Project title:	The National Cut-flower Trials Centre Programme for 2018 - 2022
Project number:	PO/BOF 002b
Project leader:	Lyndon Mason (Director, The Cut Flower Centre Ltd)
Report:	Annual Report (2021)
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Key staff:	Lyndon Mason (Director, The Cut Flower Centre Ltd) David Robinson (Director, R Robinson & Son Ltd)
Location of project:	R Robinson & Son Ltd Rookery Farm, Joys Bank Holbeach St John, Holbeach, Spalding Lincolnshire PE12 8SG
Industry Representative:	Mark Eves PS & JE Ward Ltd
Date project commenced:	01 January 2018

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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.

Lyndon Mason

Project Manager and Director

Cur Flower Centre Ltd

Signature ..... Date .....

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GROWER SUMMARY

Headline

- *Tanacetum* has been demonstrated to be a crop that can be produced by growers for the home market.
- *Astrantia major* continues to show the potential to be developed as a new UK cut flower crop which is currently in demand by the market.
- *Trachelium* is also a crop that could be developed by the UK growers if demand can be developed with the supermarkets.
- New varieties of Scoop Scabious continue to be well received by the industry but owing to the high labour costs of harvesting they are only likely to be sold to higher value niche markets in the foreseeable future.
- Varieties of Gomphrena have shown potential for production as seed raised fillers which can be harvested by once over cropping but they need to be trialled further by the industry.
- Ongoing Peony herbicide trials have shown HDC H44 could be added to the armoury if an EAMU for use on Peony can be obtained.
- Removing the centre flower bud from Veronica produced a taller, heavier and more floriferous premium end product.
- New varieties of tissue cultured Limonium have generated interest within the industry but further trials to assess their economic potential will be undertaken in 2022.

Background

The National Cut Flower Trials Centre (CFC) was proposed by industry representatives and subsequently funded by the HDC (now AHDB Horticulture)[1], starting in 2007. Its short-term aim was to provide information on new product development, novel or alternative cut flowers

[1] Initially with part-funding from the Lincolnshire Fenlands LEADER+ programme

for production outdoors or in tunnels to stimulate UK production.

2018 was the first year of a new funded project at the CFC and after taking guidance from industry, a new five year programme of work (2018 to 2022) was agreed to broaden the remit of the CFC, addressing a wider range of issues beyond new product development (NPD). Topics addressed in the first three years included: ongoing trials examining Fusarium control in column stocks production in conjunction with Warwick University, evaluation of new herbicide products for field-grown crops and reactive trials examining current important industry issues. During 2018 the latter enabled the CFC to quickly investigate the downy mildew outbreak in column stocks, commission sensitivity testing by Fera and recommend a revised spray programme to address the issue of poor control on some nurseries. The spray programme developed as a result of this work continues to be the mainstay of the industry and has avoided any additional major outbreaks of the disease on UK grown column stocks.

The Covid 19 pandemic in 2020 resulted in the CFC losing a full year of trials and because of this the end date of the project has been moved from 2022 to 2023. Most of the trials planned for 2020 were moved to 2021 including the perennial trials which were left in situ for an additional year. After the industry voted to end the AHDB levy, the AHDB have agreed that the CFC will be one of the ongoing legacy projects ensuring funding will continue to the end of the contract for the work in 2023.

Summary

Aster ericoides.

Aster ericoides is a product that is imported to the UK for use mainly as a filler in mixed bouquets. It naturally flowers in the Autumn but can be manipulated to produce an AYR crop using blackouts and night break lighting. The CFC has investigated the crop in previous years and it was included in the 2021 trials following a request from a local packer who was interested in single flowered varieties.

A range of varieties were planted in week 20 and once the plants were well established they

grew away rapidly. By the time that the crop was in flower in early October some of the stems were nearly 2m tall and a substantial number of extra stakes were required to keep the stem upright. No powdery mildew was observed on the crop (a regular prophylactic fungicide programme had been applied) and while very long, bulky marketable stems were produced, they were too large to be usable by supermarkets. At the open day in September, it was suggested that once the stems are growing away vigorously they should be cut back again to encourage shorter and lighter shoots that would be more suited for use as fillers in mixed bouquets. This technique will be applied to next year's trial.

Astrantia major

Astrantia was planted at the CFC for the first time in 2018, with a trial of a new range of varieties including 'Sparkling Stars Pink' and 'Sparkling Stars Red'. There was a favourable market response to this crop in 2018 and with it being a perennial plant they were overwintered into 2019. It had only been intended to overwinter these for one more year but owing to the Covid issues in 2020 they were left in situ to enable them to be viewed again at the 2021 Open Day.

In 2019 and 2020 the trial produced a flush of good quality marketable stems with a stem length that was consistently in excess of 65cm and with a VL of between 10 and 12 days. In 2021 the crop produced the first stems in week 19 and continued to flush heavily for a number of weeks, again producing long good quality stems. Owing to the size of the flush and an attack of leaf miner it was decided to cut back the plants in week 25, which resulted in a second good quality flush from week 28 onwards.

Astrantia appears to have the potential for UK production as both an outdoor and protected crop and is already being commercially trialled by some growers. A number of new varieties are also now available over and above those planted at the CFC.

Column stocks (Matthiola) - Fusarium T34 trial.

An AHDB funded trial investigating *Fusarium* on lettuce indicated that T34 Biocontrol (*Trichoderma asperellum* – strain T34, a biopesticide for the control of Fusarium) applied to

the peat blocks at seeding gave a degree of control of the disease. In order to assess the potential of T34 to control Fusarium in column stocks, the CFC intended to replicate this technique in 2021 by asking the Dutch propagator of the plugs to apply T34 and Prestop (*Gliocadium catenulatum* - another product claimed to have some control of *Fusarium oxysporum),* at the seeding stage. Unfortunately, the products were not actually applied until dispatch of the seedlings so it was decided that rather than lose a full year of trials, the products would be applied after planting into the tunnel already infected with *Fusarium oxysporum.*

The results of the 2021 trial did not show any visual or statistical control of the disease by either of the products. In 2022 the original proposed trial will be revisited to investigate the effect of a commercial propagator drenching the plugs with T34 and Prestop at the seeding stage.

Gomphrena haageana varieties

Gomphrena has been investigated by the CFC in previous years, and of the species trialled *G. haageana* was the only one that produced stems that were long enough to be suitable for use as a filler in mixed bouquets. The product was not taken up by the industry but recent interest in UK produced fillers resulted in a request to revisit *Gomphrena* trials especially to investigate if labour costs could be reduced by once over harvesting, with the crop then being graded over a flower line.

Two plantings were made in 2021 i.e. week 25 and week 30. The week 25 planting started flowering around week 32 and was in full flush by week 36 and consistently produced flower stems in excess of 50 cm long. The week 30 planting did not produce stems of adequate length to be marketable. The week 25 crop was not harvested at the optimum time in order that it could be viewed at the September Open Day. The feedback from some growers at the Open Day was that it had potential for once over harvesting and that they would now undertake their own trials.

Limonium

Limonium is grown in Holland but is not produced by many UK growers. Of the product that is grown in the UK, most is direct seeded annual varieties, with very little perennial crop being produced. New varieties of micro propagated Limonium from Danziger were offered to the CFC in 2021 from the Danziger Safora and Sensy family.

The plants established well and grew away without any issues. The Sensy colours were the first to flower from week 33 onwards and produced a flush of very strong and tall stems in excess of 65cm long. The Safora colours flowered quite a bit later and were not ready to cut until week 40 and produced stems that while marketable, were shorter and weaker than Sensy. All plants will be overwintered and further assessments made in 2022, including an economic assessment of the crop's potential.

Peony herbicide trial

At the CFC 2019 Open Day, herbicide trials on Peony were given high priority by the industry, and as a result plans were drawn up to develop a number of trials over the life of the CFC project. The first of these was planted in the autumn of 2019, with the treatments being applied in February of 2020 and 2021. Two products were trialled that have not been previously used on Peony i.e. Hurricane SC (500g/l diflufenican), both on its own and also tank mixed with Stomp Aqua (455g/l pendimethalin); and HDC H44 both on its own and also tank mixed with Sunfire (500g/l flufenacet).

Owing to the very dry Spring of 2020 and 2021, there was little weed growth in any of the plots during the period that these herbicides would still be active. Assessments were made for phytotoxicity, stem length and total stems per plot but weed control could not be assessed. Expected range of activity for the selected treatments however is summarised below.

Treatment	Expected activity
Sunfire	Mainly for grass control, has worked well and has current ornamentals approval

HDC H44	Wide range of weed activity and also some good post emergence activity Will need an EAMU for ornamentals if effective
Hurricane	Long residual activity and has existing ornamentals approval
Stomp Aqua	Has ornamentals approval and is a safe option, well used on peonies already and good record/experience with it

In the 2020 trial, some shoots had already emerged when the herbicide treatments were applied. This resulted in a significant amount of damage in the Hurricane SC plots in the form of leaf purpling and distortion. No damage occurred in 2021 when no shoots had emerged at the time of herbicide application.

Statistical analysis of stem length and total stem numbers data confirmed there was no significant difference between treatments, confirming that none of the treatments had any impact on flower stem length or total stem count. HDC H44 does not have a current approval for use on ornamentals so if the industry wants to use this herbicide an EAMU will need to be obtained. The damage seen from Hurricane seems to rule it out as being a possible candidate for use on Peony.

Seed Priming Trial

Seed priming is a technique used quite extensively in the vegetable industry but has not been widely adopted by the cut flower industry. Preliminary trials undertaken by Elsoms had shown that there may be the potential to prime some flower seeds with the intention of achieving an earlier and more even germination, hence aiding both weed control and making flower maturity more even. It had been intended to undertake trials at the CFC in 2020 but owing to the Covid restrictions, these trials had to be delayed until 2021.

During 2021 it was intended to trial a wide range of species including Ammi, Bupluerum, Larkspur, ornamental brassica and Sweet Williams but owing to issues with the priming of small quantities of seed, only Sweet William and Larkspur were available to trial in 2021. Two different seeding dates were used (week 25 and week 33) with the trial being direct seeded

in the third bay of the multispan tunnel.

Unfortunately, the 2021 trials did not show any visual differences between the primed and non-primed crop so in conjunction with Elsoms the seed priming technique will revisited in 2022.

Scabious (varieties of *Scabiosa atropurpurea*).

Scabious are well-known as a vigorous garden plants with prolific, attractive flowers in a wide range of colours. The perennial forms are already grown as outdoor commercial cut flower crops. In recent years new ranges of *S. atropurpurea* have been introduced to the market with the Scoop series generating the most interest from the industry. New and improved varieties have continued to be introduced and the 2020 trials concentrated on a new range called Bon Bon and new introductions of Focal Scoop.

Trials in previous years have indicated that an early planting date produces a more prolific crop because it allows the plant to establish a sturdy frame and good root structure before being put under stress during warmer weather conditions. In order to maximise their potential the plugs were therefore potted into 9cm pots in week 12, pinched four weeks later and the well branched plants transferred to the tunnel in week 20.

In 2021 the plants did not establish as well as they had in previous years and were constantly less vigorous. This would appear to have been caused by the diabolical weather in May, which meant the plants did not bulk up in the way they usually do. This lack of growth was not made up later in the season. The trial started to flush in week 27, and while many marketable stems were produced throughout the season, they were not as strong as in previous years.

The ongoing CFC and grower trials have shown that new series of Scabious (especially the ‘Scoop’ series) have good market potential and are popular with consumers. The positive attributes of the crop include a unique flower form, vibrant colours, high yield and a consistently good vase life. However, the growth habit and flowering of the crop means that

harvesting costs are an issue, and unless this is reflected in the final stem price the large scale production of Scabious will not be economically viable. At the current time, the crop is only being grown on a small scale in the UK by growers that are supplying premium markets or via direct sales to the public.

A webpage entitled *Scabious as a cut flower for the UK market* was produced by the CFC/AHDH in 2021.

Tanacetum parthenium

Tanacetum (also known as Matricaria) is a member of the *Asteraceae* family and produces a mass of small flower heads similar to Santini chrysanthemums. They are widely grown in Holland and imported to the UK to be used mainly as a filler. The purpose of the 2021 trial was to investigate the potential for *Tanacetum* to be grown as a UK crop and show the range of varieties currently available for cut flower production.

Plantings were made in week 23 and 29 with both plantings establishing well and the plants growing away with no issues except for a small amount of leaf miner which was eliminated by an appropriate application of pesticide. The first flowers were cropped 7 to 8 weeks after planting with the Vegmo single flowering variety 7 to 10 days earlier than the other varieties. The quality of the end product, potential to produce over a long flowering period and ease of production mean that this crop has potential for home production.

Trachelium caeruleum

Trachelium is another crop produced in Holland but not widely grown in the UK. Earlier CFC trials had shown that it has the potential to be home grown hence producing a fresher product with a better VL than imported stems. It was decided that the current market dynamics mean it is now is a suitable time to revisit *Trachelium* as UK grown crop and put it in front of growers and buyers to assess its potential.

'Lake Michigan Blue' and 'Lake Michigan White' were planted in week 23 with the first flowers being ready to harvest in week 33. The trial produced strong stems in excess of 50cms in

length with a large flower head.

Previously, *Trachelium* has been grown as an annual crop but after a request at the 2021 Open Day it will be trialled as a perennial in 2022.

Veronica longifolia

In 2018 a new range of Veronica was trialled (the 'Skyler' series) which is available as blue, white and pink flowered varieties. The trial demonstrated that when tunnel grown, a combination of different planting and pinching dates can achieve a three-month flowering period. It is likely that this period could be extended further if the crop was grown in a glasshouse. The trial was left in situ and in 2021 the disbudding trial was developed further. This technique involved the removal of the centre bud.

The first flush of flowers was ready to disbud from week 24 and the "spray type" product was ready to harvest 10 to 14 days later. The removal of the centre bud resulted in a longer and visibly stronger "spray type" flower stem with between four and six blooms. This was considered to be a better-quality product for use in mixed bouquets.

The CFC will not be undertaking additional trials on *Veronica* and some plantings have already been made by UK growers.

Financial Benefits

This is the third year of the new five-year project and as such any financial benefits reported will not take into account the potential £2.5 million of new product trialled and facilitated by previous CFC trials.

One of the main ongoing financial benefits to the industry from the current 5 year CFC work plan has been from the 2018 work on downy mildew in column stocks (followed up by additional sensitivity testing in 2019 and 2021 that was facilitated by, but not funded by the core CFC project). While it is impossible to put an exact figure on the savings, the ongoing adoption of the control measures and spray programme from the 2018 trials resulted in no

known major outbreaks of downy mildew on column stocks. The UK produces about 18 million stems at an average of 24 p per stem, making a total industry value of around £4.3 m. A conservative industry estimate of potential crop loss from the new strain of downy mildew (based on 2018 losses in Holland and the UK) of 10% represents an annual saving to the industry in 2020 of £430,000.

A number of new products trialled during the first three years of the current CFC programme such as Scabious, Lepidium and Veronica have been planted by small to medium sized nurseries. An estimate of the total area of these new products in 2021 is 2 ha and if Scabious is used as an example, with a yield of around 30 stems/m^2 at a return of 25 p per stem this is an additional farm gate value of £150,000.

Other new products have been planted either on a commercial scale or as commercial trials for supply to the supermarkets. These include *Astrantia, Eryngium* and Willow. An estimate of the area of these products would be 4ha and with an estimated average farm gate value of £25,000 per ha this amounts to an additional total farm gate value of £100,000.

Action Points

- Production of Aster ericoides. Limonium, Veronica and Scabious could be suitable novel, niche ventures for UK cut flower growers.
- Other products from the 2021 CFC trials could be considered for production on a larger scale for supermarket production. These include *Astrantia, Tanecetum* and *Trachelium.*
- Growers can access a number of CFC/AHDB technical notes and webpages relating to CFC trials, of which the latest is entitled *Scabious as a cut flower for the UK market*.
- Column stock growers should continue to be vigilant to the ongoing threat of the new strain of downy mildew identified in 2018, and obtain a copy of, and implement the recommendations of AHDB / CFC Information Sheet 11 *Maintaining successful*

control of downy mildew in protected crops of cut flower column stocks. Additional trials on DM will be undertaken in 2022 and growers should be alert to any updates to the control strategy that develops from this work.

- If there is enough industry support an EAMU should be obtained for the use of the herbicide HDC H44 on Peony.

SCIENCE SECTION

Introduction

The past decade has seen a rise in imports of cut flowers into the UK at a time when home production has been declining. The crops produced by UK growers have also changed significantly over the past decade, with protected chrysanthemum production (both AYR and natural season) declining to an insignificant area and also a decline in indoor lily bloom production. By contrast, protected tulips and column stock production have increased and are now the most important crops for UK protected flower growers. The production of outdoor flowers has also changed significantly with a major reduction in natural season chrysanthemums and gladioli areas but significant increases in sunflowers, Peony and hardy foliage (including berries). Dried flower production has also decreased significantly and now mainly comprises Larkspur (and a few other species) for the confetti industry). The number of grower holdings has also decreased with the majority of the production area now being controlled by a small number of larger-scale producers, who have made significant investment in new capital facilities including packhouses, glasshouse and grading/packing equipment.

The desire of supermarkets to offer more UK produced flowers to their customers could offer more potential for import substitution with UK grown product having the advantage of freshness and market proximity hence minimising air miles. Brexit had the potential to open up new opportunities for home grown produce, but in 2021 this was seriously hampered by a shortage of seasonal labour and to a lesser extent the costs of importing of young plant material.

The National Cut Flower Trials Centre (CFC) was proposed by industry representatives and subsequently funded by the HDC (now AHDB Horticulture), starting in 2007. Its short-term aim was to provide information on new product development, novel or alternative cut flowers for production outdoors or in tunnels to stimulate UK production.

Over the past few years the CFC has concentrated on new product development (NPD) and

despite a wide range of potential products being identified, it has proved difficult to commercialise some of these new products on a large scale. This has been due to a number of issues, not least struggling to provide them at a unit cost that is acceptable to UK supermarkets (although a number of these crops have however been grown on a limited scale by small to medium sized growers). Owing to this fact, after taking guidance from the industry, a new five year trials programme was developed (originally 2018 to 2022 but now extended to 2023 due to trials being postponed in 2020 as a result of Covid) and this programme has a broader remit seeking to address technical issues such as identifying new pest, disease and weed control measures (in the form of Fusarium control and ongoing herbicide evaluations mainly focusing on Peony) and investigating current technical issues of concern to industry (such as the outbreak of downy mildew in column stocks during 2018, where the CFC commissioned sensitivity testing undertaken by Fera and generated revised spray programmes and a summary technical note in early 2019). The CFC also provided grower samples for additional sensitivity testing by the James Hutton Institute in 2019 and 2021.

Materials and methods

By arrangement with David Robinson (managing director, Rookery Farm Packing Ltd), the trials programme was hosted at Rookery Farm, Holbeach St John, Spalding, Lincolnshire. The National Cut Flower Trials Centre (t/a Cut Flower Centre Ltd; CFC) is directed by project leader Lyndon Mason and overseen by a management group comprising representatives of growers, packers, retailers and AHDB Horticulture. As from 2019 the site is only rented from Rookery with all of the labour required to run the trails being provided by the CFC Project Manager and appropriate casual labour. Crop protection advice is provided by a BASIS and FACTS registered consultant who liaised closely with the project leader as well as visiting the site on a weekly basis during the main trial season.

The experimental programme is agreed with the CFC management group (MG) and amended annually, taking into account views received from the industry about technical issues that

need to be addressed as well as possible NPD subjects. Information from the reviews of new cut flower crops and overseas cut flower trials, undertaken as part of the previous CFC project, was also used to identify suitable NPD candidates.

Generic protocols are presented in this section, specific actions are documented within the results section.

Facilities and site preparation

The CFC facility at Rookery Farm comprises a single-span 'Haygrove' tunnel (7.9 m wide × 38.1 m in length; Haygrove Ltd, Redbank, Ledbury, Herefordshire), a triple-span 'Pro-Tech' tunnel (overall 22.7 m wide × 38.0 m in length; Pro-Tech Marketing Ltd, Ironbridge, Telford, Shropshire) and a 600 m^2 adjacent area of outdoor beds provided with anti-rabbit fencing. Since it is an exposed site, wind-breaks of 2.5 m-high polypropylene netting are provided at each end of the tunnel area. The tunnels are covered with a standard polythene film (in late March or early April) and, as is usual, in order to protect the structure of the tunnels, the polythene covers are then removed for the winter, usually during October. The Soil Survey of England and Wales' *Soils of England and Wales* describes the soil at the CFC as a deep alluvium drained by ditches and pumps, which is typical of the area.

The soil within the multi-span tunnels was sterlised with Basamid in the early summer of 2021. Before planting, soil samples were taken across the site to undertake a standard glasshouse soil analysis. As fertiliser recommendations don't exist for all cut flower crops, the aim was to bring base nutrient levels up to those required for Chrysanthemum, i.e. indices of 2 for nitrogen, 4 for phosphorus, 3 for potassium and 4 for magnesium. Before planting in 2018 the 'Haygrove' tunnel received 15 g/m^2 ammonium nitrate (as 'Nitram') and 40 g/m^2 sulphate of potash; 'Pro-Tech' bay 1, 30 g/m^2 ammonium nitrate and 40 g/m^2 sulphate of potash and 'Pro-Tech' bay 3, 30 g/m^2 ammonium nitrate and 40 g/m^2 sulphate of potash.

Plant material and planting

Plants were obtained as plug-plants ('plugs'), seeds, or rooted cuttings as appropriate. Seeds

were germinated in module trays and then transplanted. Most plants were transplanted into labelled plots along 1m-wide beds at the specified density. Individual plot lengths were dependent on the trial and plant availability, and wherever practical unplanted areas were left between plots and at the ends of the beds as 'guard plots'. Crops were watered with a hand-lance immediately after planting and then as and when required to ensure good establishment.

Crop husbandry

Once established, plants were irrigated as required via lay-flat irrigation lines, a hand-lance was also used to provide supplemental irrigation. Once in full growth, plants received a liquid feed at every watering. The liquid fertiliser used was 'Universal® Green' (23:6:10:2.7 N:P:K:MgO with trace elements).

Beds were provided with one or more layers of support netting as required by the crop, the net was raised in line with crop growth. Sometimes plants were stopped (pinched) or other treatments applied.

Pesticide applications

The crop protection products applied in 2021 are listed in the table below.

Table 1. Crop protection products applied in 2021

WEEK number	Pest/Disease	Product/s	Rates
Week 15	Downy mildew	Percos + Hortiphyte	80ml+200ml/100L
Week 16	Downy mildew	Fubol Gold +HortiPhyte	190g+200ml/100L
Week 17	Powdery Mildew	Amistar	100ml/100L
Week 18	Powdery Mildew	Nimrod+Takumi	250ml + 15ml/100L
Week 20	Powdery mildew	Signum + Karma	135g+300g/100L
Week 21	Downy mildew	Fubol Gold + HortiPhyte	190g+200ml/100L
Week 22	Downy Mildew + caterpillar	Percos + HortiPhyte + DiPel	80ml+200ml + 75g/100L
Week 23	Powdery Mildew + aphids	Amistar + Mainman	100ml + 14g/100L
Week 23	Downy Mildew	Revus + HortiPhyte	60ml + 200ml/100L
Week 25	Spider mites/Leaf miner	Dynamec + SW7	50ml + 50ml/100L

Week 25	Powdery Mildew + aphids	Frupica + SW7 + Gazelle	90ml + 50ml + 50g/100L
Week 25	Downy mildew + aphids	Percos+ HortiPhyte + Gazelle	80ml + 200ml + 50g/100L
Week 26	Downy mildew + flea beetle	Amistar + Hallmark	190g + 9ml/100L
Week 26	Powdery mildew	Systhane	30ml/100L
Week 29	Downy Mildew	Paraat + HortiPhyte	36g+200ml/100L
Week 29	Powdery Mildew + aphids	Signum + Mainman	135g+14g/100L
Week 34	Powdery mildew	Amistar + Poliverdol	100ml + 200ml/100L
Week 34	Spider mites	Dynamec + SW7	50ml + 50ml/100L
Week 35	Powdery mildew	Nimrod + Takumi	250ml + 15ml/100L
Week 37	Powdery mildew	Frupica + SW7	90ml + 50ml + 50g/100L
Week 39	Powdery mildew	Potassium Bicarbonate + Systhane	300g + 30ml/100L

Crop assessments

Flower stems were picked at the appropriate commercial stage for each crop, wherever practicable taking samples close to the peak cropping date. If applicable to the trial, the number of marketable stems picked was recorded (and converted to numbers per m^2), along with (for an appropriate random sample of each plot) picking dates, lengths and weights of flower stems (either overall figures or after trimming to a specified length) and other measurements as required (such as spike length or flower-head diameter). Other than as required by trimming, the stem lengths and weights quoted always refer to the total weights and lengths of the whole stem (including buds, flowers or inflorescences).

As appropriate to the practical nature of the project, demonstration plots were not usually replicated, but where replicated and randomised trials were used, the data were subjected to statistical analysis. In 2021 the statistical analysis was undertaken by Chris Dyer of ADAS.

Less formally, but importantly, the plots were assessed at intervals by the CFC management group and others from the industry. In the case of preliminary demonstrations, emphasis was placed on photographs and grower comments. Numerous samples of products were made available to the industry to gather feed-back and for promotion. In 2021 (and in previous

years) samples of new products grown at the CFC were also provided to Jonathan Mosley for use in his floral demonstrations at a number of UK shows including the Great Yorkshire Show and the RHS shows including Tatton Park .

Vase-life testing

Unfortunately vase life testing was not possible in 2021.

Results

Aster ericoides.

Aster ericoides is a product that is imported to the UK mainly for use as a filler in mixed bouquets. It naturally flowers in the Autumn, but can be manipulated to produce an AYR crop by the use of blackouts and night break lighting. The CFC have investigated the crop in previous years and it was included in the 2021 trials following a request from a local packer who was interested in single flowered varieties.

Table 2. Details of 2021 demonstration of Aster ericoides varieties

Location	Rookery Farm
Varieties	*Aster ericoides* ' 'Cassandra', 'Chanel', 'Cirina Pink', 'Claudia', 'Lesley' and 'Monte Cassino'
Plant longevity and hardiness	Frost hardy perennials;
Format(s) and supplier(s)	Plugs from DecoNova.
Propagation and pre-planting treatment(s)	Supplied as plugs in 104 trays.
Planting or sowing date(s)	Well established plugs planted in week 20.
Plots	3 m-long.
Planting/housing site(s)	'Pro-Tech' tunnel bay 3
Layout	Demonstration plots
Plant spacing(s)	12 plants per/m^2
Post-planting treatment(s)	One layer of support netting
Pests, diseases and disorders	Prone to powdery mildew so prophylactic sprays were applied at regular intervals (see Table 1).
Picking stage(s) and market specification(s)	When 30 to 50% of the buds have opened

Picking and recording date(s)	Most of the plots had some stems ready to harvest in early October and continued for another 3 weeks.
Records taken	Observations
VL testing	None in 2021

Figure 1. *Aster ericoides* in demonstration plots in 2021; top left trial planted in week 20; top right plants pinched in week 24; bottom-left crop in flower in week 40 and bottom right *A. ericoides* 'Lesley' also in week 40.

Once the plants were well established, they grew away rapidly and by the time the crop was in flower in early October some of the stems were nearly 2m tall and a substantial number of extra stakes were required to keep the stem upright. No powdery mildew was observed on the crop and while very long and bulky marketable stems were produced, they were too large to be usable by supermarkets. At the open day in September, it was suggested once the stems are growing away vigorously, they should be cut back again to encourage shorter and lighter shoots that would be more suited for use as fillers in mixed bouquets. This technique will be applied to the 2022 trial.

The trial was cut down in week 41 and will be overwintered to next year.

Astrantia major

Astrantia had never been investigated by the CFC but in 2018 the Project Manager was approached by Peter Collins of Botanical International with a view to set up trials examining two new varieties 'Sparkling Stars Pink' and 'Sparkling Stars Red'. There was a favourable market response to this crop in 2018 and with it being a perennial plant, they were overwintered into 2019. It had been intended to overwinter these for one more year but owing to the Covid issues in 2020 they were left in situ to enable them to be viewed again at the 2021 Open Day.

Table 3. Details of 2021 demonstration of Astrantia varieties

Location	Rookery Farm
Varieties	*Astrantia major* 'Sparkling Stars Pink' and 'Sparkling Stars Red'
Plant longevity and hardiness	Perennials; Assumed to be fully hardy.
Format(s) and supplier(s)	Plants supplied by Walter Blom.
Propagation and pre-planting treatment(s)	Supplied as large plugs
Planting or sowing date(s)	Planted in week 33 of 2018 and overwintered into 2019, 2020 and 2021.
Plots	7 m-long plots.
Planting/housing site(s)	'Pro-Tech' tunnel bay 2

Layout	Demonstration plots
Plant spacing(s)	6 plants/m^2
Post-planting treatment(s)	One layer of support netting
Pests, diseases and disorders	In 2019, two-spotted spider mite attacked the crop so prophylactic sprays were applied in 2021. Leaf miner was an issue in the 2021 crop.
Picking stage(s) and market specification(s)	When 30 to 50% of the buds have opened.
Picking and recording date(s)	The trial flowered continually from week 19 until it was cut back in week 25. This reinvigorated the plants and a second flush was produced from week 28 and continued to produce good quality long stems up until week 38.
Records taken	Observations
VL testing	Tested in 2019.

Figure 2. *Astrantia major* in demonstration plots in 2021; top left trial planted in 2018; top right first flush in week 19; bottom-left crop cut back in week 25 and bottom right second flush in week 28 (note the leaf miner damage on the leaves).

In 2019 and 2021 the trial produced a flush of good quality marketable stems with a stem length that was consistently in excess of 65cm and a VL of between 10 and 12 days (tested in 2019). In 2021 the crop produced the first stems in week 19 and continued to flush heavily for a number of weeks. Owing to the size of the flush and an attack of leaf miner it was

decided to cut back the plants in week 25 which resulted in a second good quality flush from week 28 onwards.

Column stocks (Matthiola) - Fusarium T34 trial.

A previous AHDB funded trial investigating *Fusarium* on lettuce has indicated that T34 Biocontrol (*Trichoderma asperellum* – strain T34, a biopesticide for the control of Fusarium) applied to the peat blocks at seeding gave a degree of control of the disease. In 2019, in order to assess the potential of T34 to control Fusarium in column stocks, the CFC replicated this technique by direct seeding stocks into treated peat blocks. The results were not conclusive but were promising enough to set up a trial in 2021 to investigate drenching the plugs at seeding by the Dutch propagator who supplies the UK with its planting material. Because of the high *Fusarium* and weed population in the Haygrove tunnel it was sterilised with a low rate Basamid (dazomet) in the spring of 2021 in order to reduce (but not eliminate) the *Fusarium* inoculum in the soil to levels that should enable more subtle differences in infection to be observed.

The intention was for the propagator to drench trays with T34 and Prestop (*Gliocadium catenulatum* - another product claimed to have some control of *Fusarium oxysporum),* at the seeding stage. Unfortunately in 2021, these products were not actually applied until the dispatch stage of the seedlings (and then only T34 not Prestop) so it was decided that rather than lose a full year of trials, the CFC would again investigate drenching the plugs with Prestop and T34 after they had been planted into the tunnel already infected with *Fusarium oxysporum.*

Table 4. Details of 2021 Fusarium T34 and Prestop trial.

Site	Rookery Farm
Varieties	‘Debora’, and ‘Aida White’.
Format(s) and supplier(s)	Plugs from Florensis.

Propagation and pre-planting treatment(s)	Plugs drenched immediately just before dispatch with T34 at a rate of 1g in 10L of water per/ m^2 of tray area.
Planting or sowing date(s)	Planted in week 20.
Plant spacing(s)	64/ m^2
Planting site(s)	1.5m-long plots.
Layout	Replicated trial
Post-planting treatment(s)	T-34 was applied 0.5g/m2 using a Dosatron at 1% applying 4L/m2. This achieved a rate 0.5g/4L of water as final solution which is equivalent at 5kg/ha. Prestop was applied at 5g/m2 applied in 4L of water. Same application method as above giving a rate of 50kg/ha.
Pests, diseases and disorders	A small amount of downy mildew was the only problem observed in 2021 (except for Fusarium)
Picking stage(s) and market specification(s)	N/A.
Picking and recording date(s)	Fusarium levels assessed and number of plants infected with *Fusarium* counted on 25th June, 5th of July and 16th of July
Records taken	Assessment of Fusarium infection score (0 to 5) of 10 stems in the centre of each plot, total number of plants per plot infected with *Fusarium* and for the final assessment date only, the total number of marketable stems per plot. As there was no significant difference in any of the treatments only a summary of the *Fusarium* assessment score has been included in this report.
VL testing	N/A

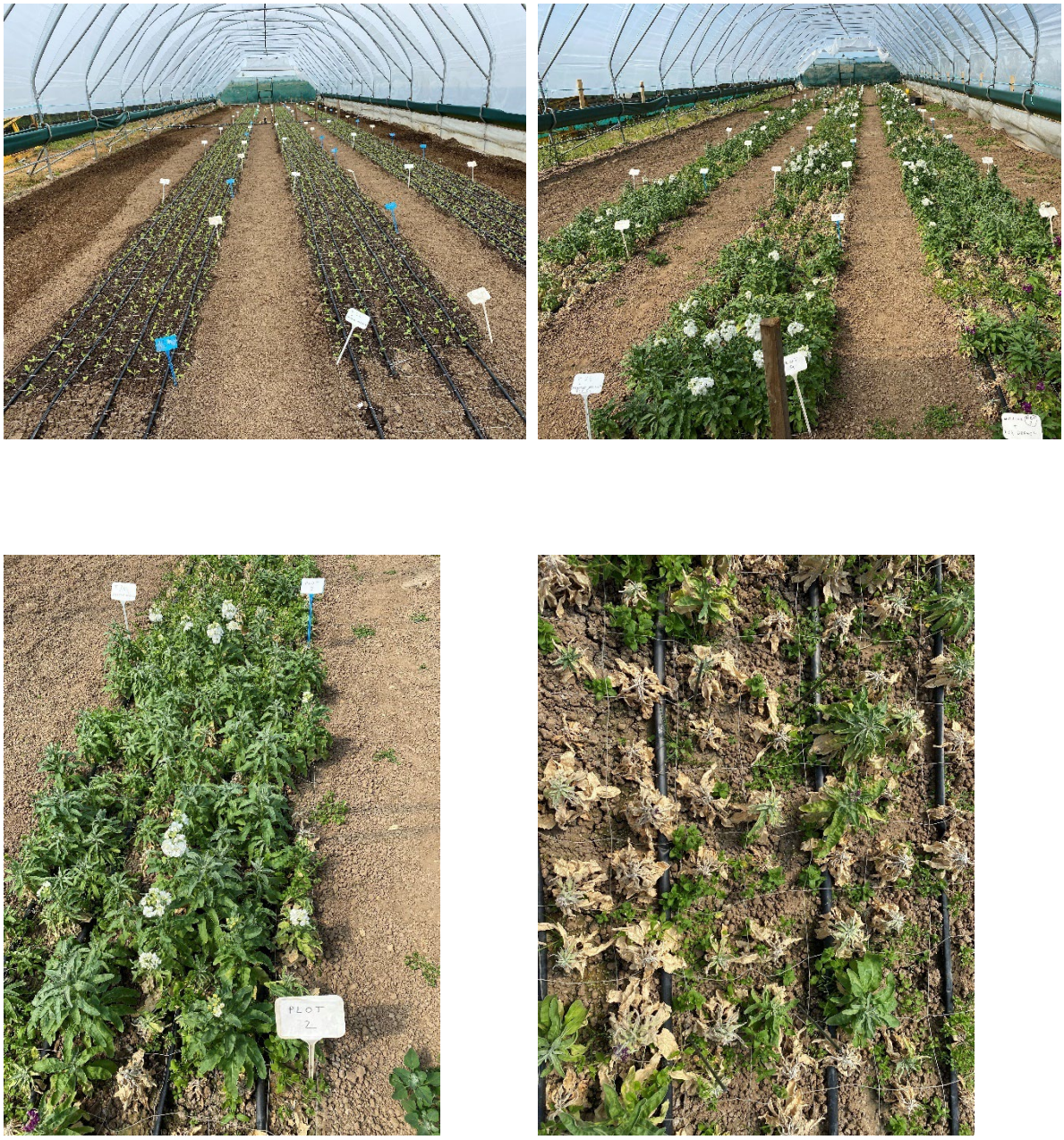
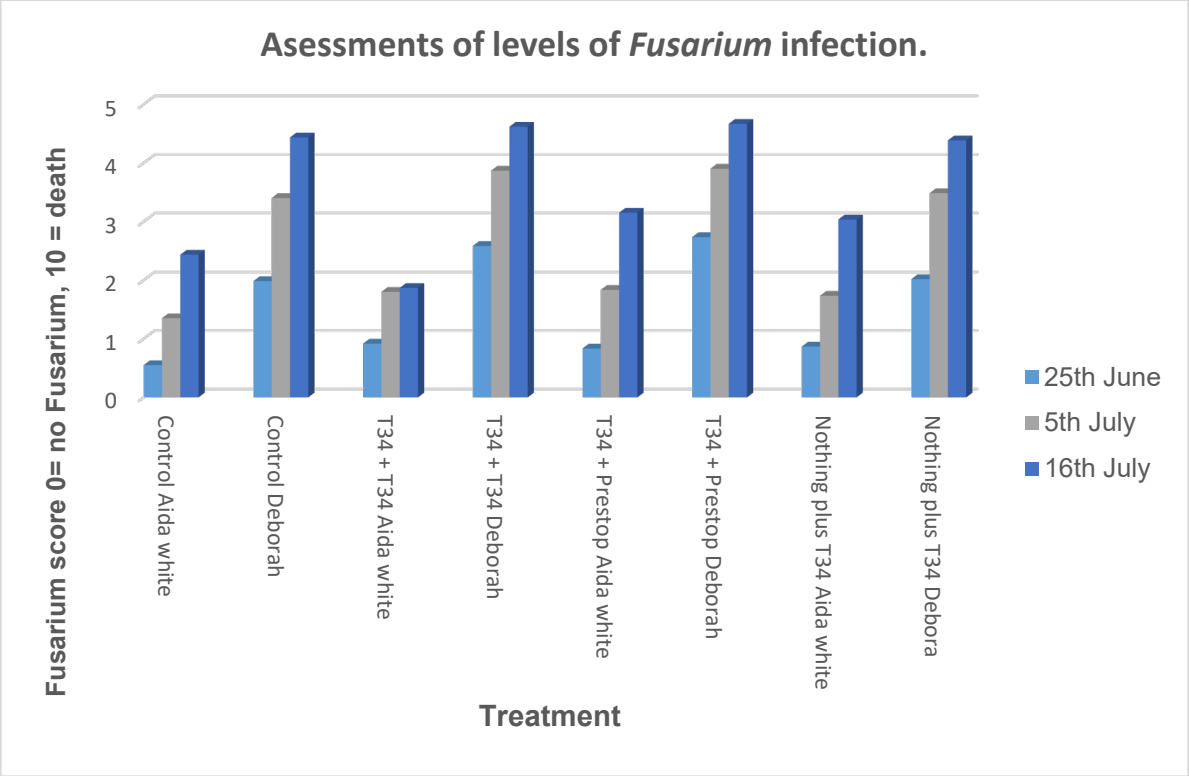


Figure 3. *Fusarium* T34 trial in 2021; top left trial planted in week 20; top right view of trial at final assessment in week 28; bottom-left 'Aida white' plot at final assessment and bottom right 'Deborah' plot at final assessment.

There was no visual difference between treatments but as would be expected from previous observations, 'Deborah' was more severely damaged by *Fusarium* than was the Aida white.

The results of the *Fusarium* assessment scores are shown at Figure 4.

Figure 4. Assessments of levels of Fusarium infection from 10 plants located in the centre of each plot.



The visual observations were confirmed by a statistical analysis undertaken by Chris Dyer of ADAS were none of the treatments were shown to be statistically significant but the differences between the varieties were.

Gomphrena haageana cultivars

Gomphrena is another example of a cut-flower produced abroad but unfamiliar to UK customers. It is an annual herbaceous plant bearing white, pink, purple or red solitary flower spikes at the stem tips and can be used fresh-cut or dried. Gomphrena was previously grown in demonstration plots at CFC in 2016 but renewed interest from the industry resulted in further trials in 2021. The 2016 trial demonstrated that *G. globosa* do not produce stems long enough to be marketable so the 2021 trial only consisted of *G.haageana* cultivars. The main purpose of the trial was to investigate once over harvesting in order to minimise labour costs.

Table 5. Details of 2021 gomphrena cultivar demonstration

Site	Rookery Farm
Varieties	'Haageana Strawberry Fields' and 'Haageana Fireworks'
Format(s) and supplier(s)	Seeds from Chiltern Seeds.
Propagation and pre-planting treatment(s)	Sown into plugs weeks 12 and 18.
Planting or sowing date(s)	Planted in weeks 25 and week 30.
Plant spacing(s)	25/m^2
Planting site(s)	18 m-long plots (full beds).
Layout	Demonstration plots
Post-planting treatment(s)	One layer of support netting (but not raised)
Pests, diseases and disorders	None evident.
Picking stage(s) and market specification(s)	Various (best stage yet to be determined)
Picking and recording date(s)	Week 32 onwards
Records taken	Observations and picking dates.
VL testing	Not in 2021

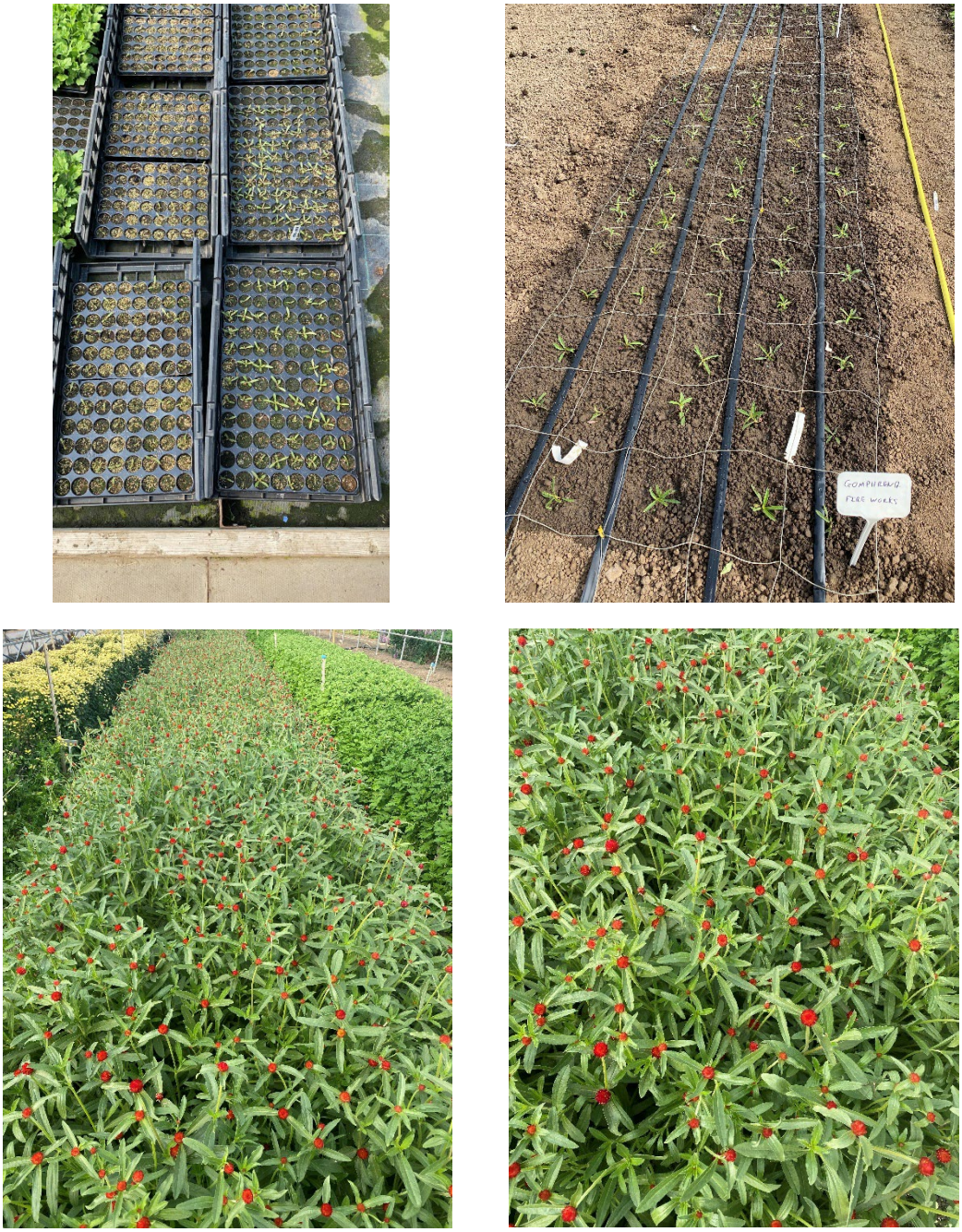


Figure 5 . *Gomphrena haageana* in demonstration plots in 2021; top left seedlings 2 weeks before planting; top right first planting in week 25; bottom-left and bottom right, crop in full flush in week 36.

The week 25 planting started flowering around week 32 and was in full flush by week 36 and consistently produced flower stems in excess of 50 cm long. The week 30 planting did not produce stems of adequate length to be marketable. The week 25 crop was not harvested to enable it to be viewed at the Open Day and the feedback from some growers was that it

had potential for once over harvesting and that they would now undertake their own trials.

Limonium sinensis

Limonium is grown in Holland but is not produced by many UK growers. Of the product that is grown in the UK, most is direct seeded annual varieties with very little perennial crop being produced. New varieties of micro propagated *Limonium* from Danziger were offered to the CFC in 2021. Different spacings were also investigated and any differences in performance etc will most likely show up in the second year of the trial.

Table 6. Details of 2021 Limonium trial.

Site	Rookery Farm
Varieties	'Safora Dark Blue', 'Lilac', 'Oshi Pink' & 'LS-15-760' and 'Sensy Pinacolada', 'Pink Beauty' & 'White'.
Format(s) and supplier(s)	Pugs from Danziger.
Propagation and pre-planting treatment(s)	From microprop material.
Planting or sowing date(s)	Planted in week 20
Plant spacing(s)	8/m^2 and 13/ m^2
Planting site(s)	3m-long plots.
Layout	Demonstration plots
Post-planting treatment(s)	One layer of support netting
Pests, diseases and disorders	No problems were observed in 2021
Picking stage(s) and market specification(s)	30 to 50% of flowers open
Picking and recording date(s)	'Sensy' flowered in from week 33 and 'Safora' from week 40.
Records taken	Observations and picking dates
VL testing	One packer tested at their own facility and obtained a VL of 21 days.

Figure 6 . *Limonium* in demonstration plots in 2021; top left trial planted in week 20; top right ‘Safora’ starting to throw flower stems in week 35; bottom-left ‘Sensy Pink Beauty’ in week 35 and bottom right ‘Sensy white’ in full flush in week 35.

The plants established well and grew away without any issues. The ‘Sensy’ colours were the first to flower from week 33 onwards and produced a flush of very strong and tall stems in excess of 65cm long. The ‘Safora’ colours were quite a bit later, were not ready to harvest

until week 40 and produced stems that while marketable, were shorter and weaker than 'Sensy'. All plants will be overwintered, and further assessments made in 2022.

Peony herbicide trial.

The area of UK grown peony has increased over the past decade and one of the main issues that growers face is weed control. This was highlighted at the 2019 CFC Open Day where it was identified as the top priority for future trials conducted by the CFC. In order to address this need, the CFC has instigated a number of trials to investigate both pre and post weed emergence control with the first of these commencing in 2020 (Table 7).

Table 7. Details of 2020/21 pre-emergence peony weed control trial.

Location	Rookery Farm
Variety	'Coral Charm', Dr Alexander Fleming, Duchess De Nemours and Sarah Bernhardt.
Plant longevity and hardiness	Hardy long lived perennial propagated from tubers.
Format(s) and supplier(s)	3/5 eyed tubers from Kolster bv
Propagation and pre-planting treatment(s)	Routine hot water treatment and disinfectant treatments by the propagator.
Planting or sowing date(s)	Planted in week 7 of 2019
Plant spacing(s)	2.5 tubers /m^2
Layout	Four beds each of a different variety with each bed being treated as a separate replicate for statistical purposes (see Table 8 for specific herbicide treatments)
Post-planting treatment(s)	N/A
Pests, diseases and disorders	None evident during the trial.
Picking stage(s) and market specification(s)	N/A
Picking and recording date(s)	Week 24.
Records taken	Stem length at harvest and number of stems per plot.
VL testing	N/A

Table 8. Details of the specific herbicide treatments of the 2020/21 peony herbicide trial.

Treatment	Active ingredient	Dose rate /ha	Application volume.	Concentration	Approval notice.
Untreated	N/A	N/A	N/A	N/A	N/A
HDC H44	HDC H44	1.75 L/ha	300L	5.8ml / Litre	Not Aproved
Hurricane SC	500g/l diflufenican (SC)	0.25 L/ha	300L	0.83ml / Litre	EAMU 2018-3440
Hurricane SC + Stomp Aqua	500g/l diflufenican (SC) + 455g/l pendimethalin (SC)	0.25 + 2.9 L/ha	300L	0.83ml + 9.7ml / Litre	EAMU 2018-3440 EAMU 2009-2919
HDC H44 + Sunfire	HDC H44) + 500g/l flufenacet (SC)	1.75 + 0.48 L/ha	300L	5.8ml + 1.6ml / Litre	Not Aproved + EAMU 2017-1065

In 2020, first year of the trials, owing to very wet weather in February the herbicides were not applied until week 10 which is not the ideal time and as a consequence some of the shoots had already emerged. This resulted in some damage from especially the Hurricane SC which became more pronounced as the crop developed with some of the stems being unmarketable as a result as shown at Figure 7.

Figure 7. Peony herbicide trials in 2020; top left waterlogged conditions when herbicides were applied in week 10; top right, emergence of shoots at time of herbicide application; bottom left and bottom right, damage to pre emerged shoots as a result of the Hurricane SC application.

The assessments undertaken in 2020 were the stem lengths of 10 random stems per plot and the total number of stems per plots. These are shown at Figure 8 and 9 and a detailed statistical assessment undertaken by Chris Dyer of ADAS demonstrated that there were no

treatment affects. This indicted that none of the treatments had any impact on either yield or stem length. After the very wet weather in February, March and April (the main period that the herbicides would be active) were very dry resulting in virtually no weed growth in any of the plots. No assessments of weed cover were therefore undertaken.

Figure 8. Stem length at harvest of 10 random stems from each plot in 2020.

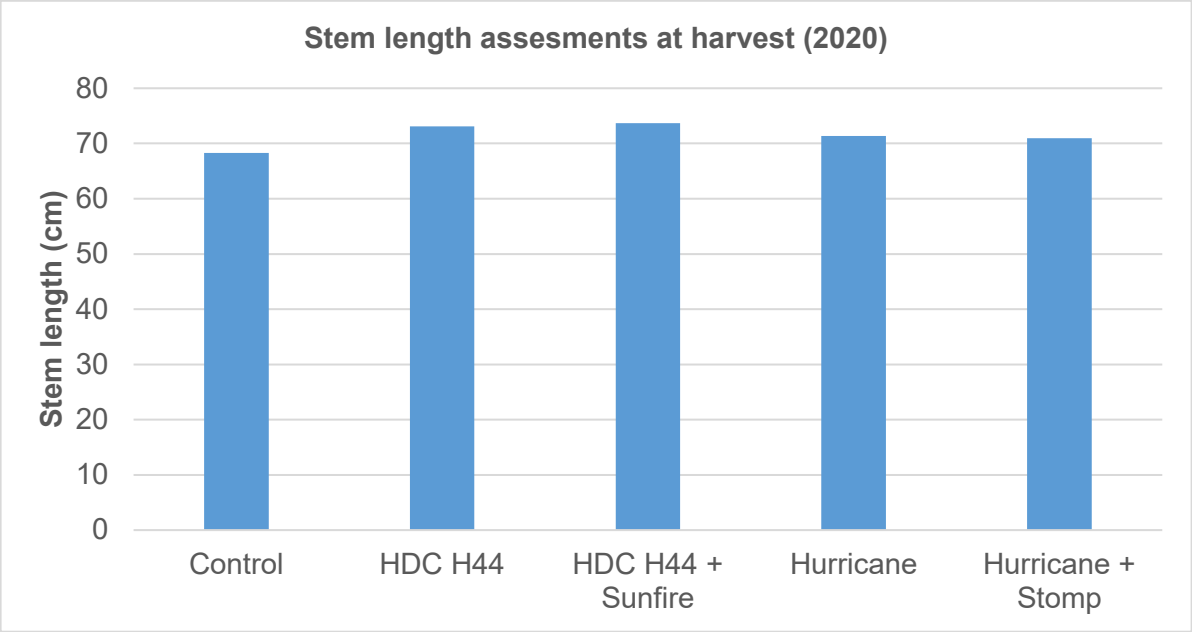
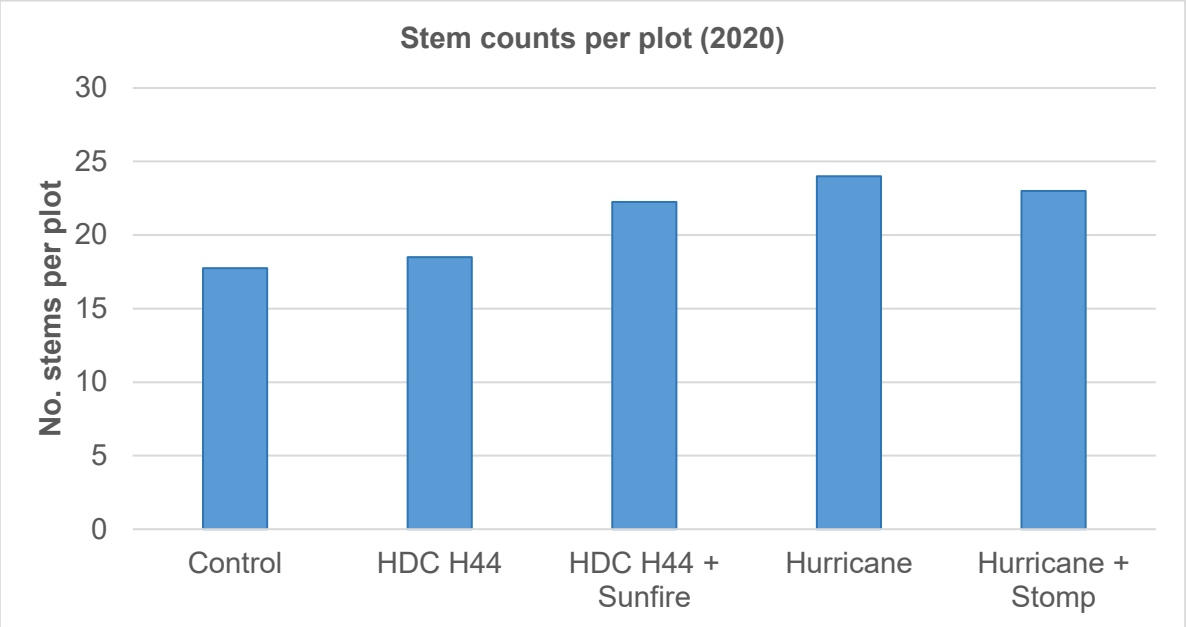


Figure 9. Stem count of marketable stems from each plot in 2020.



In 2021 the February weather, while not ideal was more favourable, and the herbicides were applied in week 5 before any shoot emergence had occurred. However very dry weather again in March and April resulted in very little weed growth meaning that only the stem length and yield assessments were undertaken. The different stages of the 2021 trial are shown at Figure 10.

Figure 10 Peony herbicide trials in 2021; top left, herbicides being applied in week 5; top right, emergence of shoots in week 11; bottom left, dry weather in April (photo taken in week 17) resulting in lack of weed growth and bottom right, trial just before final assessments in week 24.

No damage was observed from any of the treatments in 2021 and again statistical analysis by Chris Dyer showed that none of the treatment has any statistically viable impact on either stem length or yield. The result of the stem length and stem yield assessments are shown at Figure 11 and 12.

Figure 11. Stem length at harvest of 10 random stems from each plot in 2021.

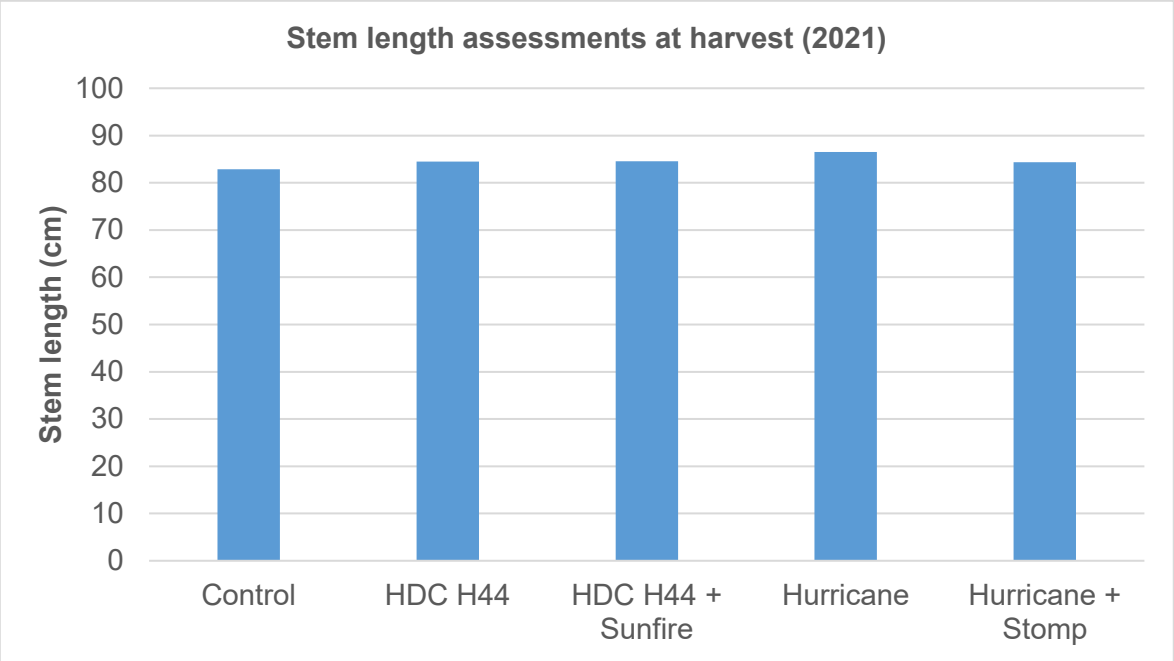
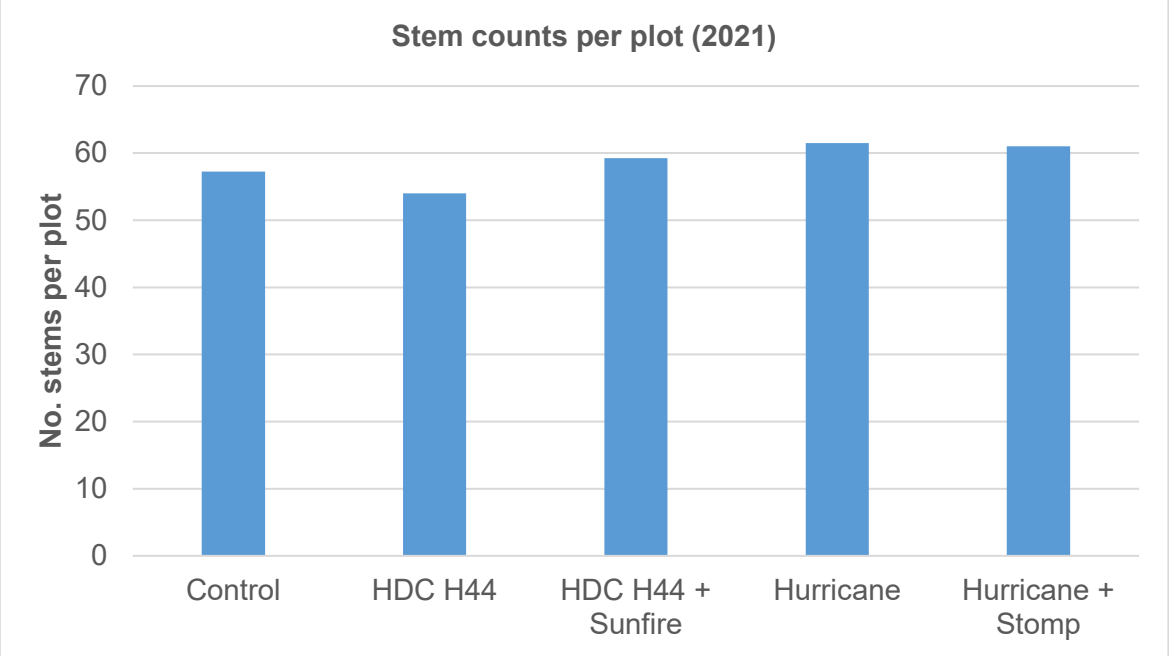


Figure 12. Stem count of marketable stems from each plot in 2021.



Scabious (varieties of *Scabiosa atropurpurea*).

Scabious are well-known as vigorous garden plants with prolific, attractive flowers in a wide range of colours with the perennial forms already grown as outdoor cut flowers. In recent years a new ranges of *S. atropurpurea* have been introduced to the market with the 'Scoop' series generating the most interest from the industry over the past few years of CFC trials. New and improved varieties continue to be introduced and in 2021 it was decided to look at the newest Focal Scoop varieties and the new range of Bon Bon Scoop.

Trials in previous years have indicated that an early planting date produces a more prolific crop because it allows the plant to establish a sturdy frame and good root structure before being put under stress during warmer weather conditions. With this in mind, in order to maximise their potential, the plugs were again potted into 9cm pots in week 12, pinched four weeks later and the well branched plants transferred to the tunnel in week 20. (see Table 9 for full details)

Table 9. Details of 2021 demonstration of Scabious

Varieties	'Scoop' series - 'Bon Bon French Vanilla', 'Marashino Cherry' plus 'Merlot' and 'Focal Biclour Pink', 'Blackberry', 'Dark Purple', 'Hot Pink', 'Lavender', 'Lilac', 'Purple Lace' plus 'White'.
Plant longevity and hardiness	*S. atropurpurea:* biennial or short-lived perennial, fully hardy Some other Scabious are annuals or biennials and some are frost-hardy
Format(s) and supplier(s)	Plugs from Danziger.
Propagation and pre-planting treatment(s)	Potted into 9cm pots in week 12 and pinched in week 16.
Planting or sowing date(s)	Transplanted to tunnel week 20.
Plots	3 m-long
Planting/housing site(s)	'Pro-Tech' tunnel bay 1
Layout	Demonstration plots
Plant spacing(s)	8/m^2 in two rows along bed
Post-planting treatment(s)	One layer of support netting.
Pests, diseases and disorders	No P&D issues in 2021.

Picking stage(s) and market specification(s)	When first whorl of petals opens
Picking and recording date(s)	First flowers from week 27 onwards.
Records taken	Observations
VL testing	Previous vase life trials have consistently shown that Scoop has a good vase life and hence no further VL trials were undertaken in 2021.

Figure 13. Scabious ‘Scoop’ varieties in demonstration plots 2021 (various dates); top left, pinched well branched plant in 9cm pot planting in week 20; top right first flush in week 27; bottom left ‘Focal Pom Pom French Vanilla’ and bottom right ‘Focal Bicolour Pink.’

In 2021 the plants did not establish as well as they had in previous years and continued to be less vigorous. This would appear to have been caused by the poor weather in May when the plants did not bulk up in the way they usually do and this lack of growth was not made up later in the season. The trial started to flush in week 27 and while many marketable stems were produced throughout the season, they were not as strong as in previous years.

Seed Priming Trial

Seed priming is a technique used quite extensively in the vegetable industry but has not been widely adopted by the cut flower industry. Preliminary trials undertaken by Elsoms seed had shown that there may be the potential to prime some flower seeds with the intention of producing an earlier and more even germination hence aiding with both weed control and making flower maturity more even. It had been intended to undertake trials at the CFC in 2020 but owing to the Covid restrictions, these trials was delayed until 2021.

It was intended to trial a wide range of species including Ammi, Bupluerum, larkspur, ornamental brassica and sweet Williams but owing to issues with the priming of small quantities of seed, only sweet William and larkspur were ready for 2021. Two different seeding dates were used (week 25 and week 33) with the trial being direct seeded in the third bay of the multispan tunnel. Each run of seeds was 15m long with 3gms of sweet William being sown and 1.5gms of larkspur.

Figure 14. Seed priming trials in 2021 (various dates); top left, second sowing in week 33; top right second sowings in week 38; bottom left, first sowing of sweet William in week 38 and bottom right, first sowing of larkspur in week 40.

The 2021 trials did not show up any clearly observable differences between the primed and non-primed crops so in conjunction with Elsoms this will be revisited in 2022

Tanacetum vulgare

Tanacetum (also known as Matricaria) is a member of the Asteraceae family and produces a mass of small flower heads similar to Santini chrysanthemums. They are widely grown in Holland and imported to the UK to be used mainly as a filler.

The purpose of the 2021 trial was to investigate the potential for *Tanacetum* to be grown as a UK crop and show the range of varieties currently available for cut flower production.

Table 10. Details of 2021 Tanacetum variety demonstration

Site	Rookery Farm
Varieties	'Amazone', 'Vegmo Single', 'Vegmo Snowball' and 'Vegmo yellow'
Plant longevity and hardiness	Grown as a non hardy annual.
Format(s) and supplier(s)	Plugs from Florensis
Propagation and pre-planting treatment(s)	None
Planting or sowing date(s)	Planted in week 23 and 29 and supported with one layer of wire.
Plots	6 m-long plots
Planting site(s)	'Pro-Tech' tunnel bay 1
Layout	Demonstration plots
Plant spacing(s)	64/m^2
Post-planting treatment(s)	N/A.
Pests, diseases and disorders	Small amount of leaf miner but kept under control by an appropriate spray programme
Picking stage(s) and market specification(s)	With a maximum of 30 to 50% of flower heads open
Picking and recording date(s)	Week 23 planting harvested from week 31 and the week 29 planting was harvested from week 37.
Records taken	Observations
VL testing	One packer tested at their own facility and obtained a VL of 15 days.

Figure 15. *Tanacetum* trials in 2021 (various dates); top left; second planting in week 29; top right 'Vegmo Yellow in week 32; bottom left 'Vegmo Snowball in week 37 and bottom right 'Amazone' also in week 37.

Both plantings established well and grew away with no issues except for a small amount of leaf miner which was eliminated by an appropriate application of pesticide. The first flowers were cropped 7 to 8 weeks after planting with the 'Vegmo Single' flowering 7 to 10 days earlier than the other varieties. All of the varieties produced an even crop with strong stems in excess of 55cms.

It is also interesting to note that owing to issues beyond the CFC's control, the first planting used leggy plugs that should have been planted a week to 10 days earlier and the second

planting was cold stored for 10 days prior to setting. Both of these factors meant that the plugs had a less than ideal start but this did not have any detrimental effect on the end quality of the crop as would have been expected from e.g. column stock plugs.

Trachelium caeruleum

Trachelium is another crop produced in Holland but not widely grown in the UK. Earlier CFC trials had shown that it has the potential to be home grown hence producing a fresher product with a better VL than imported product. It was decided that the current market dynamics mean that now is a suitable time to revisit *Trachelium* as UK grown crop and put it in front of growers and buyers to assess its potential.

Table 11. Details of 2021 Trachelium variety demonstration

Site	Rookery Farm
Varieties	'Lake Michigan Blue' and Lake Michigan White'
Plant longevity and hardiness	Semi hardy perennial but grown commercially as an annual.
Format(s) and supplier(s)	Plugs from Florensis
Propagation and pre-planting treatment(s)	None
Planting or sowing date(s)	Planted week 23
Plots	8 m-long plots
Planting site(s)	'Pro-Tech' tunnel bay 1.
Layout	Demonstration plots
Plant spacing(s)	25/m^2
Post-planting treatment(s)	N/A.
Pests, diseases and disorders	None seen in 2021
Picking stage(s) and market specification(s)	With a maximum of 30 to 50% of florets open
Picking and recording date(s)	First flowers ready in week 35.
Records taken	Observations.
VL testing	Not in 2021

Figure 16. Trachelium trials in 2021 (various dates); top left; trial planting in week 23 top right well established crop in week 33;, bottom left Lake Michigan White in full flower in week 37 and bottom right, harvested Lake Michigan Blue also in week 37.

The trial was planted in week 23 and the first stems were harvested in week 33 with most stems achieving a length of between 55 and 60cm.

Veronica longifolia

In 2018 a new range of Veronica was trialled (the 'Skyler' series) which is available as blue, white and pink flowered varieties. The trial demonstrated that when tunnel grown, a combination of different planting and pinching dates can achieve a three month flowering period. It is likely that this period could be extended further if the crop was grown in a glasshouse.

The trial was left in situ and in 2021 the disbudding trial began in 2019 was developed further. This technique involved the removal of the centre bud to produce a "spray" type flower head which is both heavier and bulkier the natural single bloom product.

Table 12. Details of 2021 Veronica "disbudding" trial.

Site	Rookery Farm
Varieties	'Skyler Blue', 'Skyler Pink', Skyler White'
Plant longevity and hardiness	Like many other Veronicas, *V. longifolia* is perennial and fully hardy
Format(s) and supplier(s)	Rooted cuttings in plugs from Danziger
Propagation and pre-planting treatment(s)	None
Planting or sowing date(s)	Transplanted week 18 and 25 of 2018.
Plots	2m long plots
Planting site(s)	'Pro-Tech' tunnel bay 2.
Layout	Demonstration plots
Plant spacing(s)	25/m^2 reduced to 12/m^2 in 2019.
Post-planting treatment(s)	N/A.
Pests, diseases and disorders	None in 2021 but a regular pesticide spray programme was applied.
Picking stage(s) and market specification(s)	With a maximum of 30 to 50% of florets open
Picking and recording date(s)	First flush disbudded in week 24 and harvested in week 26.
Records taken	Observations.
VL testing	Not in 2021

The first flush of flowers was ready to disbud from week 24 and the "spray type" product was

ready to harvest 10 to 14 days later. The removal of the centre bud resulted in a longer and visibly stronger “spray type” flower stem (see Figure 17) with between four and six blooms. This was considered to be a better-quality product for use in mixed bouquets and confirmed the trials undertaken in 2019.

Figure 17. *Veronica* trials in 2021 (various dates); top left; first flush developing in week 19; top right, stage of disbudding in week 24; bottom left, immediately after disbudding in week 24 and bottom right, comparison of disbudded and single bloom product.

No further trials are planned to be undertaken with *Veronica* and the crop was removed in the autumn of 2021 ready for the tunnel to be sterilised in the spring of 2022.

Discussion

Aster ericoides

Aster ericoides is a crop that is in demand for use as a filler in UK provenance bouquets and is already widely grown in Holland but mainly as a daylength manipulated crop. Its production as a natural season crop will be more problematic owing to the limited window of supply but it could have a place in a seasonal bouquet. However, for this to be successful the flower stems will need to be smaller (in terms of length, bulk and weight) than those produced in the 2021 trial. A final assessment of the potential of this crop will be made after the 2022 trial investigating the effect of cutting back the crop in late spring to encourage more prolific and lighter shoots.

Astrantia major

Astrantia was planted for the first time in 2018 at the CFC with a trial of a new range of varieties including 'Sparkling Pink Star' and 'Sparkling Red Star'. The ongoing 2021 trial demonstrated that this is a crop that once established produces a long flush of good quality stems with a long VL. *Astrantia* is a product that is generating a lot of interest amongst the industry and is in demand by both the packers and end consumers. Growers would need to investigate the economics of production, but *Astrantia* does seem to have the potential to be developed as both a protected and outdoor new UK produced cut flower crop. Further varieties are also now available beyond those trialled at the CFC.

Column stocks (Matthiola) - Fusarium T34 trial

The trials in 2021 confirmed previous trials and observations that indicate that the use of T34 as a soil drench alone will not control a heavy infestation of *Fusarium oxysporum.* In 2022 it is proposed to undertake the original trial investigating the drenching of T34 and Prestop at

the seeding stage on the propagator's nursery. A number of elicitors will also be investigated in a separate trial with the CFC Haygrove "Fusarium" tunnel.

Gomphrena haageana varieties

Gomphrena has been investigated by the CFC in previous years and of the species trialled, *G. haageana* was the only one that produced stems that were long enough to be suitable for use as a filler in mixed bouquets. At the time the product was not taken up by the industry but recent interest in UK produced fillers resulted in a request to revisit *Gomphrena* trials. A single planting was therefore made in 2019 which produced a crop that was very prolific with a good stem length, received positive feedback from the industry, and had an acceptable VL. The speed and cost of cropping is a potential issue but the crop could lend itself to multiple sowing dates with the possibility of once-over cropping and this was investigated in 2020. The later planting (week 30) did not produce flowers of a marketable length and the week 25 planting was not harvested in order for it to be viewed at the Open Day. The feedback from some of the growers who attended the Open Day was that the crop had potential for once over harvesting and that they would now undertake their own trials.

Limonium sinensis

The quality and length of the stems produced from the 'Sensy' series, ease of production and apparent lack of any major P& D issues (although downy mildew is listed as a possible issue) mean that this crop has real potential for UK production. However, it is marketed as an annual so if it does not successfully overwinter a new planting will be required in 2022 and as these are micro-propagated plants (and therefore relatively expensive), a detailed record of yield would be required in order to make an assessment of the economic viability of the crop. The 'Safora' series did not show as much promise as the 'Sensy' series in year 1 because the stems were shorter and weaker. However, it is marketed as a perennial and as such its true potential cannot be assessed until year 2 when a full economic assessment will be made. For this crop to be a success in the UK it must be marketed (and priced) in a way that positively differentiates it from the cheap, seed raised, mainly outdoor crop that is currently produced.

Peony herbicide trial

The 2020/21 herbicide trial is one of a number of trials to be undertaken by the CFC as a direct result of grower feedback, which has identified such work as having a high priority. In 2022 and 2023 further pre-emergence trials are planned as well as post emergence trials. The 2020/21 trial identified additional herbicides that growers could trial on commercial crops but owing to the damage seen from Hurricane SC, the time of application is crucial to ensure there is no evidence of shoot emergence and this may rule it out as being a possible candidate for use on peony. HDC H44 did not show any damage in either year of the trial, but as it does not have any recommendations for use on ornamentals, if the industry wants to use this herbicide an EAMU would need to be obtained.

As there was little weed challenge to assess in either year of the trials the manufacturer recommendations for weed spectrum covered by each of the treatments, and the reason for including them in the trials are summarised below to indicate the situations in which they may be best used.

Sunfire – AMG, blackgrass, bayweed, chickweed, charlock, cleavers, lose silky bent, ryegrasses, sterile brome (+other bromes). Mainly for grass control but also very good ornamental approval currently.

HDC H44 – field pansy, fat hen, amaranthus, annual mercury, chickweed, common speedwell, false mayweed, field penny cress, pale persicaria, red dead nettle, shepherds purse, vOSR, wild pansy, black bindweed, cleavers, hemp nettle, redshank, cranesbill, fumitory, knotgrass, runch, scented+scentless mayweed, bittercress. Chosen for the trials because of the wide range of activity and also some good post emergence activity.

Hurricane – charlock, chickweed, speedwell, common poppy, corn spurrey, field forget-me not, field pansy, dead nettle, parsley piert, shepherds purse, vOSR, runch. Long residual activity and existing ornamental approval as a reason for choice.

Stomp Aqua – AMG, chickweed, red dead nettle, fat hen, fumitory, knotgrass, small nettle, field pansy, orache, common poppy, speedwell. Ornamental approval and safe option, well

used on peonies already and good record/experience with it.

Scabious (varieties of *Scabiosa atropurpurea*)

Ongoing trialling at the CFC and on growers' holdings have shown that the new varieties of Scabious (especially the Scoop series) have good market potential but there are issues with the economics of producing the product for sales through the supermarkets. The positive attributes of the crop include a unique flower form, vibrant colours, high yield and a consistently good VL. However, the growth habit of the crop means that harvesting costs are an issue and unless this is reflected in the final stem price, the large scale production of Scabious will not be economically viable. At the current time, the crop is only being grown on a small scale by growers that are supplying premium markets (eg mail order) or direct sales to the public.

The CFC does not intend to undertake any further Scabious trials unless the ongoing breeding work develops any new varieties that have attributes that justify planting additional demonstration plots. A technical note summarising the CFC trials to date was produced in 2020.

Seed priming trial

In principle seed priming should be very advantageous to flower crops to both produce a more even stand of seedlings and also aid herbicide efficacy and general weed control owing to an earlier emergence of the crop which should then outcompete the weeds. Unfortunately the limited trials in 2021 did not demonstrate any observable differences in the treatments but in 2022 the CFC will investigate this further as Elsoms continue to develop systems that are more suited to priming small batches of seed.

Tanacetum parthenium

2021 was the first year that the CFC has investigated *Tanecetum* and the trials have proved very encouraging. The two different plantings (week 23 and 29) both produced a strong marketable crop with all of the different varieties performing equally well although there was

a slight difference in flowering time between the varieties. The crop was easy to grow and suffered from very few problems except a small amount of leaf miner on the first planting but a prophylactic spray programme prevented this from being an issue on the second planting. This is a product that would appear to have a good potential for UK produced filler and its similarity to Santini type chrysanthemums gives it further potential for a wider usage in mixed bouquets. The crop will be included in the 2022 trials with a view to investigating season extension, once over harvesting and vase life.

Trachelium caeruleum

The 2021 trial has again demonstrated that *Trachelium* has the potential to be produced in the UK giving a fresher more vibrant product with a potentially longer vase life. It is not intended to undertake any further trials on this crop.

Veronica longifolia

The CFC trials and small commercial plantings of *Veronica* have demonstrated that the crop has the potential for UK outdoor and protected production but achieving an acceptable stem strength and length can be an issue with the second flush especially during hot weather. However, *Veronica* is very prone to powdery mildew, necessitating an intensive spray programme throughout the life of the crop in order to keep the foliage clean. The disbudding trials in 2021 have confirmed that *Veronica* can be transformed from a relatively lightweight product to a heavier, longer and more floriferous stem which has much more potential as a filler for mixed bunches.

Knowledge and Technology Transfer

Website

The CFC website (www.thecutflowercentre.co.uk) includes a weekly blog during the production season keeping the industry up to date about developments and trials at Rookery Farm. The website also carries news of events, notifications of handouts and reports.

Events

The CFC Open Days have consistently attracted 80–100 delegates and continue to be the only national event attended by a large proportion of UK cut flower industry including associated members of the retail sector. The event in 2021 was staged on 8th September 2021.

Publications

Factsheet 01/20. Guidelines for the post-harvest handling of cut flowers and foliage.

New webpage. Scabious as a new flower for the UK market.

New webpage. Seed raised species suitable for use as ‘fillers’ in mixed bouquets.

New webpage. Management of botrytis in cut flower peony crops.

New webpage. Ornamental grasses suitable for use as ‘fillers’ in mixed bouquets.

Glossary

N/A for this report.

References

N/A for this report.

Appendices

N/A for this report.

