Grower Summary

PO 005 & PO 005a

Column stocks (cut-flowers): An Investigation into the cause(s) of poor establishment, growth and flower uniformity in commercial crops (PO 005)

&

To investigate the commercial scale use of various soil amendments to improve the quality and disease control in glasshouse grown crops of stocks, following on from the results of PO 005 (PO 005a)

Final 2013

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HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

HDC is a division of the Agriculture and Horticulture Development Board.

Project Number:	PO 005 & PO 005a
Project Title:	Column stocks (cut-flowers): An Investigation into the cause(s) of poor establishment, growth and flower uniformity in commercial crops (PO 005) & To investigate the commercial scale use of various soil amendments to improve the quality and disease control in glasshouse grown crops of stocks, following on from the results of PO 005 (PO 005a)
Project Leader:	Lyndon Mason Director, L&RM Consultancy Ltd
Contractor:	L&RM Consultancy Ltd Stockbridge Technology Centre
Industry Representative:	Mr Colin Frampton First Flora Ltd
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GROWER SUMMARY

Headline

- As a result of these findings, growers of column stocks have started to move away from sterilising with Basamid to using steam sterilisation. This particularly applies where varieties of the 'Aida' and 'Figaro' Series are grown.
- Using steam-sterilisation reduced problems with *Pythium* and poor root development, even in sub-optimal growing conditions in poor quality glasshouses.
- *Fusarium* is still potentially a major problem on some nurseries, especially on sites with a history of the disease, and this was still the case in some glasshouses even where the soil had been steamed (steaming for 6 to 8 hours does not always fully control *Fusarium*).
- The varieties 'Centum Deep Blue', 'Fedora Deep Rose' and 'Francesca' are particularly susceptible to *Fusarium*.
- Growers and propagators should work more closely together to match the choice of varieties to the growing practices used.
- The varieties 'Figaro Lavender' and 'Figaro Light Rose' have shown symptoms similar to *Rhizoctonia*, although laboratory tests identified the cause as a strain of *Fusarium* that shows up as a yellow culture on agar plates.
- Loose-fill plugs, now being used by the main propagator, give better results than the glue-plugs previously used in terms of plant establishment.
- The variety 'Carmen Yellow' was found to be particularly slow and uneven on some nurseries.

Background

Over the past few years, UK producers of column stocks have seen an increasing incidence of problems leading to plant losses and a reduction in the marketable percentage of the crop. In some cases the percentage unmarketable crop has been as high as 50%, but on average it is closer to 15%. Currently, crops are failing to establish, grow and flower uniformly, with resultant increased labour costs owing to increased grading and repeated picking. Unless resolved, this problem could result in UK growers ceasing to grow an otherwise highly acceptable cut flower crop that is in demand. Project PO 005 was an investigation into the cause or causes of poor establishment, growth and flower uniformity in commercial crops of column stocks.

Various reasons for these failings have been suggested by growers, ranging from establishment problems due to the glue plug being used through to poor seed quality. Surveys undertaken in 2011 and 2012 were generated to try and understand these various issues. The findings from the surveys led to nursery based trials as well as pot trials

investigating the use of chemical and biological treatments with potential to control both *Pythium* and *Fusarium*, the objective being to improve the quality of UK-grown column stocks, if necessary through follow-up projects.

Summary

Surveys of grower practices (PO 005)

The 2011 and 2012 surveys were a comprehensive review of the column stock industry and included a large proportion of the UK businesses, covering about 90% of production of this crop. The main findings from the surveys are listed below:

- The total number of column stocks planted in 2011 was approximately 12 million seedlings, of which approximately 9 million were grown in steamed soil, about 2.3 million in soil sterilised with Basamid (dazomet), and about 0.8 million in non-sterilsed soil. Of the nine million grown in steamed soil, about 49% were grown in soil sterilised by dry (super-heated) steam and about 26% in soil sterilised by 'wet' steam.
- In 2012, the corresponding production figures were about 13 million in total, comprising about 12.4 million grown in steamed soil, about 0.6 million in Basamid sterilised soil, and a negligible amount in non-sterilsed soil. Of the 12.4 million grown on steamed soil, about 59 and 36% were grown in soil sterilised by dry (super-heated) and 'wet' steam, respectively. The change in practice from 2011 to 2012, moving from sterilising with Basamid to steam sterilisation, was a direct result of the earlier year's findings.
- Growers who had steam-sterilised the soil suffered from very few problems with *Pythium* or poor root development, even in poor quality glasshouses with less than ideal growing conditions.
- Growers who had not used any form of soil sterilisation, or had used Basamid, consistently had problems with certain varieties, namely from the 'Aida' and 'Figaro' Series. As some 75% of the total area in 2011 was steamed, the overall percentage of the 12 million column stocks grown affected by this problem was probably no greater than 5%. But for those growers who had not steamed and were growing 'Aida' and 'Figaro' varieties this was a very serious problem and some crops showed 50 to 90% of stems affected. The problems observed in these varieties were poor root development, lack of vigour and loss of marketable stems, wilting and sometimes plant collapse and death and in such cases *Pythium* was consistently isolated from the affected plants in 2011.
- It was agreed by the main propagator and breeder that the 'Aida' and 'Figaro' varieties are weaker rooted and would therefore be prone to problems on non-steamed soil. It

was agreed that growers and propagators should work more closely together to match the choice of varieties to the growing practices used.

Both years of the survey showed that *Fusarium* was still potentially the major problem on some nurseries, especially on sites with a history of the disease. In some situations this was the case even where the soil had been steamed, steaming for six to eight hours did not always fully control *Fusarium*.

In 2011, *Fusarium* mainly occurred in later planted crops and in two particular varieties, 'Centum Deep Blue' and 'Francesca' which could be seriously affected. Out of the total of about 12 million column stocks grown, however, only about 5% was lost through *Fusarium*. Where susceptible varieties were grown, the losses varied widely from nursery to nursery, some experiencing negligible losses and others losses in excess of 50%. These results were confirmed in 2012, but, unexpectedly, the variety 'Fedora Deep Rose' also suffered from a moderate to severe infection on some nurseries.

In 2012, problems were also seen in the varieties 'Figaro Lavender' and 'Figaro Light Rose' which appeared initially similar to *Rhizoctonia*. The problem occurred on scattered individual plants rather than in patches, and the symptoms showed within two weeks of planting, even as early as late-February. However, laboratory tests identified the cause as a strain of *Fusarium* which developed as a yellow culture on agar plates. The suggestion that the disease had been brought in with seedlings could not be proven. But no more than 1 or 2% of a batch was affected and, unlike the usual strain of *Fusarium* it did not spread to adjacent plants and did not occur again in the following season. Exact identification did not prove possible, but it was thought it was another strain of *F. oxysporum*.

There was broad industry agreement that the current column stocks varieties are flowering more unevenly than they did a decade or so ago, and it is now necessary to pick them two or three times rather than as a one-off cut.

The need to ensure good seed selection and stock maintenance to ensure a more even crop has been taken on board by growers, propagators and breeders.

The main propagator's decision to move from glue plugs to loose-fill plugs was a positive move and initial plant establishment has been better, but the loose-fill plug needs to be made more stable to facilitate better gapping-up and planting. As a result the main propagator has installed a new filling machine and conducted a number of trials with the new plug.

In addition some growers experienced poor establishment and slow growth of the variety 'Carmen Yellow'. Most of the crop was eventually marketable but it was uneven and

10 to 14 days behind other varieties in the same glasshouse. This occurred only in a small number of plantings on three nurseries.

Pythium glasshouse trial (PO 005)

A *Pythium* trial was undertaken in two glasshouses on a commercial nursery, one glasshouse contained non-sterilised soil that had a history of *Pythium*-like symptoms and in an adjacent glasshouse the soil had been sterilised by steam. 15 biopesticides and other treatments were tested on the varieties 'Aida White' and 'Figaro Lavender'. The treatments included Trianum (*Trichoderma* species) both drenches to the soil and application at propagation, applications of HDC F45, Prestop, Serenade ASO (all biopesticides) and Paraat and Subdue (both conventional fungicides), as well as Trianum and Prestop drenches combined with the incorporation of paper waste or spent mushroom compost into the soil. The addition of products with specific activity against *Pythium* did not reduce the poor rooting associated with these two plant varieties. The only improvement came from the addition of spent mushroom compost.

Fusarium glasshouse trial (PO 005)

This trial was also undertaken on a commercial nursery, in a glasshouse with a history of *Fusarium* related problems. Half of the soil in the glasshouse had been steam-sterilised before producing an early round of column stocks, after which the trial was planted without further sterilisation. The other half of the soil in the glasshouse was steamed before planting the second round. Each area was planted with the varieties 'Centum Deep Blue' and 'Francesca' because of their sensitivity to *Fusarium*. The treatments included Trianum and HDC F45 (soil drenches and application at propagation) and HDC T34 as a plug-tray soak, applications of Prestop and Serenade ASO (biopesticides) and Octave, Signum and Switch (conventional fungicides), as well as Trianum and Prestop drenches combined with the incorporation of paper waste, spent mushroom compost or composted bark, and mushroom compost or composted bark used on their own. None of the fungicides or biopesticides showed any control of *Fusarium*. However, the incorporation of composted bark showed a significant level of control of *Fusarium* and an overall improvement in the quality of the stems not affected with *Fusarium*.

Pythium and *Fusarium* pot trials (PO 005)

Pot-plant trials were carried out at Stockbridge Technology Centre, Cawood, North Yorkshire. The pathogens used to inoculate the test plants were virulent strains isolated from confirmed infected column stocks samples. Two varieties of columns stocks were used because of their observed susceptibility, 'Figaro' for the *Pythium* studies and 'Francesca' for *Fusarium*. The range of treatments used was similar to that tested in the glasshouse trials

though with additional experimental products. Two drench applications were made, immediately post-sowing and then 21 days later.

In the *Pythium* pot trial, none of the applied treatments were found to be effective at controlling *Pythium* when compared with the inoculated control. There were however, several treatments that appeared to increase the levels of post-emergence damping-off, the most notable being Serenade ASO and the experimental products HDC F132 and HDC F128. Differences in plot vigour were observed, with PlantTrust producing a significant increase in vigour compared with all other treatments, though this may have been due to the presence of additional nutrients in the formulation.

In the *Fusarium* pot trial, all of the varied treatments reduced the number of seedlings emerging (although treatment at this time with many of the products examined would not be standard practice). Following inoculation by *F. oxysporum* f.sp. *matthioli,* vascular wilt developed rapidly and 90% of the seedlings died in the inoculated control. The non-inoculated control remained disease-free throughout the study. Only two of the applied treatments, Systhane and Octave, resulted in a significant decrease in *Fusarium* infection levels, by 32 and 85% respectively, compared with the inoculated control, and none of the other treatments had any significant effect (although due to an application error the rate of Octave applied was much higher than the label recommendation, so this result needs interpreting with caution). No significant differences in plot vigour were observed between treatments, nor were any phytotoxic effects seen during the trial, although four weeks after the cessation of the trial there was some severe leaf curling and distortion in several of the Octave-treated plots.

Bark incorporation glasshouse trials (PO 005a)

In 2013 there was further testing of the promising bark incorporation trials against *Fusarium*. This was undertaken on a large-scale at a number of commercial nurseries, and included a range of bark application rates including full-rate (30 L/m^2), half-rate, first- and second-round incorporation, pre- and post-steaming incorporation as well as interactions with Basamid sterilisation and composted green material incorporation. None of the treatments or sites showed any advantage due to the incorporation of composted bark.

Financial Benefits

At an average planting density of 64 plants/m^2 every square metre of lost crop represents about £16 of lost income in terms of revenue from the cut flowers. Hence if the industry was losing between 5 and 10% due to unidentified problems, on a total area of about 30 ha (300,000 m^2) this would represent between £240,000 and £480,000 per annum. The first

year of this survey identified a number of key action points for growers which will help to reduce crop losses.

Financial losses also occur as a result of the down-grading of lower quality stems and repeat harvesting of uneven crops. The use of appropriate varieties to suit time of year and sterilisation method will help reduce these financial losses.

At the 2014 review of the Cut Flower Centre there was broad agreement amongst the largest column stock growers that the bringing together of the industry, including the crop walks, was one of the major achievements of this project but that it was very difficult to put a value on it. However, the general feeling of the growers was that in its totality, this project had increased the overall number of stems marketed by between 2 and 5%, which on a total of 15 million at 25p per stem (2014 figures) would equate to an extra annual income of between £75,000 and £187,500.

Action Points

The following action points should be considered as a result of the both the survey and trials carried out from 2011 to 2113.

- Investigate any unexplained plant losses or areas of poor growth and consider sending samples for laboratory analysis of the problem.
- If growing on soil that has not been steamed, avoid planting varieties from the ‘Aida’ and ‘Figaro’ Series.
- If the glasshouse soil has a history of *Fusarium*, try to avoid late plantings of ‘Centum Deep Blue’, ‘Francesca’, and ‘Opera Deborah’.
- Work closely with plant suppliers to ensure the correct varietal choice.
- Ensure that any soil to be steamed has been cultivated to ensure it is not too wet and has a good structure to allow the steam to penetrate to depth.
- The trials indicate there is limited scope to control either *Pythium* or *Fusarium* infestations in the soil using the current range of conventional fungicides and biopesticides applied at the label recommended rates.
- Growers should liaise with their local suppliers to keep updated with progress and possible future beneficial treatments.