REPORT

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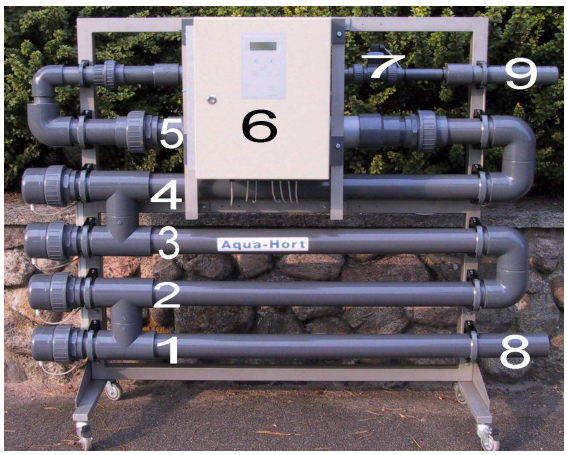
Efficacy of Water Treatment with the AquaHort®-System against the two-spotted spidermite *Tetranychus urticae* Kock in *Rosa* sp. var. High Society

(L. Riis)



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Introduction

Aqua-Hort® is a machine that provides controlled electrolytic supply of copper and an electromagnetic water treatment to irrigation water. Aqua-Hort® shows an approved efficacy against zoospores of oomycetic pathogens such as *Pythium* spp. and *Phytophthora* spp. and phytopathogenic bacteria, such as *Xanthomonas hortorum* pv. *Pelargonii*, *Agrobacterium tumefaciens*, *Ralstonia solenacearum* Race 3 and *Erwinia carotovora* pv. *Zantedeschia*. For the elimination of zoospores a Cu^{++}-concentration of 0.5 - 1.5 ppm is sufficient for 1 hour. For the elimination of bacterial pathogens a minimum Cu^{++}-concentration of 2 ppm and exposure time of at least 4 hours is required. The effect of Aqua-Hort®-machine on other pest and disease problems in horticultural crops should continue to be examined.

Objectives

To test the effect of the Aqua-Hort®-System on the infestation of the two-spotted spidermite *Tetranychus urticae* Kock in protected cut roses.

Material and Methods

Aqua-Hort® Danmark Aps installed an Aqua-Hort® -machine at the experimental greenhouse of Harvest Limited located on the dry Athi River plains in Kenya. The greenhouse contained cut roses, *Rosa* sp., of the variety High Society grown in hydroponics with 75% cocos and 25% pumice.

Irrigation water for the total experimental greenhouse area (the Aqua-Hort®-treated sector and the adjacent control sector) came from the same source. After the nutrition mixer, the irrigation water for the Aqua-Hort®-treated greenhouse sector was diverted through the Aqua-Hort®-machine and continued directly into the Aqua-Hort®-treated greenhouse sector. A Cu^{++} concentration of 3 ppm was released into the irrigation water at any flow. The Aqua-Hort®-machine was installed and maintained by Mr. Josphat Githii of Harvest Limited throughout the experiment.

Pesticide treatments required to maintain the rose production were carried out under the supervision of the spray manager Mr. Patrick Njogu of Harvest Limited. The Aqua-Hort®-treated sector and the control sector underwent similar pesticide treatments.

Numbers of two-spotted spidermites, *T. urticae*, (adults, nymphs and eggs) in the total experimental greenhouse area were recorded by Mr. Benson Eboya and Mr. Edward Anyonyi of Harvest Limited using the Scarab® Pest and Disease Monitoring System. The records were mapped and summarized by Scarab® Solutions.

Results and Discussion

The Aqua-Hort®-treated sector showed a reduction in spidermite infestation over time while the spidermite population increased in the control sector as shown in fig. 1. After 12 weeks, the spidermite population in the Aqua-Hort®-treated sector was almost eliminated.

The oscillations of the spidermite populations observed in fig. 1 can be attributed to weather changes and applications of miticidal chemicals. During the first three weeks of the trial period, the weather was cool and cloudy. Also, the water uptake by the plants was low during this period due to low transpiration. After the third week, the hot season began followed by increased spidermite multiplication. Repeated miticide applications were carried out throughout the trial period as blanket sprays. These are listed as tiny vertical text in fig. 1. It appears that a combination of Aqua-Hort®-treatment and miticides almost eliminated the spidermite population, which miticides could not do alone.

Fig. 2 shows the spatial spidermite distribution in the Aqua-Hort®-treated sector and the control sector one week (8 days) after the trial start. At this time, the Aqua-Hort®-treated sector was infested with 870 spidermites per square meter on average and the control sector was infested with 1047 spidermites per square meter on average. This should be compared with the scenario after 12 weeks (84 days) in fig. 3, where the Aqua-Hort®-treated sector was infected with only 57 spidermites per square meter on average, whereas the control sector was infested with 1427 spidermites per square meter on average.

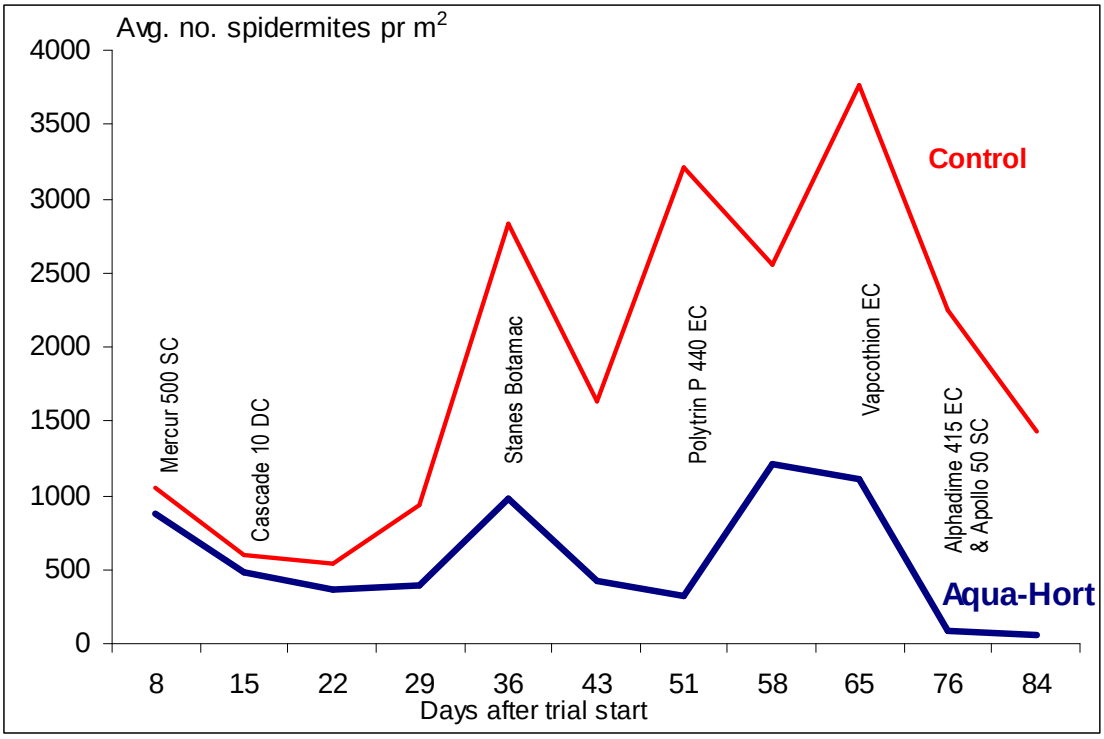

Figure 1. Average number of two-spotted spidermites, *T. urticae* (adults, nymphs and eggs) per square meter over a time period of 12 weeks in the greenhouse sector irrigated with Aqua-Hort water (blue line) and the control (red line). Timings of miticidal blanket sprays are indicated with tiny vertical text.

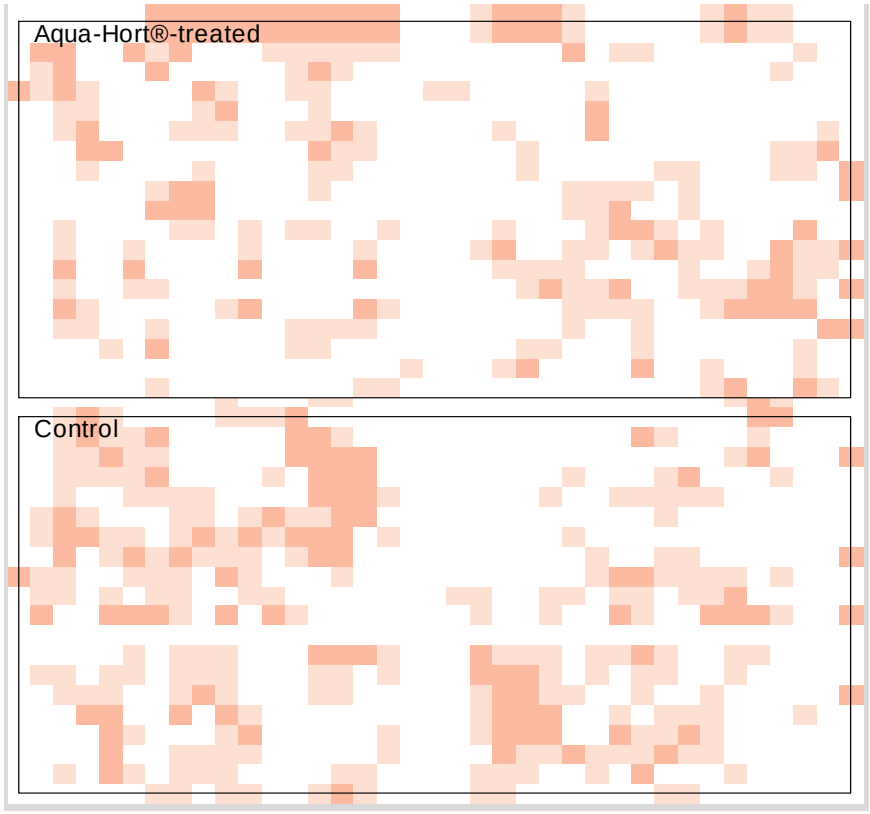

Figure 2. Spatial distribution of two-spotted spidermites, *T. urticae* (adults, nymphs and eggs), shown as beige shading, in the greenhouse sector irrigated with Aqua-Hort water (upper half of the map) and the control (lower half of the map) one week after the trial start.

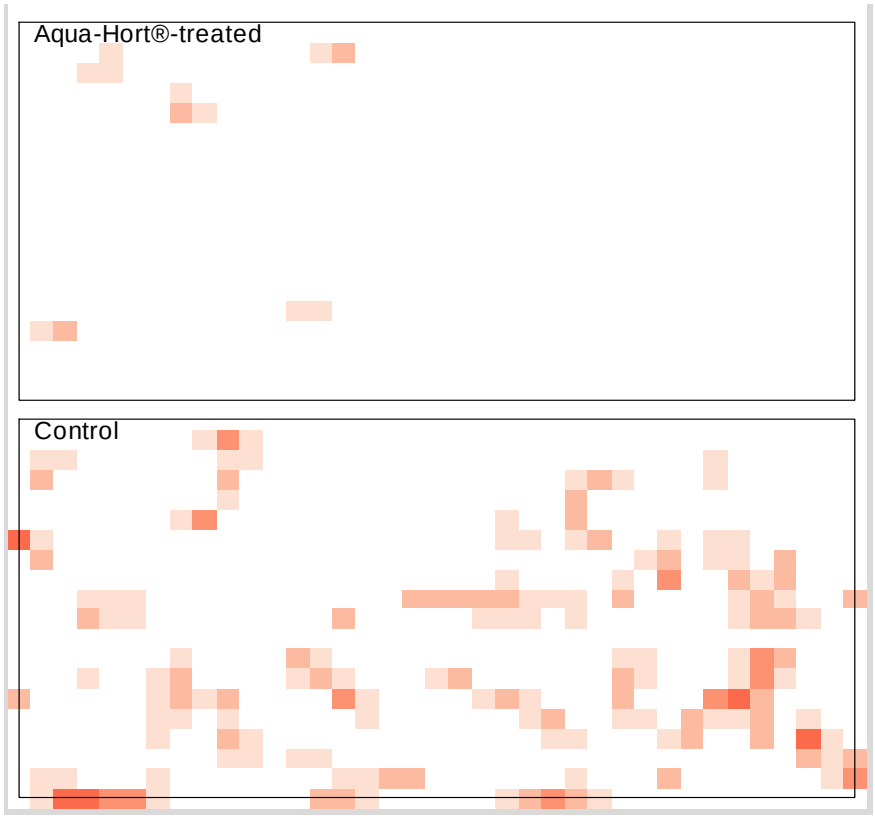

Figure 3. Spatial distribution of two-spotted spidermites, *T. urticae* (adults, nymphs and eggs), shown as beige shading, in the greenhouse sector irrigated with Aqua-Hort water (upper half of the map) and the control (lower half of the map) 12 weeks after the trial start.

Copper has a marked effect on the formation and chemical composition of cell walls. Lignification responds rapidly to copper supply and the activity of the copper-containing enzyme diamine oxidase increases in response to wounding and is closely correlation with the lignification of the wounded area (Marschner, 1995). The observed effect of the Aqua-Hort®-System in reducing spidermites could be attributed to the above having an antagonizing effect on the spidermite feeding activity. According to Marschner (1995), resistance can be particularly increased by altering plant responses to parasitic attacks through enhanced formation of mechanical barriers (lignification). It is also likely that increased copper uptake could have a lethal or repellent (unpalatable) effect on the spidermites.

The combination of Aqua-Hort®-treatment and control interventions emerges as a cost effective approach to highly effective spidermite control in cut roses. It is evident that with the Aqua-Hort®- System installed in cut roses, spidermite control can be reduced to spot treatments and the frequency of treatment is likely to be reducible too. Also, lower spidermite populations open up for economically sustainable biological control.

The effect of the Aqua-Hort®-System on spidermites (*T. urticae*) should be tested in more rose varieties, and the concentration of free copper ions required for effective spidermite control should be fine-tuned.

Nairobi, 23 October 2007

(Dr. Lisbeth Riis)

Cited:

Marschner, H. (1995) Mineral Nutrition of Higher Plants. 2nd ed. Academic Press