H_2NO_3 otherwise the copper will easily “disappear”. It is recommended to operate in the range of 0.3 to 0.5 ppm copper. This is within acceptable nutrient levels. Above 1.0 ppm copper possible growth damage from excessive copper can occur. In practice there has not been any large problems with accumulation. Copper is a futile metal. This is one of the reasons for developing this system.

Experiences with Aqua-Hort show that a certain amount of free copper ions remain in the nutrient solution flowing back to the reservoir.

The magnetic coil is permanently supplied with 15 volts and no adjustment or service is needed.

When the copper electrodes are “used up” they must be replaced. New electrodes are ordered from Aqua-Perl, Danmark. Electrode lifetime depends entirely on usage. For example, at a rate of 0.3 ppm copper and with the 16 kg copper available, there is sufficient copper for making 55,000 m^3 of water. With a usage of 0.5 $m^3 m^{-2}$ of glasshouse this means that the electrodes can last for 1 year in an 11-ha unit.

The supplied Merck test system is used rather frequently when the system is introduced in a nursery. Alternatively water is sent to a laboratory for analysis. When confidence with the system has been achieved, the measurements are reduced to periodic control tests.