

**Project title:** The National Cut-flower Trials Centre Programme for  
2018 - 2023

**Project number:** PO/BOF 002b

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**Report:** Final Report (2023)

**Previous report:** Annual Report (2022)

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**Location of project:** Mainly office based but also field based trials at:-  
  
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**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

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## GROWER SUMMARY

### Headline

- Eight peony herbicide trials spanning 2018 to 2024 have facilitated the production of a detailed web note on the topic entitled *Weed control in outdoor peony crops for cut flower production*.
- Five column stock downy mildew fungicide susceptibility trials undertaken by FERA spanning 2018 to 2024 has facilitated the production of the original and updated version of AHDB/CFC Information Sheet 11, *Maintaining successful control of downy mildew in protected crops of cut flower column stocks*.
- Further webpages have been written in 2023 including, *A summary of minor crops trialled at the CFC*, *Management of botrytis in cut flower peony crops* and *Tanacetum as a cut flower for the UK market*.
- This is in addition to those prepared throughout the life of the project ie [CFC/AHDB Information Sheet 9. 'Sunflowers \(\*Helianthus annuus\* cultivars as a field and tunnel grown cut flower crop](#), [CFC/AHDB Information Sheet 10. 'Alstroemerias \(\*Alstroemeria\* hybrids\) as tunnel grown cut flower crop](#), [CFC/AHDB Information Sheet 11. 'Maintaining successful control of downy mildew in protected crops of cut flower column stocks](#) (now updated as the webpage [Downy mildew control in protected crops of cut flower column stocks](#)), [Management of botrytis in cut flower peony crops](#), [New webpage. Ornamental grasses suitable for use as 'fillers' in mixed bouquets](#) and [seed raised species suitable for "fillers" in mixed bouquets](#).
- A cut flower group has been developed with the BPOA to enable contributions to be collected by the industry on behalf of the Horticultural Crop Protection Ltd (HCP).
- Growers are now contributing to the HCP to enable the provision of cut flower EAMU's to continue.

- Over the life of the project, 20 New Product Development (NPD) trials have been undertaken which has resulted in the commercial scale production of *Eryngium* and *Tanacetum*.
- A number of other products are also produced on a smaller scale especially by specialist and artisan growers including *Ammi*, *Aster ericoides*, *Astrantia*, *Craspedia*, *Limonium*, Scoop Scabious and Veronica.
- Variety trials have been undertaken with column stocks especially the lines that are more heat tolerant such as Stox leading to these being produced commercially.
- Further investigations into the ongoing sunflower spotting issue has isolated *Itersonilia* leading to the postulation that it could be the primary cause of the problem.

## Background

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.

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 prevented CFC trials from going ahead in 2020 extending the end date of the project to 2023. Due to the sale of the CFC trials site at Rookery Farm the final trials in 2023 were undertaken on growers holding. Other work in 2023 has concentrated on updating and producing new web pages and technical notes and facilitating the cut flower industry input into the new Horticultural Crop Protection (HCP) Ltd which has taken on the role of providing EAMUS for the Horticultural Industry

## **Summary**

### **Additional Web Pages**

New technical notes and webpages have been produced or updated in 2023 include

*A summary of trials not included in previous technical notes*

*Maintaining successful control of downy mildew in protected crops of cut flower column stocks*

*Management of botrytis in cut flower peony crops*

*Tanacetum as a cut flower for the UK market*

*Weed control in outdoor peony crops for cut flower production*

These supplement the 5 pieces of technical information produced for growers and advisors through the life of this current project (2018-2023)

### **Column stocks (Matthiola) – Additional downy mildew fungicide sensitivity trials and updating of technical note.**

Downy mildew continues to be a threat to the column stock industry especially with the potential withdrawal of some of the key active ingredients of some of the fungicides used for its control. In order to identify any new actives that could be introduced to a revised spray programme, the CFC commissioned further fungicide sensitivity trials at FERA using samples of DM collected from growers holdings in 2023. The purpose of the trial was to investigate potential new products for stocks DM control and because these are not currently approved for this usage they can only appear as coded products at this stage. However, as can be

seen from the results of the trial copied at appendix I of the main report, some achieved very good control of the disease and EAMU's are now being actively pursued. The 2019 technical note, [Downy mildew control in protected crops of cut flower column stocks](#) is now available from the AHDB archive website.

### **Horticultural Crop Protection (HCP) Ltd**

The demise of AHDB Horticulture left the industry without a viable route to obtain and update EAMU's relating to the specific horticultural sectors including cut flowers. In order to fill this gap, Horticultural Crop Protection Ltd (HCP) was established under the British Growers umbrella of Crop Associations and Companies. HCP is funded from voluntary contributions from growers which are collected through the Grower Associations (GA) for the different sectors. As the cut flower sector does not have a specific GA a solution was required to enable cut flower growers to be able to contribute to HCP. Rather than to try and set up a new GA, after discussions with the British Protected Ornamental Association (BPOA) it was agreed that a cut flower sub group would be established. This will enable the BPOA to collect HCP contributions on behalf of the cut flowers sector. This system is now in place and cut flower growers are already contributing to the HCP but in order to make the system sustainable it will require additional growers to be involved.

### **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. The 2022 trial investigated the use of contact and systemic herbicides applied after the crop has been cut down in the Autumn. In 2023 these herbicides were applied again in July, after harvesting but before the crop had been cut back in order to



determine the level of damage to the foliage. These and previous CFC trials have facilitated the production of the new web page [Weed control in outdoor peony crops for cut flower production | AHDB](#) .

### **Sunflower petal spotting issue.**

The CFC has for some years investigated the petal spotting issues that occur on UK grown sunflowers for cutting, but no conclusive cause of the problem has so far been identified. In previous years the disease *Itersonilia perplexans* was isolated from some samples, but not from all, meaning that it could not be categorically identified as the cause of the problem. Unfortunately, the methodology required to identify *Itersonilia* was notoriously difficult but has recently been revised for the investigation of parsnip canker which can be caused by *Itersonilia spp.* Some of this work on parsnips has been undertaken by Lauren Chappell from Warwick Life Sciences who was contacted by the CFC with a view to develop a joint project to further investigate the sunflower issue. During the 2022 season, Lauren and other colleagues from Warwick visited sunflower fields in Lincolnshire to better understand the production process and also collected samples to return to the labs in order to refine their technique for testing for sunflower *Itersonilia*.

The 2022 work in conjunction with Warwick Life Sciences has indicated that *Itersonilia* could be the primary cause of the ongoing sunflower spotting issue because it has been regularly isolated from samples showing the symptom. However, it was not isolated from every sample and further samples were needed to confirm that it was the main pathogen involved with the problem. Unfortunately, the industry did not provide any additional samples in 2023 as the problem was rarely seen. The Project Manager will continue to liaise with both the researchers and growers beyond the life of the CFC and it is hoped that additional funding can be secured to investigate the issue further.

### **Financial Benefits**

This is the final year of the CFC project and as such any financial benefits reported should

also take into account the potential £2.5 million of new product trialled and facilitated by previous CFC programmes.

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. The 2018 work was able to quickly develop an effective new spray programme that, when adopted by growers, reduced losses considerably. Since then, the CFC has continued to monitor the situation and has ensured that the spray programme continues to be effective by follow sensitivity testing in 2019 and 2021. Phytotoxicity trials were also undertaken in 2022 as part of the scoping work to develop additional products to include in the spray programme and a final sensitivity trial undertaken in 2023. The outcome of these most recent trials has been used to produce a revised web page and amended suggested spray programme for the control of DM on column stocks. As in previous years, 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 11 million stems at an average of 32p per stem in 2023, making a total industry value of around £3.5m. Again, using 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 2023 of over £350,000.

A number of new products trialled during the 6 years of the current CFC programme such as *Ammi majus and visnaga*, *Aster ericoides*, *Astrantia*, *Daucus carota*, *Lepidium*, *Limonium*, *Scabious* and *Veronica* have been planted by small to medium sized nurseries. An estimate of the total area of these new products in 2023 is 4 ha and if *Scabious* is used as an example, with a yield of around 30 stems/m<sup>2</sup> at a return of 25p per stem this is an additional annual farm gate value of £3000,000.

Other new products have been planted either on a commercial scale or as commercial trials for supply to the supermarkets. These include *Eryngium*, *Tanacetum*, Willow and other woody foliage. An estimate of the area of these products would be 8ha and with an estimated

average farm gate value of £30,000 to £50,000 per ha depending on species this amounts to an additional total farm gate value of between £240,000 and £400,000.

The following section is a summary of all of the trials undertaken during the final 6 years of the CFC project and signposts the annual report they can be found in. The annual reports can be accessed from the CFC project page on the AHDB archive website ([The National Cut Flower Centre Trials Programme for 2018 to 2022 | AHDB](#)).

***Asclepius incarnata and tuberosa*** variety trial covered in the 2018 and 2019 annual reports.

***Ammi majus and visnaga*** spacing and variety trials covered in the 2018 and 2019 annual reports and a new web page [Seed-raised species suitable for use as 'fillers' in mixed bouquets | AHDB](#).

***Aster ericoides*** variety and spacing trial covered in the 2021 and 2022 annual reports.

***Astrantia*** variety and continuity trial covered in the 2018, 2019 and 2021 annual reports.

***Craspedia*** variety trial covered in the 2021 annual report.

***Dahlia*** vase life trials in conjunction with Floralife covered in the 2018 annual report.

***Daucus carota*** spacing and variety trials covered in the 2018 and 2019 annual reports and a new web page [Seed-raised species suitable for use as 'fillers' in mixed bouquets | AHDB](#).

***Didiscus caeruleus*** variety trial covered in the 2019 annual report.

***Echinacea*** variety trial covered in the 2018 and 2019 annual reports.

***Eryngium*** variety trial covered in the 2019 annual report.

***Eucomis autumnalis*** seed and corm raised variety trial covered in the 2018 and 2019 annual reports.

***Gomphrena*** spacing, continuity, harvesting techniques and variety trial covered in the 2019 and 2021 annual reports.

***Lepidium*** spacing and different forms of planting material trial covered in the 2019 annual report.

***Lily*** alternative growing media trials in conjunction with Bullrush covered in the 2018 and 2019 annual reports.

***Limonium (statice)*** variety and spacing trial of new annual and perennial varieties covered in the 2021 and 2022 annual reports.

***Lysimachia fortunei*** variety trial covered in the 2018, 2019 and 2021 annual reports.

***Matthiola incana* (Column stocks)**

- *Fusarium oxysporum* variety susceptibility trial covered in 2018, 2019 and 2022 annual reports.
- Variety trial of late flowering Japanese varieties covered in the 2018 and 2019 annual reports.
- *Fusarium oxysporum* control using biological agents covered in the 2019, 2021 and 2022 annual reports.
- Downy mildew (DM) control of a new and aggressive “Dutch strain” covered in the 2018, 2019 and 2023 annual report and revised technical guidance webpage [Downy mildew control in protected crops of cut flower column stocks | AHDB](#).
- Phytotoxicity of new DM chemicals covered in the 2022 annual report.
- Variety trial of the new ‘Stox’ range of *Matthiola* covered in the 2022 annual report.
- Elicitors for *Fusarium* control covered in the 2022 annual report.

***Monarda*** demonstration plots covered in the 2018 annual report.

***Peony*** herbicide trials covered in the 2019, 2021, 2022 and 2023 annual reports and summarised in a new technical guidance webpage [Weed control in outdoor peony crops for cut flower production](#).

***Scabious*** variety trial featuring the new Scoop series covered in the 2018, 2019, and 2021 annual reports and a web page [Scabious as a cut flower for the UK market | AHDB](#) .

**Seed priming** trials covered in the 2021 and 2022 annual report.

***Tanacetum vulgare* (Matricaria)** variety and continuity trials covered in the 2021 and 2022 annual reports.

***Trachelium caeruleum*** variety and spacing trial covered in the 2021 annual report.

***Veronica longifolia*** spacing, variety, continuity and disbudding trial covered in the 2018, 2019 and 2021 annual reports.

***Zinnia*** vase life trials in conjunction with Floralife covered in the 2018 annual report.

**Other web pages and technical notes during this period.**

[CFC/AHDB Information Sheet 9. ‘Sunflowers \(\*Helianthus annuus\* cultivars as a field and tunnel grown cut flower crop.](#)

[CFC/AHDB Information Sheet 10. ‘Alstroemerias \(\*Alstroemeria\* hybrids\) as tunnel grown cut flower crop.](#)

[Factsheet 01/20. Guidelines for the post-harvest handling of cut flowers and foliage.](#)

[New webpage. Management of botrytis in cut flower peony crops.](#)

[New webpage. Ornamental grasses suitable for use as 'fillers' in mixed bouquets.](#)

[New webpage. Seed raised species suitable for "fillers" in mixed bouquets.](#)

[New webpage. Summary of minor crops trialled at the CFC.](#)

[New webpage. Tanacetum as a cut flower for the UK market.](#)

[New webpage. Weed control in outdoor peony crops for cut flower production.](#)

[Webpage update. Downy mildew control in protected crops of cut flower column stocks.](#)

## Action Points

- Column stock growers should continue to be vigilant to the ongoing threat of the new and very damaging strain of downy mildew identified in 2018, and obtain a copy of, and implement the recommendations of the AHDB webpage [Downy mildew control in protected crops of cut flower column stocks](#).
- As part of the column stocks downy mildew work, the CFC is investigating the possibility of obtaining EAMU's to add more fungicides to the DM armoury via the newly formed Horticultural Crop Protection Ltd and growers should therefore keep themselves regularly updated on new EAMU approvals via the internet, their local agronomist or the [HCP website](#).
- Peony growers should keep themselves up to date with the CFC herbicide trials and any new EAMU's issued.
- Sunflower growers will have the opportunity to be involved with the ongoing petal spotting issues if further collaborative trials can be developed and should keep themselves up to date with developments.
- Growers can consider voluntarily contributing to the HCP via the BPOA to ensure that the future provision of cut flower EAMU's can be maintained.

## 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 this has been hampered by a shortage of seasonal labour, energy and other rising input costs 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 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 then extended to 2023) with a remit of 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. These have included sensitivity testing undertaken by FERA due to the outbreak of downy mildew in column stocks during 2018 which generated revised spray programmes and a summary technical note in early 2019 and revised in 2024. The CFC also provided grower samples for additional sensitivity testing by the James Hutton Institute in 2019 and 2021.

Following the sale of Rookery Farm in 2022, the 2023 CFC programme consisted of a combination of trials on growers' holdings, lab trials, the preparation of technical notes and grower liaison.

## **Materials and methods**

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 (MG) comprising representatives of growers, packers, retailers and AHDB Horticulture although in recent years most of the guidance has come from the grower element of the MG.

## **Facilities and site preparation**

Trials in 2023 were based on a well-established commercial peony crop which hosted ongoing herbicide trials in a field at Herdgate Lane. Pinchbeck, Spalding, Lincs

## **Plant material and planting**

No plants or planting material was used in 2023.

## **Crop husbandry**

This section is also not applicable to the 2023 CFC programme of work except for the peony herbicide trials which were the crop was managed in line with commercial practice.

## **Pesticide applications**

Apart from the herbicide trials no pesticides were applied in 2023 were these were applied in line with current commercial practice..

## **Crop assessments.**

The only assessments undertaken in 2023 were those involving the peony herbicide trial.

## **Vase-life testing**

No Vase life testing was required in 2023.

## **Results**

### **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. The 2022 and 2023 trials investigated the use of contact and systemic herbicides both before and after the crop had been cut down after flowering.

The objectives of the 2023 trial was to evaluate the level of acceptable damage to peony crops caused by selective contact and total herbicides when applied in post cropping situation over the top of peony plants in full canopy. The applications were made on 21/07/2023 using a standard diaphragm pump knapsack at high pressure and red flat fan nozzle - FF110-04 delivering 400L/ha water volume. The same plots were used from the 2022 trial on P. Sarah Bernhardt. The assessment of the impact on peonies was made on 12/08/2023 (21DAA).



**Table 1.** Details of 2023 peony weed control trial.

Location	New Horizon Flowers Pinchbeck site.
Variety	'Sarah Bernhardt'.
Plant longevity and hardiness	Hardy long lived perennial propagated from tubers.
Format(s) and supplier(s)	Long established crop and original supplier not known.
Layout	Three replicates randomised trial
Post-planting treatment(s)	Herbicides applied over the top of the crop on 21/07/2023
Pests, diseases and disorders	None evident during the period of the trial.
Picking stage(s) and market specification(s)	N/A
Picking and recording date(s)	N/A
Records taken	Levels of herbicide damage on 12/8/2023
VL testing	N/A

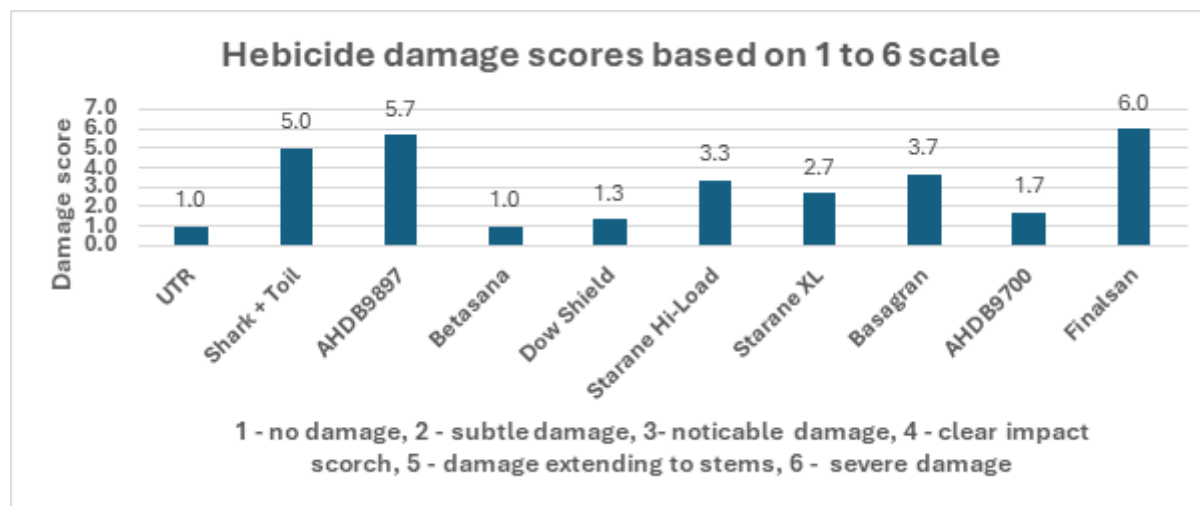
**Table 2.** Details of the specific herbicide treatments of the 2023 peony herbicide trial.

1	UNTREATED	Active Ingredient	Rate	Approval Status
2	Shark + Toil	carfentrazone -ethyl 60g/l (ME) + adjuvant	0.800l/ha + 2.25l/ha	EAMU 2019-0630
3	AHDB9897 + Toil	pyraflufen ethyl 26.5g/l (EC) + adjuvant	0.800l/ha + 2.25l/ha	Experimental Permit 2023-00920
4	Betasana	phenmedipham 160g/l (SC)	3.00l/ha	EAMU 2015-2050
5	Dow Shield	clopyralid 400g/l (SL)	0.500l/ha	EAMU 2022-1089
6	Starane Hi-Load	fluroxypyr 333g/l (EC)	0.600l/ha	EAMU 2021-0942
7	Starane XL	florasulam 2.5g/l + fluroxypyr 100g/l (SE)	1.80l/ha	EAMU 2023-2516
8	Basagran	bentazone 870g/kg (SG)	1.65kg/ha	EAMU 2008-2819
9	AHDB9700	clopyralid 200g/l + triclopyr 200g/l (SC)	1.00l/ha	Experimental Permit 2023-00920
10	Finalsan	pelargonic acid 186.7g/l (EC)	102.00l/ha	On label approval

Finalsan was applied in concentration of 17% in 600L/ha providing 102 L/ha dose rate rather than the full 170L/ha.

All treatments were applied with tap water in this trial in comparison to previous years trial where water conditioning was adopted.

**Table 3.** Herbicide damage scores from assessment on 12/8/2023



When the applications were made the natural senescence process had not started but by the time the assessment was made (12/8/2023-21DAA) the plants had started to senesce\_ and even the untreated had some chlorotic foliage and general wilting.

**Table 4 – Observations made at time of assessment on 21/8/2023**

<b>Shark + Toil</b>	Very obvious scorch, where crop canopy was open the weeds below were also affected, with the exception of couch grass
<b>AHDB9897 + Toil</b>	Lots of scorch on peony plants and significant weed scorch, some sheltering of weeds but considered much better impact than Shark +Toil
<b>Betasana</b>	Unaffected crop foliage and weeds, with perhaps some very slight weed stunting and yellowing
<b>Dow Shield</b>	Stunting and twisting of sow thistle, no damage to peony plants, only slight leaf scorch
<b>Starane Hi-Load</b>	Interveinal chlorosis, stunting and leaf twisting, some purpling and bronzing of foliage, stunting was the most obvious, good control on cleavers
<b>Starane XL</b>	Visible yellowing and stunted growth, some slight twisting, similar to Starane Hi-Load but less crop damage better weed control
<b>Basagran</b>	Obvious scorch and leaf chlorosis, relatively good and unexpected level of weed control.
<b>AHDB9700</b>	Yellowing of foliage, slight stunting, very good thistle control
<b>Finalsan</b>	Severe scorch on foliage and stems, sheltering effect visible, very quick burn off almost same day but short lived, weeds started to grow by 21DAA

## Discussion

### **Column stocks (Matthiola) – Additional downy mildew fungicide sensitivity trials and updating of technical note.**

Downy mildew continues to be a threat to the column stock industry especially as some of the key fungicides in the armoury have either been lost or are in imminent danger of being withdrawn. The sensitivity trials undertaken at FERA in 2023 (for full details see appendix 1) have shown that there are some potential new products that can be introduced into the spray programme if appropriate EAMU's can be secured. This highlights the importance of the cut flower industry contributions to HCP to ensure the future provision of cut flower EAMU's.

The original 2019 information sheet AHDB/CFC Information Sheet 11 *Maintaining successful control of downy mildew in protected crops of cut flower column stocks* has now been revised and is available as [Weed control in outdoor peony crops for cut flower production | AHDB](#).

### **Peony herbicide trial**

The 2022/23 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.

Table 3 provides observations on the effects of the herbicides tested in 2023 on weeds and crops. There are a couple of unexpected observations to note i.e. that Basagran's weed control was good even at that late stage and the impact on peony crop was not anticipated. And also that the Starane XL treatment showed less damage in comparison to Starane Hi-Load but with very good weed control.

Dow Shield and AHDB9700 had very promising results with both having low impact on the crop but high impact on specific weeds. This selectivity will be very helpful for pernicious perennial weeds where growers can adopt targeted hot spot treatments.

Shark and AHDB9897 mixed with Toil and Finalsan provided the greatest burn off on both weeds and crop. Finalsan was particularly quick and significantly damaged the peony stems. Finalsan cost per litre is somewhat prohibitive and it is worth noting that the product was

difficult to apply due to the formation of bubbles and foaming through the droplet diffusion and possibly water quality. Finalsan also had very distinctive heavy scent at time of application. It is important to condition the water when using Finalsan. Rapid crop senescence was associated with all three of these treatments and the plots will be monitored for their performance in 2024 to check for possible reduction in stem length and number of stems.

Over the last 5 years as part of CFC funding the CFC has conducted total of 8 herbicide trials (8<sup>th</sup> is currently ongoing) on newly planted and mature crops of peonies with total of 29 herbicide products tested in pre-emergence or post emergence situations. Of the 29 products tested, 20 herbicides were approved for use on peonies and 9 products were tested under code identified with potential for use in peony cut flower production. Of the 20 approved products, Eagle, Starane XL, Starane Hi-Load, Betasana were found to be useful in peony cut flower production as well as crop safe, provided they were used in specific timings. The trials also identified AHDB9700, AHDB9897, HDC H44, AHDB2826 and AHDB9890 all with potential for future approval and use in peony cut flower production. Submissions for EAMUs were made for AHDB9700, AHDB9826 and evaluation currently ongoing with HDC H44 and AHDB9890 currently being progressed for EAMUs.

The results of all of the CFC trials have been incorporated into a new web page entitled Weed control in outdoor peony crops for cut flower production.

### **Sunflower petal spotting issue**

Work in 2022 in conjunction with Warwick Life Sciences found *Itersonilia* was regularly isolated from samples showing petal spotting symptoms. As the fungus was not isolated from every sample, the Warwick research scientists would require further samples to confirm that *Itersonilia* is the main pathogen involved with the problem, although they are sure that it is a significant factor. Unfortunately, as the problem was rarely seen in 2023 the industry did not provide any additional samples. The Project Manager will continue to liaise with both the

researchers and growers beyond the life of the CFC and it is hoped that additional funding can be secured to investigate the issue further.

## **Knowledge and Technology Transfer**

### **Website**

The CFC website ([www.thecutflowercentre.co.uk](http://www.thecutflowercentre.co.uk)) was set up to host news of events, notifications of handouts and reports. As the project has now come to an end, this website will be closed down however growers can continue to access the technical information from the AHDB Horticulture and Potatoes archive site ([Horticulture | AHDB](#)) which now holds the horticultural resources that the AHDB has produced.

### **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 final Open CFC Day to be hosted by Rookery Farm was held on 17<sup>th</sup> August 2022.

### **Publications**

[CFC/AHDB Information Sheet 9. 'Sunflowers \(\*Helianthus annuus\* cultivars as a field and tunnel grown cut flower crop.](#)

[CFC/AHDB Information Sheet 10. 'Alstroemerias \(\*Alstroemeria\* hybrids\) as tunnel grown cut flower crop.](#)

[Factsheet 01/20. Guidelines for the post-harvest handling of cut flowers and foliage.](#)

[New webpage. Management of botrytis in cut flower peony crops.](#)

[New webpage. Ornamental grasses suitable for use as 'fillers' in mixed bouquets.](#)

[New webpage. Seed raised species suitable for "fillers" in mixed bouquets.](#)

[New webpage. Summary of minor crops trialled at the CFC.](#)

[New webpage. Tanacetum as a cut flower for the UK market.](#)

[New webpage. Weed control in outdoor peony crops for cut flower production.](#)

[New webpage. Downy mildew control in protected crops of cut flower column stocks.](#)

## Appendix I

**CONFIDENTIAL (FINAL)**

## **Fungicide Efficacy screen (5) – Stock Downy Mildew**

### **Report for The Cut Flower Centre Limited**

September 2023



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## 1. Introduction

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Downy mildews are some of the most destructive diseases of crops. Most downy mildew pathogens are host specific i.e., only attack one plant family. Pathogen species which cause downy mildew infections include *Peronospora*, *Bremia*, *Plasmopara* and *Basidiophora*. They infect a wide variety of greenhouse crops including pansy, snapdragon, impatiens, salvia, primula, verbena as well as cut flowers, including scabiosa and stock.

In 2018, the UK and Ireland saw widespread downy mildew infection of Stock plants (*Matthiola incana*). Downy mildew in Stock plants is caused by *Hyaloperonospora parasitica* (syn. *Peronospora parasitica*; the literature also sites *Peronospora matthiolae* Gäum. as the species responsible for downy mildew on several *Matthiola* spp. These infections proved difficult to control which raised the possibility of fungicide resistance.

The aim of this trial was to screen the efficacy of a range of fungicides against three Stock Downy Mildew isolates; 1 collected July 2022 (M-22) and 2 collected July 2023 (L-23 and C-23).

## 2. Materials and Methods

---

### Fungicide Efficacy screening

#### *Isolates*

Three isolates were used in the trial. All isolates were collected from Stocks produced in the UK, isolate M-22 was collected during July 2022 and was used in a screen carried out in 2022, whereas L-23 and C-23 were both from diseased plants collected in July 2023.

#### *Fungicide treatment*

Eleven fungicide treatments were trialled with each applied as a protectant treatment one day prior to inoculation. Three replicate plants were sprayed for each treatment.

Plants were treated five weeks after sowing using a Generation 3 track sprayer fitted with a Tee Jet XR110VP Yellow nozzle.

Disease severity (% leaf area with sporulation) was assessed on five leaves per replicate plant six days after inoculation and disease control compared to an untreated inoculated control.

### 3. Results

#### Fungicide Efficacy screening

Raw data for the trial are shown in the Annex 1.

Disease levels in the trial were high with an average disease severity of 82 % (M-22), 81 % (C-23) and 79 % (L-23) on the untreated control plants (untransformed data).

Combining all isolate data for each treatment (Figure 1) showed there were significant differences ( $p = 0.05$ ) in disease severity dependant on the treatment applied. Treatments 2 to 8 and 11 all produced significant reductions in disease severity compared to the inoculated control, whereas treatments 9, 10 and 12 did not reduce disease levels (Figure 1). Disease severity following treatments 2 and 3 was significantly ( $p = 0.05$ ) lower than any other treatment, giving disease control of 95 and 93 % respectively.

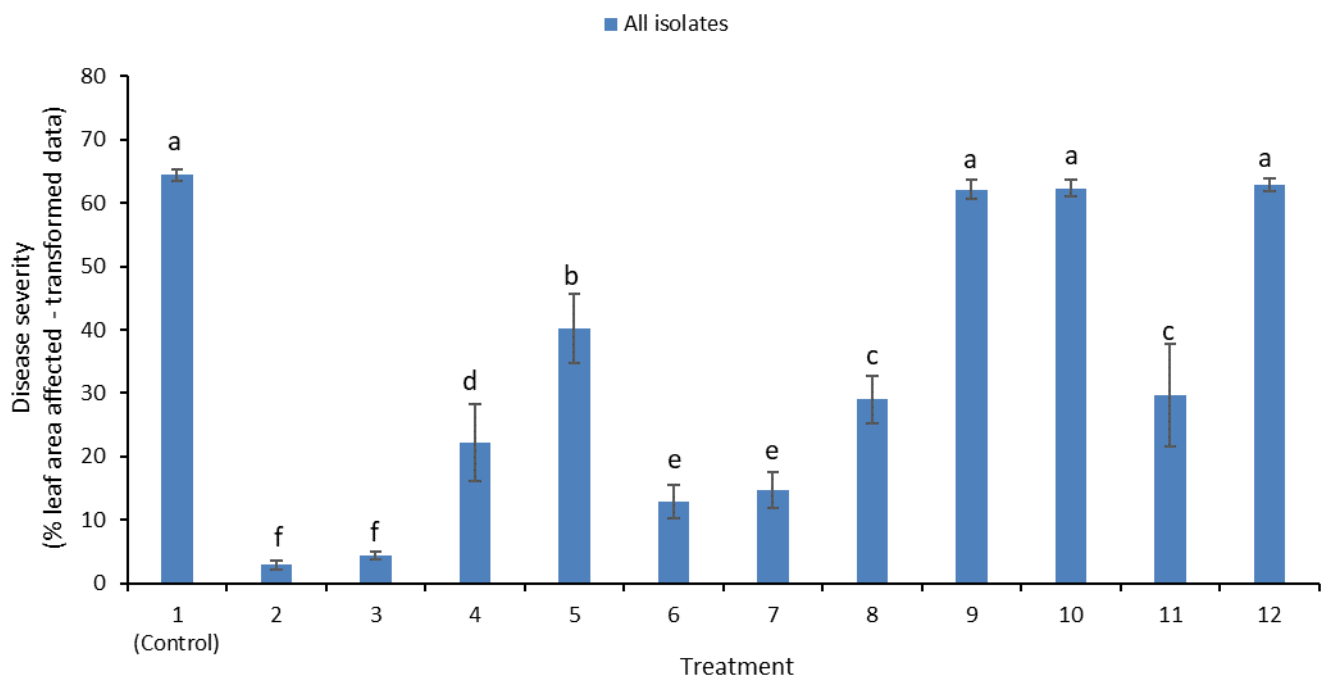


Figure 1. Stock downy mildew disease severity (all isolates combined) following fungicide treatment. Transformed data presented, bars represent standard error of mean. Columns with the same letter above are not significantly different (LSD 5% = 3.78).

Combining all treatment data for each isolate (Figure 2) indicated that overall plants inoculated with isolate L-23 had significantly ( $p = 0.05$ ) higher disease severity than plants inoculated with isolates

M-22 or C-23; there was no significant ( $p = 0.05$ ) difference in disease severity between isolates M-22 or C-23. These data suggested that isolate L-23 was harder to control than the other two isolates used in the trial.

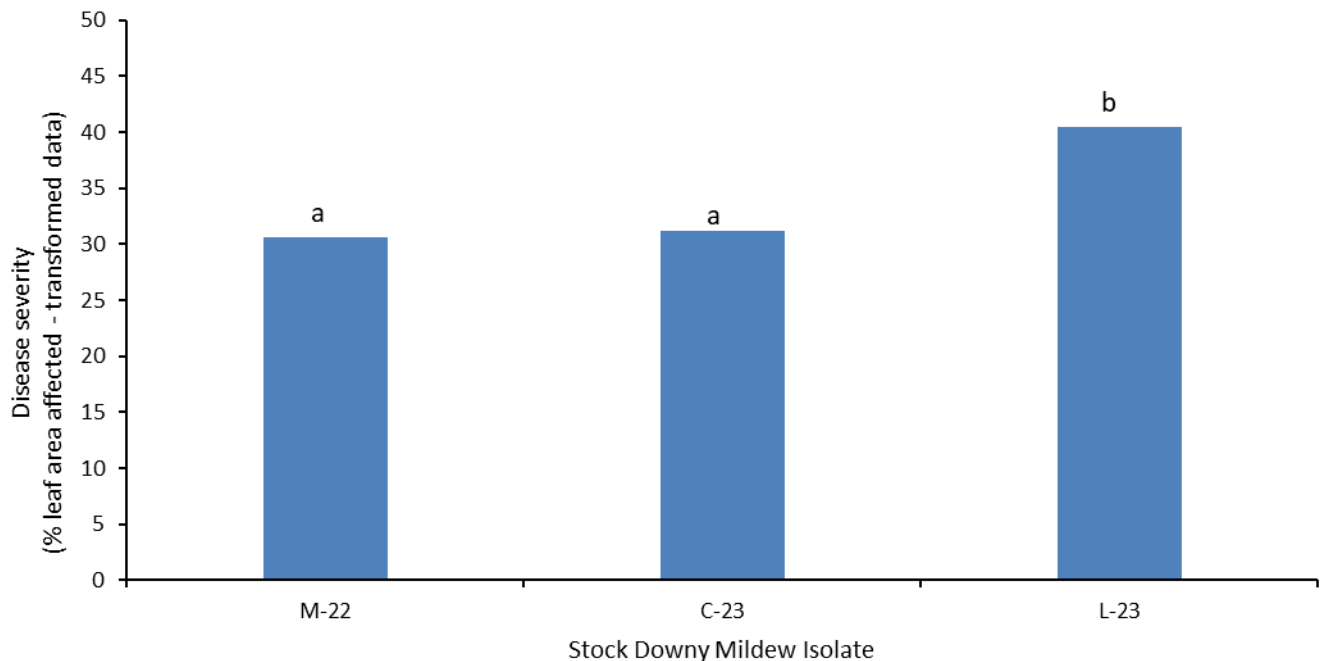


Figure 2. Overall Stock downy mildew disease severity (all treatments combined) for each isolate. Transformed data presented, bars represent standard error of mean. Columns with the same letter above are not significantly different (LSD 5% = 1.89).

Looking at individual treatment/SDM isolate interactions, significant ( $p = 0.05$ ) reductions in disease severity, compared to the control and across all three isolates, were seen following treatments 2, 3, 4, 6, 7 and 8 (Figure 3). For treatments 2 and 3 the reduction was the same for all three isolates, however for treatments 4, 6 and 7 disease severity following inoculation with L-23 was significantly higher than for isolates M-22 and C-23. Treatments 5 and 11 produced significant reductions in disease severity compared to the control for isolates M-22 and C-23 but not for isolate L-23. No significant ( $p = 0.05$ ) reduction in disease severity was observed for any isolate following treatments 9, 10 or 12.

Products 2 and 3 were the most effective products giving over 90% control of all isolates (Figure 4).

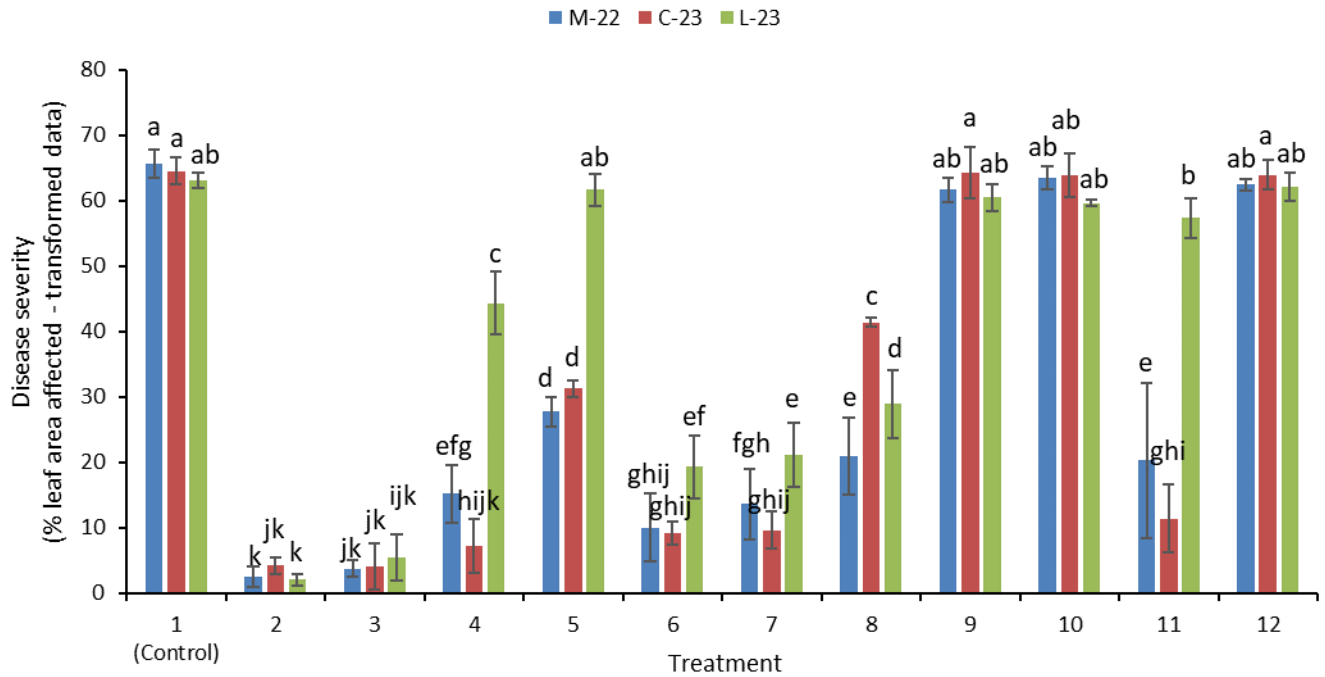


Figure 3. Stock downy mildew disease severity following treatment. Transformed data presented, bars represent standard error of mean. Columns with the same letter above are not significantly different (LSD 5% = 6.55).

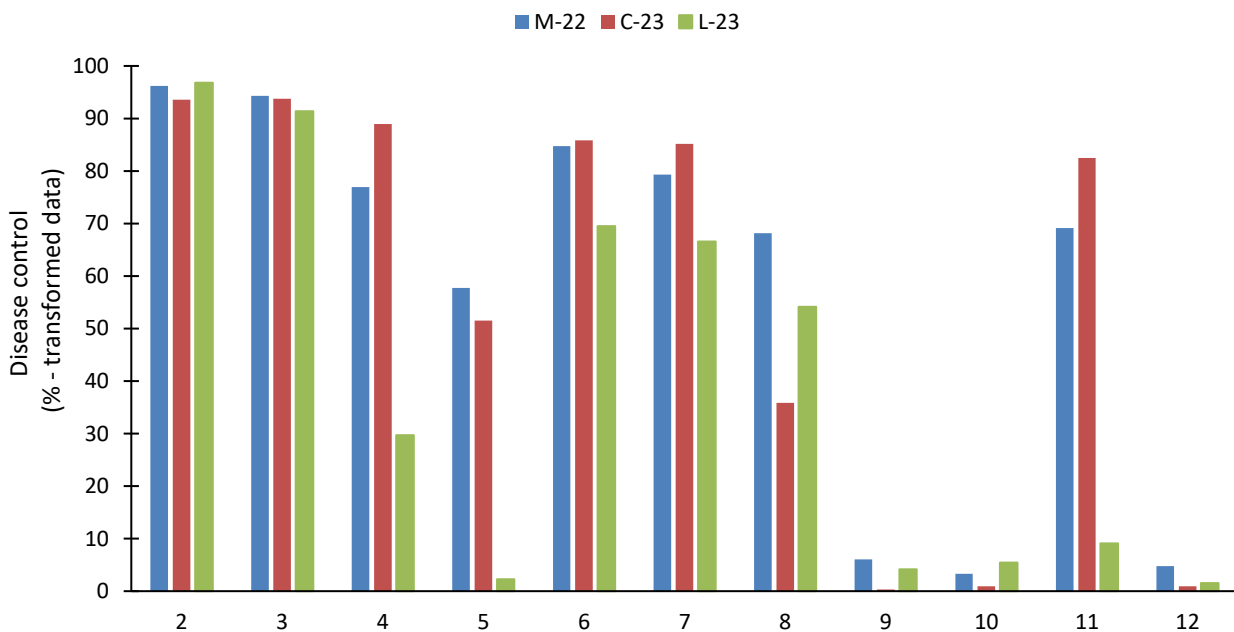


Figure 4. Stock downy mildew disease control (calculated using transformed data) following treatment.

## 4. Conclusions

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- Isolate L-23 proved harder to control than isolates M-22 and C-23.
- The highest levels of disease control across all isolates was achieved following treatments 2 and 3.
- Treatments 4, 6 and 7 reduced levels of disease caused by all three isolates, compared to the control, however disease levels on plants inoculated with isolate L-23 were significantly higher than for those inoculated with isolates M-22 and C-23
- Treatments 5 and 11 reduced disease levels following inoculation with isolates M-22 and C-23 but not isolate L-23.
- Treatments 9, 10 and 12 did not control disease caused by any of the isolates used.

## 5. Annex 1

---

Product!	Isolate!	Rep!	Leaf!	% infection
1	M-22	1	1	80
1	M-22	1	2	90
1	M-22	1	3	80
1	M-22	1	4	80
1	M-22	1	5	90
1	M-22	2	1	95
1	M-22	2	2	90
1	M-22	2	3	80
1	M-22	2	4	80
1	M-22	2	5	80
1	M-22	3	1	90
1	M-22	3	2	70
1	M-22	3	3	70
1	M-22	3	4	80
1	M-22	3	5	80
1	C-23	1	1	80
1	C-23	1	2	90
1	C-23	1	3	60
1	C-23	1	4	90
1	C-23	1	5	80
1	C-23	2	1	90
1	C-23	2	2	80
1	C-23	2	3	90
1	C-23	2	4	90
1	C-23	2	5	80
1	C-23	3	1	80
1	C-23	3	2	90
1	C-23	3	3	70
1	C-23	3	4	70
1	C-23	3	5	70
1	L-23	1	1	90
1	L-23	1	2	60
1	L-23	1	3	70
1	L-23	1	4	80
1	L-23	1	5	80
1	L-23	2	1	80
1	L-23	2	2	90
1	L-23	2	3	90
1	L-23	2	4	50
1	L-23	2	5	80
1	L-23	3	1	80

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1	L-23	3	2	80
1	L-23	3	3	90
1	L-23	3	4	80
1	L-23	3	5	80
2	M-22	1	1	5
2	M-22	1	2	0
2	M-22	1	3	0
2	M-22	1	4	5
2	M-22	1	5	0
2	M-22	2	1	0
2	M-22	2	2	0
2	M-22	2	3	0
2	M-22	2	4	0
2	M-22	2	5	0
2	M-22	3	1	0
2	M-22	3	2	0
2	M-22	3	3	0
2	M-22	3	4	1
2	M-22	3	5	1
2	C-23	1	1	0
2	C-23	1	2	0
2	C-23	1	3	0
2	C-23	1	4	1
2	C-23	1	5	1
2	C-23	2	1	0
2	C-23	2	2	0
2	C-23	2	3	1
2	C-23	2	4	20
2	C-23	2	5	0
2	C-23	3	1	0
2	C-23	3	2	0
2	C-23	3	3	1
2	C-23	3	4	0
2	C-23	3	5	5
2	L-23	1	1	0
2	L-23	1	2	0
2	L-23	1	3	1
2	L-23	1	4	0
2	L-23	1	5	0
2	L-23	2	1	0
2	L-23	2	2	0
2	L-23	2	3	1
2	L-23	2	4	0
2	L-23	2	5	0
2	L-23	3	1	0
2	L-23	3	2	1
2	L-23	3	3	0

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2	L-23	3	4	0
2	L-23	3	5	5
3	M-22	1	1	10
3	M-22	1	2	0
3	M-22	1	3	0
3	M-22	1	4	0
3	M-22	1	5	1
3	M-22	2	1	0
3	M-22	2	2	0
3	M-22	2	3	5
3	M-22	2	4	0
3	M-22	2	5	0
3	M-22	3	1	5
3	M-22	3	2	1
3	M-22	3	3	0
3	M-22	3	4	0
3	M-22	3	5	0
3	C-23	1	1	1
3	C-23	1	2	1
3	C-23	1	3	0
3	C-23	1	4	5
3	C-23	1	5	1
3	C-23	2	1	0
3	C-23	2	2	0
3	C-23	2	3	1
3	C-23	2	4	0
3	C-23	2	5	1
3	C-23	3	1	5
3	C-23	3	2	0
3	C-23	3	3	0
3	C-23	3	4	1
3	C-23	3	5	0
3	L-23	1	1	0
3	L-23	1	2	5
3	L-23	1	3	1
3	L-23	1	4	0
3	L-23	1	5	0
3	L-23	2	1	0
3	L-23	2	2	0
3	L-23	2	3	5
3	L-23	2	4	5
3	L-23	2	5	0
3	L-23	3	1	0
3	L-23	3	2	1
3	L-23	3	3	1
3	L-23	3	4	5
3	L-23	3	5	5



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4	M-22	1	1	5
4	M-22	1	2	0
4	M-22	1	3	1
4	M-22	1	4	0
4	M-22	1	5	5
4	M-22	2	1	15
4	M-22	2	2	15
4	M-22	2	3	20
4	M-22	2	4	1
4	M-22	2	5	5
4	M-22	3	1	20
4	M-22	3	2	10
4	M-22	3	3	15
4	M-22	3	4	10
4	M-22	3	5	10
4	C-23	1	1	0
4	C-23	1	2	0
4	C-23	1	3	10
4	C-23	1	4	0
4	C-23	1	5	0
4	C-23	2	1	1
4	C-23	2	2	0
4	C-23	2	3	0
4	C-23	2	4	1
4	C-23	2	5	0
4	C-23	3	1	0
4	C-23	3	2	10
4	C-23	3	3	15
4	C-23	3	4	15
4	C-23	3	5	5
4	L-23	1	1	70
4	L-23	1	2	60
4	L-23	1	3	20
4	L-23	1	4	70
4	L-23	1	5	60
4	L-23	2	1	50
4	L-23	2	2	20
4	L-23	2	3	40
4	L-23	2	4	50
4	L-23	2	5	10
4	L-23	3	1	80
4	L-23	3	2	50
4	L-23	3	3	40
4	L-23	3	4	60
4	L-23	3	5	60
5	M-22	1	1	40
5	M-22	1	2	30

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5	M-22	1	3	10
5	M-22	1	4	30
5	M-22	1	5	20
5	M-22	2	1	20
5	M-22	2	2	20
5	M-22	2	3	10
5	M-22	2	4	20
5	M-22	2	5	10
5	M-22	3	1	40
5	M-22	3	2	40
5	M-22	3	3	10
5	M-22	3	4	10
5	M-22	3	5	30
5	C-23	1	1	20
5	C-23	1	2	20
5	C-23	1	3	50
5	C-23	1	4	10
5	C-23	1	5	20
5	C-23	2	1	30
5	C-23	2	2	40
5	C-23	2	3	40
5	C-23	2	4	30
5	C-23	2	5	10
5	C-23	3	1	50
5	C-23	3	2	20
5	C-23	3	3	10
5	C-23	3	4	30
5	C-23	3	5	40
5	L-23	1	1	80
5	L-23	1	2	90
5	L-23	1	3	90
5	L-23	1	4	70
5	L-23	1	5	80
5	L-23	2	1	70
5	L-23	2	2	50
5	L-23	2	3	80
5	L-23	2	4	80
5	L-23	2	5	70
5	L-23	3	1	90
5	L-23	3	2	60
5	L-23	3	3	80
5	L-23	3	4	80
5	L-23	3	5	80
6	M-22	1	1	10
6	M-22	1	2	0
6	M-22	1	3	10
6	M-22	1	4	0

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6	M-22	1	5	5
6	M-22	2	1	5
6	M-22	2	2	20
6	M-22	2	3	15
6	M-22	2	4	20
6	M-22	2	5	1
6	M-22	3	1	1
6	M-22	3	2	0
6	M-22	3	3	0
6	M-22	3	4	0
6	M-22	3	5	0
6	C-23	1	1	5
6	C-23	1	2	0
6	C-23	1	3	5
6	C-23	1	4	5
6	C-23	1	5	1
6	C-23	2	1	10
6	C-23	2	2	1
6	C-23	2	3	1
6	C-23	2	4	10
6	C-23	2	5	5
6	C-23	3	1	0
6	C-23	3	2	5
6	C-23	3	3	0
6	C-23	3	4	1
6	C-23	3	5	5
6	L-23	1	1	10
6	L-23	1	2	5
6	L-23	1	3	1
6	L-23	1	4	0
6	L-23	1	5	10
6	L-23	2	1	10
6	L-23	2	2	20
6	L-23	2	3	5
6	L-23	2	4	10
6	L-23	2	5	10
6	L-23	3	1	20
6	L-23	3	2	40
6	L-23	3	3	20
6	L-23	3	4	5
6	L-23	3	5	30
7	M-22	1	1	40
7	M-22	1	2	10
7	M-22	1	3	20
7	M-22	1	4	5
7	M-22	1	5	5
7	M-22	2	1	1

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7	M-22	2	2	0
7	M-22	2	3	1
7	M-22	2	4	0
7	M-22	2	5	1
7	M-22	3	1	10
7	M-22	3	2	0
7	M-22	3	3	20
7	M-22	3	4	10
7	M-22	3	5	5
7	C-23	1	1	1
7	C-23	1	2	5
7	C-23	1	3	1
7	C-23	1	4	1
7	C-23	1	5	0
7	C-23	2	1	5
7	C-23	2	2	20
7	C-23	2	3	0
7	C-23	2	4	10
7	C-23	2	5	10
7	C-23	3	1	1
7	C-23	3	2	0
7	C-23	3	3	5
7	C-23	3	4	1
7	C-23	3	5	5
7	L-23	1	1	1
7	L-23	1	2	20
7	L-23	1	3	1
7	L-23	1	4	5
7	L-23	1	5	5
7	L-23	2	1	50
7	L-23	2	2	40
7	L-23	2	3	10
7	L-23	2	4	30
7	L-23	2	5	5
7	L-23	3	1	1
7	L-23	3	2	20
7	L-23	3	3	20
7	L-23	3	4	20
7	L-23	3	5	10
8	M-22	1	1	1
8	M-22	1	2	5
8	M-22	1	3	10
8	M-22	1	4	1
8	M-22	1	5	5
8	M-22	2	1	20
8	M-22	2	2	20
8	M-22	2	3	40

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8	M-22	2	4	30
8	M-22	2	5	30
8	M-22	3	1	5
8	M-22	3	2	10
8	M-22	3	3	15
8	M-22	3	4	10
8	M-22	3	5	20
8	C-23	1	1	30
8	C-23	1	2	40
8	C-23	1	3	50
8	C-23	1	4	40
8	C-23	1	5	50
8	C-23	2	1	60
8	C-23	2	2	20
8	C-23	2	3	60
8	C-23	2	4	50
8	C-23	2	5	40
8	C-23	3	1	
8	C-23	3	2	
8	C-23	3	3	
8	C-23	3	4	
8	C-23	3	5	
8	L-23	1	1	30
8	L-23	1	2	70
8	L-23	1	3	20
8	L-23	1	4	50
8	L-23	1	5	30
8	L-23	2	1	10
8	L-23	2	2	20
8	L-23	2	3	20
8	L-23	2	4	10
8	L-23	2	5	10
8	L-23	3	1	50
8	L-23	3	2	30
8	L-23	3	3	20
8	L-23	3	4	5
8	L-23	3	5	5
9	M-22	1	1	70
9	M-22	1	2	50
9	M-22	1	3	80
9	M-22	1	4	90
9	M-22	1	5	80
9	M-22	2	1	80
9	M-22	2	2	90
9	M-22	2	3	90
9	M-22	2	4	80
9	M-22	2	5	70

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9	M-22	3	1	60
9	M-22	3	2	80
9	M-22	3	3	70
9	M-22	3	4	80
9	M-22	3	5	80
9	C-23	1	1	90
9	C-23	1	2	95
9	C-23	1	3	80
9	C-23	1	4	95
9	C-23	1	5	80
9	C-23	2	1	80
9	C-23	2	2	80
9	C-23	2	3	90
9	C-23	2	4	90
9	C-23	2	5	70
9	C-23	3	1	60
9	C-23	3	2	80
9	C-23	3	3	80
9	C-23	3	4	70
9	C-23	3	5	60
9	L-23	1	1	90
9	L-23	1	2	70
9	L-23	1	3	70
9	L-23	1	4	90
9	L-23	1	5	50
9	L-23	2	1	90
9	L-23	2	2	60
9	L-23	2	3	80
9	L-23	2	4	80
9	L-23	2	5	90
9	L-23	3	1	70
9	L-23	3	2	70
9	L-23	3	3	80
9	L-23	3	4	70
9	L-23	3	5	60
10	M-22	1	1	80
10	M-22	1	2	90
10	M-22	1	3	90
10	M-22	1	4	90
10	M-22	1	5	70
10	M-22	2	1	85
10	M-22	2	2	70
10	M-22	2	3	80
10	M-22	2	4	75
10	M-22	2	5	80
10	M-22	3	1	70
10	M-22	3	2	80

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10	M-22	3	3	60
10	M-22	3	4	90
10	M-22	3	5	80
10	C-23	1	1	90
10	C-23	1	2	90
10	C-23	1	3	95
10	C-23	1	4	70
10	C-23	1	5	90
10	C-23	2	1	90
10	C-23	2	2	80
10	C-23	2	3	70
10	C-23	2	4	80
10	C-23	2	5	80
10	C-23	3	1	80
10	C-23	3	2	70
10	C-23	3	3	80
10	C-23	3	4	60
10	C-23	3	5	70
10	L-23	1	1	90
10	L-23	1	2	60
10	L-23	1	3	90
10	L-23	1	4	50
10	L-23	1	5	80
10	L-23	2	1	80
10	L-23	2	2	80
10	L-23	2	3	70
10	L-23	2	4	80
10	L-23	2	5	60
10	L-23	3	1	80
10	L-23	3	2	80
10	L-23	3	3	40
10	L-23	3	4	70
10	L-23	3	5	90
11	M-22	1	1	80
11	M-22	1	2	30
11	M-22	1	3	50
11	M-22	1	4	40
11	M-22	1	5	40
11	M-22	2	1	0
11	M-22	2	2	0
11	M-22	2	3	5
11	M-22	2	4	10
11	M-22	2	5	5
11	M-22	3	1	0
11	M-22	3	2	0
11	M-22	3	3	0
11	M-22	3	4	0

**CONFIDENTIAL (FINAL)**

11	M-22	3	5	40
11	C-23	1	1	70
11	C-23	1	2	10
11	C-23	1	3	5
11	C-23	1	4	10
11	C-23	1	5	0
11	C-23	2	1	5
11	C-23	2	2	0
11	C-23	2	3	0
11	C-23	2	4	1
11	C-23	2	5	0
11	C-23	3	1	5
11	C-23	3	2	5
11	C-23	3	3	5
11	C-23	3	4	1
11	C-23	3	5	0
11	L-23	1	1	80
11	L-23	1	2	90
11	L-23	1	3	90
11	L-23	1	4	70
11	L-23	1	5	60
11	L-23	2	1	60
11	L-23	2	2	80
11	L-23	2	3	80
11	L-23	2	4	70
11	L-23	2	5	60
11	L-23	3	1	40
11	L-23	3	2	60
11	L-23	3	3	80
11	L-23	3	4	60
11	L-23	3	5	70
12	M-22	1	1	65
12	M-22	1	2	90
12	M-22	1	3	90
12	M-22	1	4	70
12	M-22	1	5	70
12	M-22	2	1	80
12	M-22	2	2	80
12	M-22	2	3	60
12	M-22	2	4	70
12	M-22	2	5	90
12	M-22	3	1	90
12	M-22	3	2	90
12	M-22	3	3	80
12	M-22	3	4	60
12	M-22	3	5	80
12	C-23	1	1	90



**CONFIDENTIAL (FINAL)**

12	C-23	1	2	80
12	C-23	1	3	80
12	C-23	1	4	70
12	C-23	1	5	70
12	C-23	2	1	80
12	C-23	2	2	90
12	C-23	2	3	90
12	C-23	2	4	90
12	C-23	2	5	80
12	C-23	3	1	70
12	C-23	3	2	70
12	C-23	3	3	90
12	C-23	3	4	80
12	C-23	3	5	70
12	L-23	1	1	90
12	L-23	1	2	70
12	L-23	1	3	80
12	L-23	1	4	90
12	L-23	1	5	80
12	L-23	2	1	70
12	L-23	2	2	90
12	L-23	2	3	70
12	L-23	2	4	70
12	L-23	2	5	90
12	L-23	3	1	80
12	L-23	3	2	80
12	L-23	3	3	60
12	L-23	3	4	70
12	L-23	3	5	70

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