Confidential Summary of UK Research on Aqua-Hort in Nursery Stock. Report to be released in Spring 2010

Project Title	Hardy nursery stock: manipulation of copper in irrigation water as a component of integrated crop protection
Project number:	HNS 142
Project leader:	John Atwood, ADAS Boxworth
Report:	Final report, October 2009
Previous report	
Key staff:	John Atwood – Overall Project Manager Tim O'Neill – Joint Project Leader (Plant Pathology) Erika Wedgwood, Plant Pathologist Chris Dyer – ADAS Statistician Olga Grant – East Malling Research
Location of project:	East Malling Research & Robin Tacchi Plants Ltd, Illington, Norfolk
Project coordinator:	John Adlam, Dove Associates, Dickleborough, Norfolk. Nick Dunn, Frank P Matthews, Tenbury Wells, Worcs
Date project commenced:	1 March 2006
Date completion due:	31 October 2009
Key words:	*Bacillus*, *Carex* Evergold, *Chamaecyparis lawsoniana* 'Chilworth Silver', compost tea, copper, *Choisya* 'Sundance', disease, electromagnetic, ioniser, *Phytophthora cinnamomi*, *Hedera helix*, *Helleborus orientalis, Iris foetidissima, Prunus laurocerasus, Prunus lusitanica, Pseudomonas syringae, Pythium*, *Trichoderma, Vinca minor, Xanthomonas*

Confidential Summary of UK Research on Aqua-Hort in Nursery Stock. Report to be released in Spring 2010

Conclusions

Phytophthora root rot

The E Cu water treatment was effective in reducing a high level of *Phytophthora* root rot in *Chamaecyparis lawsoniana* 'Elwoodii' in the year 1 experiments. Although these results could not be confirmed in the year 2 experiments, due to the failure of the disease to establish, results from the nursery observations in year 3 indicated again a good level of control, this time in infected *Prunus lusitanica* "Myrtifolia" reducing plant losses from 2.5% to 0.7%.

Pythium root rot

Results from the replicated experiments in year 1 were inconclusive because the infected *Aquilegia* test plants (year 1) also suffered copper phytotoxicity. In the year 2 study on *Choisya,* there was a small reduction in root death from both the E Cu and *Bacillus* treatments. However, the levels of disease were low and the differences were not significant. The most interesting results came from the nursery observations in year 3 where a high level of *Pythium* infection in *Helleborus orientalis* was controlled and plant quality improved.

Bacterial leaf spots

Initial (year 1) work on *Prunus laurocerasus* indicated a slight reduction in *Pseudomonas* leaf spot in E Cu treated plants, however infection levels were low. Much higher infection levels were noted in the year 3 nursery observation and a good level of control was noted, reducing infection from up to 35% to 5% or less. The disease was not completely eradicated though. It should be noted that the E Cu treated plots also received more liquid feed than the control plots so some of the improvement in plant quality may have resulted from an improvement in nutrition. The overall control level was, however, much better than normally achieved on the nursery where control measures are based on 2 -3 weekly sprays of copper fungicide.

Xanthomonas leaf spot was present in the *Hedera* study in year 2 but at relatively low level. Population numbers of *Xanthomonas* bacteria per leaf were quite variable, but showed some reduction where the E Cu treatment had been applied. The total number of leaf spots was reduced by 20% where the E Cu treatment was used, but these differences were not statistically significant. No *Xanthomonas* leaf spot occurred in year 3.

Confidential Summary of UK Research on Aqua-Hort in Nursery Stock. Report to be released in Spring 2010

Moss and liverwort

Liverwort established in two plant batches in the nursery observation year 3 and the E Cu treatment appeared to delay the infestation of liverwort compared with the control: moss was not present. However, with a heavy infestation pressure in the year 1 experiment the E Cu treatment had failed to give a significant control of moss and liverwort. In general, the experience of other nurseries is that liverwort and moss still remain a problem even when using E Cu irrigation. Previous studies (HNS 93c) have shown copper to have some efficacy in control of liverwort. Whilst E Cu irrigation might help in a control strategy it would appear that other measures need to be taken as well.

Compatibility with biological control agents

Compatibility with microbial and invertebrate biological control agents was quite good with the E Cu treatment. There were no adverse effects on microbial populations of *Trichoderma* and compost tea microbes, but a slight (not statistically significant) reduction in *Bacillus* populations. It was not possible to test the effect on functionality of the microbial biological control agents because they were not significantly effective in the control of the target diseases. There were no adverse effects noted on *Phytoseilus persimilis* mites and control of two spotted spider mite was unaffected.

Figure 2. E Cu treated Prunus

Figure 3. Untreated Prunus, showing crop losses from Phytophthora root rot

Figure 4 Helleborus orientalis, stronger growth in E Cu treated area

Figure 5 Helleborus orientalis, poor growth in untreated area

Figure 6 ***Helleborus orientalis*****, good root growth in E Cu treated area**

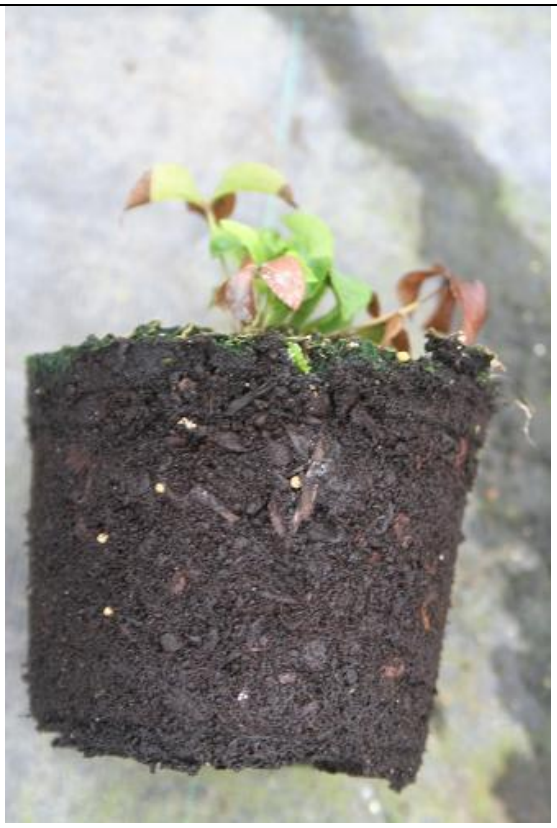

Figure 7 ***Helleborus orientalis*****, poor root growth in untreated area**

Figure 8. Less *Pseudomonas* leaf spot on E Cu treated *Prunus laurocerasus* 'Otto Luyken'

Figure 9. Untreated *Prunus laurocerasus* 'Otto Luyken'

	
Figure 10. Less liverwort on E Cu irrigated pots (*Osmanthus burkwoodii)*	**Figure 11. More liverwort on untreated water irrigated pots (*Osmanthus burkwoodii)***

Aksel de Lasson

9-1-10