Grower Summary

PO 020

The development of an experimental deep pool hydroponics system to investigate its potential for cut flowers.

Final 2016

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GROWER SUMMARY

Headlines

- Deep and shallow pool hydroponics seem to be possible systems for cut flower production.
- Column stocks production has been challenging in deep pool hydroponics owing to disease issues and a high oxygen requirement in the solution.

Background

The control of *Fusarium oxysporum* is a major issue for flower growers especially those producing *Matthiola incana* (column stocks) and Lisianthus. Despite a number of AHDB funded projects, the only reliable control is still the expensive and time consuming technique of steam sterilisation, even this is only a partial cure and large losses can still be seen in steamed glasshouses. In an attempt to overcome these issues the industry has been looking at the possibility of moving completely out of soil into a hydroponics system. The preferred option was some form of solution hydroponics rather than substrate hydroponics and the simplest system seemed to be deep pool hydroponics where the crop is grown on floating rafts in a large pool of water 25 to 30 cm deep. After a trip in December 2014 to look at lettuce production in deep pool hydroponics, Phil Collison of J A Collison and Son decided to construct a small trial pool (7 m x 3.8 m) in order to undertake AHDB funded trials during 2015. There was very little documented work on the production of stocks in a solution hydroponics system and none in deep pool. The purpose of the trial was therefore to simply explore some of the basics of production to determine if a marketable crop was even possible.

Summary

The deep pool hydroponic trial facility was constructed in December 2014 and was then filled with water in mid March 2015 ready for the trial to commence in late March 2015.

A number of different floating trays were made from 600 mm x 400 mm x 25 mm dense polystyrene sheets which enabled both plugs and blocks to be investigated. The nutrient status was controlled by an existing "Heron" controller using a traditional A and B tank as well as concentrated nitric acid for pH control. The initial nutrient recipe was drawn up by Paul Challinor of May Barn Consultancy and this was slightly modified for the use of either reservoir or mains water. The water was constantly circulated and entered the pool via a perforated pipe at one side of the pool and was drawn out by a similar perforated pipe at the other side. Oxygenation was initially provided by a "Venturi" which introduced air into the solution. The first plantings were a mixture of stocks propagated in both blocks and plugs, floats of lettuce blocks to act as a "check" species as well as blocked statice and Lisianthus plugs.

It soon became clear that the stocks were not thriving and while the other species (especially the lettuce) were growing away very vigorously, the stocks looked very sick. The block propagated stock plants initially seemed to be performing better but as soon as the roots reached the water they began to turn brown and decay. This contrasted starkly with the lettuce which were ready to harvest within a few weeks and had very vigorous, healthy white roots. This clearly demonstrated that there was no fundamental problem with the pool design but in its current form it was obviously not conducive to the production of column stocks.

A number of brassica were then planted to determine if the system was suitable Cruciferae (the same family as stocks) in general in the deep pool system. A modified air gap was also introduced to some of the stock trays so that the block or plug was not directly sitting in the water. Aster ericoides and chrysanthemums were also planted at this stage to broaden the assessment.

A month later the brassica (including, cabbage, sprouts and cauliflower) had put on substantial growth, the aster ericoides and lettuces were thriving but the stocks continued to die. None of the changes that had been made seemed to have made any difference but there were a few random stock plants that had made a marketable flower despite those around them being either dead of very sick. This suggested that stocks has potential to thrive in the system with further development of the set up.

After researching the issue further the one factor that kept coming up was oxygenation of the water and there was a suspicion that perhaps stocks required more oxygen than the other crops that were growing in the pool. Accurate oxygen measuring kit and some additional oxygenating equipment in the form of air pumps and air stones were obtained to test this theory. Without additional oxygenation (beyond the venturi system) initial measurements of dissolved oxygen were low (around 2 mg/l or 20% saturation) but once the air stones were introduced, the area immediately around the stone rose to around 8.5 mg/l (85% saturation) and the concentration a few feet away from the stone rose to around 6 mg/l (60% saturation). Soon after increasing the oxygen concentration positive results were seen, with the stock plants immediately above the air stone producing both healthy leaves and more significantly, healthy white roots. However this positive effect was very localised with plants growing two rafts away from the air stone being no better than before even though the oxygen saturation had increased three fold. This clearly demonstrated that stocks seem to need a much higher oxygen concentration than anyone had initially appreciated.

Unfortunately two weeks later some of the healthy plants in the floats over the air stones began to wilt. Closer inspection showed that the problem was in the stem base which resulted in the roots and stem being detached from one another. This was subsequently confirmed by STC

plant clinic as being *Phytophthora* and a recommendation was made to apply metalaxyl as Subdue to the pool. Unfortunately because it was by now so late in the season, no more plugs could be obtained so it was only possible to look at the effect of Subdue on the existing plants rather than a new batch. However the results of the Subdue did seem to be quite significant and very few additional plants seemed to succumb to *Phytophthora* although those already infected did not of course recover. By the end of September a number of flowering stems had been achieved and since the addition of the Subdue, it seemed that the positive effect of the air stones was wider than just the float immediately above them.

In addition to the main deep pool trial a small secondary trial was undertaken in three 1.2 m x 1.2 m shallow pools which are only 10 cm deep and are designed to be used with rolling tables. This was started very late in the season so only one round could be produced hence the results must be treated with caution. However, one of these shallow pools had the addition of an experimental form of electrolysed water which allows free available chlorine (FAC) to be released into the solution and this produced some of the best stems of the season although they did not crop until late October.

To summarise, for stocks in the deep pool hydroponics system, none of the earlier variables that were investigated i.e. plugs or blocks, different forms of air gap (or no air gap), different varieties and different planting dates made any difference to the performance of the plants. It was only the introduction of additional oxygen bringing the level up to around 8 mg/l (80% saturation) that started to result in the production of marketable stems even though some of these subsequently succumbed to *Phytophthora* before Subdue was introduced to the water.

The additional trial looking at shallow pool hydroponics has given an indication that it may also be a system that can be utilised for column stock production but as with the deep pool trials it needs to be further investigated to ensure that the encouraging results obtained at the end of the 2015 trials can be both repeated and replicated.

Financial Benefits

This work is at such an early stage that it is not possible to yet provide financial benefits.

Action Points

- Consider small scale trials of deep and shallow pool hydroponics for cut flowers.
- Keep up to date with future AHDB funded trials in 2016 and beyond.