

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

Project number: PO 005

Project leader: Lyndon Mason
Director, L&RM Consultancy Ltd

Report: Interim Report (2011)

Previous report: N/A

Key staff: Lyndon Mason (L&RM Consultancy Ltd)
Martin McPherson (STC)

Location of project: Various commercial nurseries in
Lincolnshire and Norfolk

Industry Representative: Colin Frampton

Date project commenced: 1 January 2011

**Date project completed
(or expected completion date):** 30th May 2012

AHDB, operating through its HDC division seeks to ensure that the information contained within this document is accurate at the time of printing. No warranty is given in respect thereof and, to the maximum extent permitted by law the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document.

Copyright, Agriculture and Horticulture Development Board 2013. All rights reserved.

No part of this publication may be reproduced in any material form (including by photocopy or storage in any medium by electronic means) or any copy or adaptation stored, published or distributed (by physical, electronic or other means) without the prior permission in writing of the Agriculture and Horticulture Development Board, other than by reproduction in an unmodified form for the sole purpose of use as an information resource when the Agriculture and Horticulture Development Board or HDC is clearly acknowledged as the source, or in accordance with the provisions of the Copyright, Designs and Patents Act 1988. All rights reserved.

AHDB (logo) is a registered trademark of the Agriculture and Horticulture Development Board.

HDC is a registered trademark of the Agriculture and Horticulture Development Board, for use by its HDC division.

All other trademarks, logos and brand names contained in this publication are the trademarks of their respective holders. No rights are granted without the prior written permission of the relevant owners.

The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations. For accurate reporting, materials may be referred to by the name of the commercial product. No endorsement is intended of products mentioned, or criticism of those not mentioned.

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

[Name]
[Position]
[Organisation]

Signature Date

[Name]
[Position]
[Organisation]

Signature Date

Report authorised by:

[Name]
[Position]
[Organisation]

Signature Date

[Name]
[Position]
[Organisation]

Signature Date

CONTENTS

Grower Summary	1
Headline.....	1
Background.....	1
Summary	1
Financial Benefits	4
Action Points.....	4
Science Section	6
Introduction	6
Materials and methods	7
Results.....	10
Discussion	16
Conclusions	18
Knowledge and Technology Transfer	18
Glossary.....	18
References	18
Appendices	18

GROWER SUMMARY

Headline

- The production problems experienced by column stock growers in recent years are complicated and quite numerous.
- There is a clear correlation between the choice of variety and their susceptibility to root problems and subsequent establishment issues.
- Fewer problems occur in steamed soil but careful choice of varieties can enable a crop to be grown without the need for steam sterilisation each year.

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 percentage of the crop that is marketable. In some cases this was as up to 50% but an average would probably be nearer to 15%. Unfortunately, current crops are failing to establish, grow and flower uniformly with resultant increased labour costs owing to increased grading and repeated cuts. Unless resolved, this problem could result in UK growers ceasing to grow an otherwise highly acceptable, and in-demand, cut-flower crop.

However there was a lack of agreement amongst the industry as to the cause of the problem that has led to a lack of confidence in the crop and subsequent reduction of about 10% in the overall area produced at a time when the supermarket demand for the crop has never been higher. A number of reasons had been put forward by growers as to the cause of the problems ranging from establishment problems owing to the glue plug through to poor seed selection. However, there was far from universal agreement within the industry as to the cause of the problem and this was the key reason for the HDC funding a detailed practical survey of the industry in 2011.

Summary

The 2011 survey provided a comprehensive review of the column stock industry and incorporated a large proportion of the industry with about 90% being involved in one form or another. Four key growers were involved in the detailed survey, whom collectively produce about seven million stems representing about 60% of the total English production. In addition to these four growers, the project manager also visited an additional seven growers who collectively produced another four million stems.

Collectively these growers were using 68 different glasshouses providing a broad survey sample in terms of house size, house type, soil type and growing technique.

Visits were made between 11th March 2011 (week 10) and 21st July 2010 (week 29) with a total of 82 visits over this period.

The following is a list of the headline observations that have come out of the 2011 survey work:

- Approximately 12 million stocks were planted in 2011, with about two million (17% of the total) being second round production. Of the total of 12 million plants approximately 75% (9 million) was grown in steamed soil, about 19% (2.3 million) grown in Basamid sterilised soil and 6% (0.85 million) grown in unsterilised soil. Of the 9 million grown on steamed soil, about 5.85 million (about 49% of the total produced) were grown on soil sterilised by “dry” (super heated) steam with 3.15 million. around 26% of the total produced) grown in soil sterilised by “wet” steam.
- The survey work has shown conclusively that there is not one single problem affecting column stock crops and that a combination of factors is responsible for the problems experienced in recent years.
- Growers who had steam sterilised the soil prior to planting their crop of column stocks suffered from very few problems with *Pythium* or poor root development, even in poor quality glasshouses with less than ideal growing conditions (except where there had been a specific soil structure issue from for example flooding due to a burst pipe and even then poor root development rather than disease was the key issue).
- There was circumstantial evidence on some nurseries that problems still occurred if the steaming took place a long time before the crop was planted e.g. autumn steaming following by spring planting. But this was not observed during the 2011 survey.
- Growers who had not used any form of sterilisation or had used Basamid, consistently had problems with the same varieties i.e. ‘Aida’ blue, white and lavender and ‘Figaro’ light pink and rose. Since about 75 % of the total stock area is steam treated, then only around 25% of the UK stocks grown were affected by this problem. However, for those growers who had not steamed and did grow ‘Aida’ and

'Figaro', this was a very serious problem with 50 - 90% of the stems affected in some crops.

- There was appreciation between the main propagator and the breeder that these varieties are weaker rooted and would therefore be prone to problems on unsteamed soil. This also led to the conclusion that the growers and propagators should work more closely together in order to match the choice of varieties grown, to the conditions that they will be produced under, especially with reference to soil sterilisation techniques.
- The problems observed in the varieties listed above took the form of poor root development, lack of vigour (leading to stems of unmarketable quality), wilting and in some cases total plant collapse and death. In such cases *Pythium* was consistently isolated from the affected plants and it is believed this disease would have been a contributing factor to this problem. Further investigations and trial work will be undertaken in 2012.
- *Fusarium* is still a potentially major problem on some nurseries, especially, but not exclusively, on sites with a history of the disease in the soil. This was still the case were the soil had been steamed prior to planting.
- In 2011 (as with previous years) *Fusarium* mainly occurred in later planted crops and with two varieties in particular 'Francesca' and 'Centum' deep blue. Only a small percentage of the total stems grown were lost through *Fusarium* (perhaps up to 5%), however, when the susceptible varieties are looked at in isolation about 20% of the susceptible varieties were typically affected with wide variation from nursery to nursery (from negligible losses in some cases up to 50% losses in others).
- There was universal agreement amongst growers that the current varieties flower less evenly than they did a decade ago and it is now necessary to go over them two or three times rather than employ a one-off cut.
- The need to ensure good seed selection and stock maintenance in order to ensure a potentially more even crop seems to have been taken on board by growers, propagators and breeders alike.

- The main propagators' decision to move from glue plugs to loose fill was seen as a positive move with most growers agreeing that initial plant establishment was better with loose-fill than the glue plugs.
- However there was universal agreement that the loose-fill plug needs to be made more stable in order to facilitate better gapping up in the trays and easier planting on the nursery. This has been addressed by the main propagator who has installed a new filling machine and conducted a number of trials with the new plug prior to the main 2012 production period.
- In addition to the main problems described above, some growers also experienced poor establishment and slow growth with 'Carmen' yellow. Most of the crop was eventually marketable but was very uneven and 10 to 14 days behind the other varieties in the same house. However this issue only occurred on a small number of plantings on three nurseries and no explanation has so far been found to adequately explain the problem.

Financial Benefits

At an average planting density of 64 plants per square metre, every metre of lost crop represents about £16 of lost income. The survey has identified a number of key action points for growers which will help to reduce crop losses in 2012 and beyond hence reducing the level of wastage. However, the most significant financial benefits will result from improved control of *Pythium* and especially *Fusarium* and this is the focus of the work in 2012.

Financial losses also occur as a result of downgrading of lower quality stems and repeat harvesting of uneven crops. The use of appropriate varieties to suit time of year and sterilisation technique will help to reduce these financial losses. It is difficult to make an accurate estimate of the value of these savings but individual growers will be aware of their own costings in this respect.

Action Points

The following action points should be considered as a result of the 2011 survey but may be modified in the light of the 2012 work.

- Investigate any unexplained plant losses or areas of poor growth and consider sending plant and soil samples for laboratory analysis of the problem.
- If growing on soil that has not been steamed try to avoid planting 'Aida' and 'Figaro'.
- If the nursery has a history of *Pythium* problems consider treatment with a specific *Pythium* fungicide even if steam sterilisation has been carried out.
- If the glasshouse has a history of *Fusarium* try to avoid late plantings of 'Francesca', 'Centum' deep blue and 'Opera Deborah'.
- Work closely with plant suppliers to ensure that the varietal choice is suitable.

SCIENCE SECTION

Introduction

With sturdy flowers, a good range of colours, 'guaranteed' fragrance and a long cropping season, stocks are popular cut-flowers routinely carried by most of the major retailers (supermarkets), who also have a preference for the superior UK-grown product. 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 percentage of the crop that is marketable. In some cases this was as up to 50% but an average would probably be nearer to 15%. In reality, on most nurseries a minimum of 90% of the plugs are required to reach a marketable stage to achieve profitability. Unfortunately, current crops are failing to establish, grow and crop (flower) uniformly with resultant increased labour costs owing to increased grading and repeated cuts. Unless resolved, this problem could result in UK growers ceasing to grow an otherwise highly acceptable, and in-demand, cut-flower crop.

However there was a lack of agreement amongst the industry as to the cause of the problem which has led to a lack of confidence in the crop and subsequent reduction of about 10% in the overall area produced at a time when the supermarket demand for the crop has never been higher. A number of reasons had been suggested by the growers as to the cause of the problems ranging from establishment problems owing to the glue plug through to poor seed selection. However there was far from universal agreement from the industry as the cause of the problem and this was the key reason for the HDC instigating a detailed practical survey of the industry in 2011.

At the time of undertaking the project (2011) there were 3 main propagators supplying plug raised column stocks into the UK i.e. Florensis Cut Flowers, Van Klink and Combinations (Van Klink has subsequently been taken over by Florensis reducing the number to 2). The propagator with by far the largest market share is Florensis Cut Flowers who work closely with Pan American, the breeder who supply most of their seed. Therefore Florensis offer an exclusive range of varieties such as Aida, Figaro, Fedora, Carmen, Opera etc as well as varieties also offered by the other propagators such as Centum and Anytime. Van Klink also offered their own range i.e. Phantom and Fantasy while Combinations offer Jordyn. However there is strong circumstantial evidence from variety trials and commercial observations (as well as discussions with Pan American) that many of these varieties have been selected from the Pan American range and renamed by the propagators (a perfectly legal practice because the seed is not protected by PVR's.)

This project involved a two stage approach to the problem, with the first year being dedicated to a “fact finding” survey mainly involving four key growers who collectively represent about 60% of the UK column stock industry. This involved weekly visits by Lyndon Mason to assess the extent of the problem in each growing unit and record key agronomic factors such as variety, seed supplier, soil type, chemical applied, temperature, method of sterilisation, time from sterilisation to planting etc. Appropriate analyses was also undertaken for soil nutrient status presence of disease etc.

In year two (2012) the findings from year 1 will be used to identify key issues and undertake appropriate trials on growers holdings and at Stockbridge Technology Centre which will address any issues identified.

The ultimate aim of the project was to elucidate the cause(s) of the recent, but persistent, plant failure and varied crop uniformity and to propose solutions to ensure continued viability of UK stock production in the future.

Materials and methods

The survey work incorporated a large proportion of the column stock industry with about 90% of the total production area being involved in one form or another. Four key growers were involved in the detailed survey, whom collectively produce about 7 million stems representing about 60% of the total English production. In addition to these four growers, the project manager also visited an additional 7 growers who collectively produced another 4 million stems.

Collectively these growers were producing in 68 different glasshouses which gave a very broad survey sample in terms of house size, house type, soil type and of course growing technique.

Visits were made between 11th March 2011 (week 10) and 21st July 2010 (week 29) with a total of 82 visits being made over this period.

The above data ensured that the survey was truly representative of the industry and actually represented about 90% of the English stock production.

Details of the 4 main sites are as follows.

Grower 1

Operating out of multiple sites and the survey was undertaken in 20 glasshouses with the planting dates ranging from week 7 to week 22 with 5 of the glasshouse producing a second round of stocks. The nature of the glass ranged from modern multi span Venlo, through to old wide span houses, to old, low Dutch light houses and Spanish tunnels. All soil was steam sterilised close to planting before each round including the second round.

Grower 2

Operating out of multiple sites with the survey work being undertaken in 4 different glasshouse most of which was modern Venlo. Planting dates ranged from week 9 to week 16 and no second round plantings were made. Soil was sterilised with Basamid in the autumn of 2010.

Grower 3

Operating out of one site with the survey work being undertaken in 11 different glasshouses with planting dates ranging from week 7 to 24 with 6 of these glasshouses producing a second round of stocks. All glasshouses were modern Venlo of varying ages. Most houses (except two) were steam sterilised.

Grower 4

Operating out of one site with the survey work being undertaken in 3 different glasshouses with planting dates ranging from week 7 to week 25 with 2 glasshouses producing a second round of stocks. The houses were sterilised with Basamid over the winter period.

These four growers (who also made up the project steering group) were visited on a regular basis (every 7 to 10 days) throughout the whole of the production period. During the visits, each of the glasshouses was “walked” in detail and the progress of the crop noted by variety. If any disease problems were observed, samples were sent into the Stockbridge Technology Centre (STC) plant clinic for analysis (except later problems with fusarium which do not need to be sent to a lab to identify).

These growers also participated in crop walks of each other’s nursery throughout the growing season.

As well as the four main growers involved in the survey work other stock growers were also visited if the Project Manager was made aware that there was a problem. Towards the end of the season most of the remaining growers who had not been involved to date were also

visited by the Project Manager. During these visits a note was made of any problems, varieties grown and sterilisation technique. If necessary samples of diseased plants were also sent to the plant clinic for analysis.

In addition to the survey work outlined above, a very informative visit was also arranged in conjunction with Florensis and Pan American to visit Dutch stock growers, propagation facilities and to look at breeding and seed selection (31st of May to 1st June 2011).

Finally a trip was arranged in August to visit stock growers in Northern Ireland and to look at trials at the Greenmount College research facility (2nd and 3rd of August 2011).

Table 1:- Varieties Grown in 2011

Variety	Steam sterilised	Basamid sterilised	Unsterilised
Aida Lavender			✓
Centum White	✓	✓	✓
Figaro Rose Light	✓	✓	✓
Opera Francesca	✓	✓	✓
Carmen Yellow	✓	✓	✓
Aida White	✓	✓	✓
Fedora Deep Rose	✓	✓	
Figaro Lavender	✓	✓	✓
Centum Deep Blue	✓	✓	
Centum Red	✓	✓	
Opera Deborah	✓	✓	
Aida Blue	✓	✓	
Fantasy Deep Blue		✓	
Fantasy Cream Imp		✓	
Fantasy Rose		✓	
Fantasy Red Imp		✓	
Phantom Milka		✓	
Phantom Rose		✓	
Phantom Early White		✓	
Phantom Red		✓	
Phantom Dark Rose		✓	
Fantasy Lavender		✓	
Centum Yellow	✓		
Jordyn Lavender	✓		
Jordyn Red	✓		
Jordyn White	✓		
Jordyn Light Rose	✓		
Jordyn Deep Blue	✓		
Jordyn Cream	✓		
Anytime			✓
Anytime			✓
Anytime			✓
Anytime			✓
Anytime			✓

Results

This is obviously not a traditional “scientific type” trial hence some the results will be presented in a series of observations which have come out of the survey work.

- Approximately 12 million stocks were planted in 2011, with about 2 million (17% of the total) being second round production. Of the total of 12 million plants approximately 75% (9 million) was grown in steamed soil, about 19% (2.3 million) grown in Basamid sterilised soil and 7% (0.85 million) grown in unsterilised soil. Of the 9 million grown on steamed soil, about 5.85 million (i.e. about 49% of the total produced) was grown on soil sterilised by “dry” (super heated) steam with 3.15 million (i.e. about 26% of the total produced) grown in soil sterilised by “wet” steam.
- The survey work has shown conclusively that there is not one single problem affecting column stock crops and that a combination of factors is responsible for the problems experienced in recent years.
- Growers who had steam sterilised the soil prior to planting their crop of column stocks suffered from very few problems with pythium or poor root development, even in poor quality glasshouses with less than ideal growing conditions (except where there had been a specific soil structure issue from for example flooding due to a burst pipe and even then poor root development rather than disease was the key issue).
- There was circumstantial evidence on some nurseries that in previous year’s problems still occurred if the steaming took place a long time before the crop was planted e.g. autumn steaming following by spring planting. But this was not observed during the 2011 survey.
- Growers who had not used any form of sterilisation or had used Basamid, consistently had problems with the same varieties i.e. Aida blue, white and lavender and Figaro light pink and rose. Since about 75 % of the total stock area is steamed, the only around 5% of the UK stocks grown were affected by this problem; however for those growers who had not steamed and did grow Aida and Figaro, this was a very serious problem with between 50 and 90% of the stems affected in some crops.

- There was appreciation amongst both the main propagator and the breeder that these varieties are weaker rooted and would therefore be prone to problems on un-steamed soil. This also led to the conclusion that the growers and propagators should work more closely together in order to match the choice of varieties grown, to the conditions that they will be produced, especially with reference to sterilisation techniques.
- The problems observed in the varieties listed above took the form of poor root development, lack of vigour (leading to stems of unmarketable quality), wilting and in some cases total plant collapse and death. In such cases pythium was consistently isolated from the affected plants and it is believed this disease would have been a contributing factor to this problem. Further investigations and trial work will be undertaken in 2012.
- Fusarium is still a potentially major problem on some nurseries, especially, but not exclusively, on sites with a history of the disease. This was still the case were the soil had been steamed prior to planting.
- In 2011 (as with previous years) fusarium mainly occurred in later planted crops and two varieties in particular i.e. Francesca and Centum deep. Only a small percentage of the total stems grown were lost through Fusarium (perhaps up to 5%), however, when the susceptible varieties are looked at in isolation about 20% of the susceptible varieties were typically affected with wide variation from nursery to nursery (from negligible losses in some cases and in excess of 50% losses in others).
- There was universal agreement amongst growers that the current varieties flower less evenly than they did a decade ago and it is now necessary to go over them 2 or 3 times rather than a one off cut.
- The need to ensure good seed selection and stock maintenance in order to ensure a potentially more even crop seems to have been taken on board by growers, propagators and breeders alike.

- The main propagators decision to move from glue plugs to loose fill seems to have been a positive move with most growers agreeing that initial plant establishment has been better with loose fill than the glue plugs used in previous years.
- However there was universal agreement that the loose fill plug needs to be made more stable in order to facilitate better gapping up in the trays and easier planting on the nursery. This has been addressed by the main propagator who has installed a new filling machine and conducted a number of trials with the new plug prior to the main 2012 production period.
- In addition to the main problems described above, some growers also experienced poor establishment and slow growth of Carmen yellow. Most of the crop was eventually marketable but was very uneven and 10 to 14 days behind the other varieties in the same house. However this issue only occurred on a small number of plantings on three nurseries and no explanation has so far been found to adequately explain the problem.

Table Summarising Problems in 2011

Glasshouse	Type of glasshouse	Sterilisation technique	Sterilisation timing	Problem identified	Varieties affected	Level of infection	Notes
Grower 1 House 1	New Venlo	Dry steam	Two weeks before planting	Fusarium	Francesca	Low	Very bad Fusarium in 2010
Grower 1 House 2	New Venlo	Dry steam	Two weeks before planting.	Fusarium	Francesca Centum Deep Blue Others	Medium Medium Low	Very bad Fusarium in 2010
Grower 1 House 3	Old Venlo	Dry steam	Two weeks before planting	Fusarium	Francesca Centum Deep Blue	Medium Very severe	Aida blue at the side of the Centum hardly touched. First round OK
Grower 1 Tunnel 1	Spanish tunnel	Dry steam	Two weeks before planting	Fusarium	Francesca and Centum Deep blue	Severe	Has been troublesome in recent years
Grower 1 Tunnel 2	Spanish tunnel	Dry steam	Two weeks before planting	Fusarium	Francesca and Centum Deep blue.	Severe	Has been troublesome in recent years
Grower 2 – House 1	Old Venlo	Basamid	Mid October	Pythium	Figaro Lavender and Aida White	Severe	Seem similar problems in previous years.
Grower 2 – House 2	Old Venlo	Basamid	Mid October	Pythium	Figaro lavender and Aida white.	Severe	Seem similar problems in previous years.
Grower 2 – House 3	Old Venlo	Basamid	Mid October	Pythium	Figaro lavender, Aida white	Medium	
Grower 3 – House 1	Modern Venlo	Basamid	Autumn	Pythium	Aida white, Aida Lavender Aida blue, Fantasy deep blue, Fantasy white.	Severe	Similar problem in this house last year.
Grower 3 – House 2	Old Venlo	Basamid	Autumn	Pythium	Fantasy Lavender	Severe	Similar problem in

						and Aida white.	this house last year.
Grower 4 – House 1	Old widespan	Wet Steam	4 to 6 weeks before planting	Poor growth	Carmen yellow	N/A	Similar to grower 5 and 6
Grower 5 House 1	Modern Venlo	Dry steam	Two weeks before planting	Poor growth	Carmen yellow	N/A	Similar to grower 4 and 6
Grower 6 – numerous “new” houses	New Venlo	Wet Steam	Autumn	Poor growth	Carmen yellow	N/A	Similar to grower 4 and 5
Gower 6 – Old house 1	Old Venlo	None	N/A	Pythium	Aida white and Figaro Lavender	Medium	
Grower 6 – Old house 2	Old Venlo	None	N/A	Fusarium	Francesca	Medium	
Grower 7 – Numerous houses.	Old Venlo	None	N/A	Pythium	Aida lavender and Figaro rose light.	Medium	Just as bad as Whitehead and Coles Basamid area.
Grower 8 – House 1	Old Venlo	None	N/A	Pythium	Aida white and Figaro lavender + Light rose.	Severe	These varieties were troublesome last year as well.

KEY to disease incidence

Low = up to 5%

Medium = up to 25%

Severe = up to 50%

Very severe = over 50%

Incidence of Pythium

The following table shows the incidence of pythium cultured out in laboratory tests in relation to variety and sterilisation method.

Date	Variety	Disease identified	Sterilisation technique
15 th March 2011	Aida white	Pythium	Basamid
23 rd March 2011	Aida blue	Pythium	Basamid
23 rd March 2011	Figaro Lavender	Pythium	Basamid
31 st March 2011	Aida white	Pythium	Basamid
31 st March 2011	Figaro lavender	Pythium	Basamid
8 th April 2011	Aida white	Pythium	Basamid
8 th April 2011	Fantasy white	Pythium	Basamid
8 th April 2011	Fantasy deep blue	Pythium	Basamid
20 th May 2012	Figaro lavender	Pythium	Basamid
20 th May 2012	Aida white	Pythium	Unsterilised
29 th June 2012	Aida white	Pythium	Unsterilised
29 th June 2012	Figaro lavender	Pythium	Unsterilised

In addition to these samples a number of similar problems were observed on other nurseries that had not steam sterilised but the budget for the project did not allow for an unlimited number of samples.

No pythium type problems were detected on crops that had been steam sterilised even in situations where the soil structure was poor or the crop was waterlogged owing to for example leaking glasshouse gutters.

From the laboratory results obtained and from discussions with plant pathologists as well as observed improvements in crop performance after the application of an appropriate pythium fungicide, it would appear that pythium is playing a more important role than had been previously appreciated. However there are a number of anomalous results that need to be noted. In some samples of wilted plants with obviously discoloured roots, laboratory tests only yielded trace levels of pythium or none at all. However in many cases these plants had been treated with a pythium specific fungicide. In order to investigate this further, samples of wilted Figaro lavender were taken from the same nursery from an area treated with Filex and an untreated area. The laboratory results from these samples showed “consistent pythium sp” from the untreated sample but only “very low (trace) levels of pythium sp.” from the Filex treated sample. These results do suggest that pythium specific fungicides are having a suppressive effect on the laboratory cultures.

On some samples, fusarium was also detected on the roots even though no vascular staining was seen and the samples did not show classic wilt like symptoms. It was assumed that these fusarium strains were not pathogenic. However, specific pathogenicity tests did show that this stain had the ability to infect vascular tissue but did not produce wilt

symptoms or plant collapse. This result needs to be taken into account when considering the results of the 2012 work.

In addition to the main problems described above, some growers also experienced poor establishment and slow growth of Carmen yellow. Most of the crop was eventually marketable but was very uneven and 10 to 14 days behind the other varieties in the same house. However this was by no means universal and only occurred on a small number of plantings on three nurseries and no explanation has so far been found to adequately explain the problem.

Sterilisation techniques.

The sterilisation techniques can be split down in four categories and the following table give a breakdown of the number of stems growing each of these categories in 2011.

Sterilisation method	Total stems
Wet steam	3,150,000
Dry steam	5,850,000
Basamid	2,300,000
Unsterilised	850,000

There is no universal protocol for steaming soil because this is dependent on soil type, structure etc and also the growers own knowledge of how best to manage diseases on their own nursery. All growers used sheet steaming with wide variation in the amount of time each nursery steams an area, ranging from 4 to 6 hours. There seems to be a genuine mistrust of relying on probes to determine when an area has been adequately steamed with most growers relying on their own gut feeling. The differences in steaming techniques and their effect on disease control needs to be explored in more detail in the 2012 survey.

Discussion

The detailed survey work and associated activities (grower walk, study tours etc) has now been able to provide some solid explanations and partial solutions to the problems that column stock growers have been experiencing in recent years. It has become clear that not all of the problems have been universal and that there is more than one issue that needs investigating.

The problem of poor rooting (and associated discoloured roots) leading to wilting and poor growth seems to be a universal problem with the Aida and Figaro family were the soil has not been steam sterilised. Individual growers had been aware for some time that these varieties were troublesome on their nurseries but had not been aware of how widespread

the issue was with other growers. Both the propagator and breeder have subsequently stated that they consider these “newer” varieties to be potentially troublesome varieties owing to them being weaker rooted than some of the older varieties. At this stage it would seem likely that pythium is playing an important role associated with the root problems but this is not conclusive and will be investigated further in 2012.

It is clear that fusarium wilt is still a major problem in column stocks with some growers experiencing serious losses in 2011 despite the soil being steamed prior to planting. There are strong varietal differences in susceptibility to fusarium with Centum deep blue and Francesca being particularly troublesome in 2011. On one nursery a crop of Centum deep blue was grown side by side with Aida blue and the fusarium infection showed a clear “straight line” infection of the Centum deep blue. Opera Deborah is also known to be very susceptible to fusarium but owing to supply issues very little of this variety was grown in 2011. Not all nurseries surveyed experienced fusarium problems but for those that did, it was very serious resulting in considerable crop losses in some houses. In most, but not all cases, this fusarium occurred in houses with a history of the disease. It is clear that at the current time there is no commercially available chemical control of fusarium and in houses with a history of the disease, even steaming is only a partial cure. The control of fusarium will be further investigated in 2012.

Certain issues still remain unresolved, such as the poor growth of Carmen yellow on a few nurseries and it is hoped that the continued survey work in 2012 can provide some more answers.

The survey has also highlighted the differences in steaming technique that occur from nursery to nursery and this needs to be investigated further in 2012 to try and determine if for example there is any difference in disease control between wet and dry steam.

A number of growers have undertaken “look see trials” on the use of trichoderma in stocks during 2011 and while most of these trials were inconclusive, one nursery did see very promising results in both the control of pythium and fusarium. And while these trials were not replicated, they did justify the further investigation of biological control agents such as trichoderma.

The grower walks, while not part of the original proposal, have proved very popular and the participating growers have gained a great deal from this so far unprecedented level of

cooperation. This has in fact led to some growers to comment on the fact that this is the best HDC project that has ever been funded within their sector.

Conclusions

Grower should look at the findings of the 2011 work and apply the information to their own situation. A good example of this would be not to grow the Aida and Figaro family if the soil has not been steam sterilised. Also when growing later planted crops, if possible it would be wise to avoid planting Francesca, Centum deep blue and Opera Deborah in houses with a history of fusarium wilt.

The 2011 work has served to bring the column stock growers closely together and for them to clearly mould the nature of the work that they want to see developed in 2012. Therefore the 2012 work will see a continuation of the grower survey and fully replicated grower trials and research station “pot trials” to investigate the control of pythium and Fusarium by both biological and chemical means.

Knowledge and Technology Transfer

The key technology transfer activity was the regular grower walks that occurred throughout the season.

Two articles appeared in the HDC Grower news in June 2011 and November 2012.

A presentation summarising the work was given to the South Holland Growers Club on 6th February 2012

Glossary

N/A

References

N/A

Appendices

N/A

Acknowledgements

Thanks to the four growers involved in the detailed survey work i.e.:-

Sue Roger and Gareth Lamb
Lambs Flowers
Herdgate Lane
Pinchbeck
Spalding

Jenny and Graham Whitehead
Whiteheads of Boston
Wortleys Lane
Boston
Lincs

Phil, Ian and Diane Collison
J A Collison and Son
Tuxhill Farm
Tuxhill Road
Hay Green
Terrington St Clement
Kings Lynn
Norfolk

James Cole
E M Coles Farms Ltd
Small Drove Lane
West Pinchbeck
Spalding
Lincs

Thanks also to Martin McPherson of STC for both his personal input and analytical services.

And also to Florensis Cut Flowers especially John de Wit.