

# Final Report

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**PC 235**

**Bedding Plants: Assessment of the suitability of a range of miniature cyclamen varieties for use as late summer / autumn bedding plants**

Final report 2006

## AUTHENTICATION

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

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A handwritten signature in black ink, appearing to read 'W. Brough', written over a faint, illegible stamp.

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Date 9 June 2006

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Title	Bedding Plants: Assessment of the suitability of a range of miniature cyclamen varieties for use as late summer / autumn flowering bedding plants
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## **Grower Summary**

### **Headline**

- The majority of the miniature cyclamen series / varieties examined in the trial were suitable for production in both 9cm pots and double six packs for use as late summer / autumn bedding plants.

### **Summary of results**

The majority of the miniature cyclamen series / varieties examined in the trial were suitable for production in both 9cm pots and double six packs. However, the two midi series (Macro Pastel and Sterling Silver) included in the trial and three of the more vigorous miniature varieties (Compact neon pink, Compact mixed and Mini F1 Compact white) require further commercial assessment using a more intensive chemical plant growth regulator programme to ascertain their suitability to pack (and to a lesser extent pot) production.

All the series performed relatively well in the shelf life trial, all the pot plants lasting up to 3 weeks and most of the pack plants up to 2 weeks. Garden performance was also good, the plants (especially the pot grown material) performing well from planting in late September until the first severe frosts in mid November. The variety Silverado scarlet was selected by the public as their favourite variety from all those examined.

### **Background and expected deliverables**

Miniature cyclamen (*C. persicum* type) have been available as a 9cm pot plant product for many years. Originally open pollinated, recent plant breeding programmes have produced a wide range of uniform F1 hybrid types.

Around 10 years ago, other uses for miniature cyclamen commenced on the continent, such as outdoor planting in the autumn. Cyclamen are now used from the late summer onwards in patio containers and baskets, both in gardens and amenity areas. This trend for using miniature cyclamen as bedding plants, reached the UK several years ago. Since then several UK growers have developed rapidly expanding markets for miniature cyclamen in double six packs (as opposed to traditional 9cm pots) for various outlets, especially multiple retail outlets.

Whilst Defra statistics indicate there were around 5.5–6 million cyclamen of all sizes grown in the UK in 2003, the various seed suppliers have indicated that some 16 million seed were sold in the UK during 2004, of which it is estimated that around 14 million were miniature cyclamen, around 3 million being pack grown. Assuming only moderate germination rates it appears that the market for miniature cyclamen in the UK is much larger than the national records indicate.

At least 15 separate series of miniature cyclamen are currently available, mainly F1 hybrid types, the most popular series being Miracle (Goldsmiths) and Metis (Morel). Whilst these series have been assessed for use as pot plants, no independent assessments exist for their use as late summer / autumn bedding plants grown outside either in containers or directly in the garden. The only assessments that have been undertaken are ‘in-house’ assessments carried out by the plant breeding companies / seed houses covering their own range of products. Minimal shelf life and garden performance information exists on plants grown specifically for the bedding plant market in double six packs.

The objectives of this trial were threefold and included:

1. Assessment of as wide a range of miniature cyclamen series as possible for use as late summer / autumn bedding plants at two sites accessible to the public in the UK.
2. Assessment of the range of cyclamen grown for both shelf life and garden performance. Characteristics recorded during garden life included: flowering period, the extent and longevity of flowering, presence of recognisable flower scent, weather and cold tolerance (both plant and flowers), ability to provide ground cover and disease susceptibility.
3. Obtain feedback from the gardening public on the range of cyclamen examined.

### Summary of project and main conclusions

A range of fourteen miniature cyclamen series / varieties were examined in the trial.

Supplier	Variety
BallColegrave / Goldsmiths	Sterling Silver, Silverado scarlet, Miracle and Midori.
Eyraudplants	Mini F1 Compact, Sunkiss, Mini Astree and Mini Star.
Morel	Metis.
Syngenta	Libretto.
Schoneveld	Mini Winter, Compact, Original and Macro.

The trial consisted of four distinct phases – production, shelf life, garden performance and public assessment of the series / varieties examined. Seedlings were produced in 240 plug trays at WJ Findon and Son and grown on in 9cm



pots or trays of 6 x 8cm pots (the equivalent of a retail double six pack) at Kinglea Plants as a commercial crop. Once the miniature cyclamen series had reached a marketable stage, a four week shelf life trial commenced on a selection of plants at Kinglea Plants. At the same time a garden performance trial was also undertaken at RHS Wisley and Springfields Festival Gardens, Lincs. Pot and pack grown flowering plants were planted out into the soil and into 50cm diameter plastic pots during late September 2005. On two separate occasions in October the general public were then invited to select their favourite varieties at each site.

## **Production**

The germination rates attained for many of the varieties was good, in excess of 90%, although for a number of varieties including Mini Star white, Mini Star mixed and Silverado scarlet, germination was 70% or less, a factor which would need to be taken into account when producing these varieties from seed.

Sowings in weeks 8 and 11 produced plugs of sufficient size at transplanting for crops destined for a marketing period of week 33 onwards (late August to early September). The later sowing (week 15) produced less developed plugs at the time of transplanting that did not give rise to marketable crops until mid September onwards. However, the time taken to produce a marketable crop from a week 15 sowing relative to a week 8 sowing was on average around 5 weeks less.

Production times (sowing to final product) were shorter for pot grown material, however this will be determined commercially by the final specification for each, pack production times would be shorter if the specification for flower number per pack was less demanding.

Production times from sowing were found to be 21 weeks onwards from a week 15 sowing and 23 weeks onwards from an earlier sowing. The difference in production times between series from the same sowing date was up to 5-6 weeks. Differences between varieties in the same series was usually no more than 1-2 weeks, which eases the problem of trying to obtain a range of flower colours for a particular series on a specific marketing date. There were exceptions to this however, the variety Compact white when pot grown was 3-4 weeks earlier than the mixed and pink variety, whilst pack grown Midori and Miracle white were 4 weeks earlier than the deep rose variety. A detailed table of production times for all varieties can be found in the full report for this project.

The fourteen different cyclamen series / varieties examined in the trial varied in their suitability for 9cm pot and pack production. Two of the series (Macro Pastel and Sterling Silver) were medium / midi series rather than miniature and so were more vigorous than the other series. The miniature varieties Compact neon pink, Compact mixed and Mini F1 Compact white were also relatively vigorous. These varieties require further assessment using a more intensive chemical plant growth

regulator programme to ascertain their suitability to pack (and to a lesser extent pot) production.

As a result of their vigour, all these series / varieties had high levels of recorded wastage for pack production (and to a lesser extent pot production). The remaining series and varieties were of a vigour more suited to pack and 9cm pot production, although the Mini Astree Series, Mini Star Series and Midori series were quite compact and sometimes struggled to fill a 9cm pot.

The series / varieties also varied in other ways, a number were very floriferous early in the trial, for example Metis, whereas other series / varieties were very slow to come into flower including Macro Pastel, Sterling Silver, Original neon pink and Mini Winter mixed. A number had interesting foliage patterns / bold leaf variegation – Mini F1 Compact white, Sterling Silver and Silverado scarlet. Several appeared more prone to *Botrytis*, especially when grown in packs including Mini Astree series, Midori series, Miracle series and Silverado scarlet.

### **Shelf life**

With a moderate level of plant care (watering the plants from below where possible and removing dying flowers and leaves), plant quality through the shelf life period was maintained. A marketable quality was maintained for 3 weeks with all of the pot grown plants and a marketable quality of 2 weeks was attained with most of the pack grown plants. Varieties that appeared to have the best shelf life when pot grown included – Mini F1 Compact 45RV, Compact neon pink, Mini Astree mixed and Midori deep rose. Midori deep rose, Compact neon pink, Mini Astree white and Sunkiss mixed all maintained their quality as pack grown plants. Losses in quality were most significant for the Macro Pastel and Sterling Silver series due to stretching / poor plant habit.

Throughout shelf life the most floriferous series were Metis, Mini Star, Midori and Miracle; the Macro Pastel series was reluctant to flower in both pots and packs.

*Botrytis* was primarily a problem on the pack grown plants through shelf life, on several occasions *Botrytis* outbreaks were noted on the pot grown plants but the disease often disappeared by the following assessment.

Flower fragrance was noticeable throughout shelf life with several of the series including: Metis (excluding scarlet salmon), Midori, Miracle and Sterling Silver.

### **Garden performance**

The two sites used in the trial (RHS Wisley and Springfields Festival Gardens) provided a good test for the plants in terms of their relative aspect and exposure.

The RHS Wisley site was on a south-facing slope in a frost pocket, whilst the Springfields Festival Gardens site was on a flat exposed site. Differences in plant performance (primarily flower production and level of *Botrytis*) were noted between the two sites, on average the plants at the Springfields Festival Gardens site produced more flowers and suffered less from *Botrytis*. Frosts at both sites during the second week in November caused damage to the plants (both flowers and foliage) and brought the trials to a halt.

Differences between soil and container planted material were noted. Material planted in containers was generally the most vigorous, but competition for space limited the final plant size. *Botrytis* was also more prevalent in the container planted material.

Differences between pot and pack grown plants were obvious in the trial especially at the beginning. The pot grown plants were larger and had a greater number of flowers, making an instant impact after planting. However, differences in plant size between pot and pack grown plants became less as the trial progressed, an earlier planting date would have permitted further development of the pack grown plants.

Parameter	Soil planted		Container planted	
	Pot grown	Pack grown	Pot grown	Pack grown
Av. foliage height (cm)	9	7	10	8
Av. plant width (cm)	18	14	15	13
Av. flower number per plant	6	2	5	2
Av. <i>Botrytis</i> score	0.3	0.0	1.0	0.6
Av. weather tolerance score	2	2	2	2
Av. Plant quality score	4	3	4	3

On average only a small amount of growth (which may just have been leaf canopy expansion) occurred following planting out. The more vigorous series (Macro Pastel and Sterling Silver) produced the largest plants post planting and were suited to soil planting where the foliage canopy gave good levels of ground cover. These two series proved to be too vigorous when planted 10 plants per 50cm diameter container. Conversely, the more compact series (Mini Star, Libretto, Midori and Miracle) produced only minimal ground cover when soil planted and often struggled to fill the container.

Many of the varieties that had been the most floriferous through production and shelf life continued to produce the highest number of flowers after planting (Metis scarlet salmon, Midori deep rose and Miracle deep rose). Macro Pastel, Sunkiss, Libretto and Sterling Silver produced only modest numbers of flower.

Post planting *Botrytis* was not a major problem, especially early in the trial. Later in the trial the disease became more prevalent on the more vigorous varieties planted in containers and on frost damaged plant tissue.

Differences in weather tolerance were noted. Many of the white flowered varieties were prone to flower damage and required frequent dead heading, whilst the pink flowered varieties suffered from a flower bleach of varying severity. Leaf bronzing / speckling was evident on several varieties including Mini Star mixed, Compact neon pink, Compact white, Original neon pink, Sterling Silver white, Miracle white and Metis white.

Over the whole trial period, fragrance was most notable on Midori deep rose, Miracle deep rose and Miracle white.

The average post planting quality scores were similar for all the varieties examined in the trial, with slightly higher scores being recorded for Marco Pastel neon pink, Mini F1 Compact mixed, Sunkiss rose, Midori deep rose and Miracle deep rose.

### Public assessment

The top five varieties selected at each site are presented below:

RHS Wisley	Springfields Festival Gardens
Silverado scarlet	Silverado scarlet
Mini Compact 5 BA	Midori deep rose
Miracle deep rose	Miracle deep rose
Midori deep rose	Sterling Silver pink
Metis scarlet salmon	Mini Compact 5 BA

The selections made by the public appeared to be based primarily on the visual appearance of the plants, generally bold flower colours and or flower number. Foliage colour and foliage colour relative to flower colour were also important, hence the selection of Silverado scarlet as the favourite variety at both sites. Habit, plant vigour and flower fragrance appeared of lesser importance.

## **Financial benefits**

As previously mentioned, the use of miniature cyclamen for autumn bedding plants is rapidly expanding in the UK. This trial was designed to verify the suitability of use of both pot and pack grown miniature cyclamen as autumn bedding plants under UK weather conditions and to further promote their use in this way to retailers and directly to the gardening public.

Currently the pack grown miniature cyclamen market is worth well in excess of £1 million (wholesale value) and the pot grown market even more than this (though it is not known what proportion of pot grown plants are used as bedding plants as opposed to pot plants). However, there is still considerable potential to expand this market further during a period that has been traditionally dominated by pot and pack grown pansy / viola sales. As a relatively high value bedding plant, there was a need to determine garden performance (which was addressed by the trial) to ensure value for money for the final customer, increase the potential market size (by raising public awareness of miniature cyclamen) and to encourage repeat purchase of the product from year to year by the public.

The trial also highlighted how a moderate level of plant care during shelf life can maintain plant quality in the retail environment and potentially extend product shelf life.

## **Action points for growers**

The trial results highlighted a number of areas that can be acted upon by growers:

**1. Variety selection.** The public who scored the plants at both trial sites appeared to judge those varieties with bold flower colours, high flower numbers and or interesting foliage more highly than the other varieties in the trial. Other traits such as flower scent appeared of less importance but should still not be overlooked when selecting varieties for production.

**2. Production / marketing times.** Sowings during week 8 produced marketable plants from week 32 onwards whilst a week 15 sowing date gave rise to marketable plants from week 36 onwards. Differences in production times between series were as great as 5–6 weeks. Sequential sowings or the use of several varieties can therefore be used to programme production through late summer and autumn.

**3. Pot versus pack production.** Pot grown plants gave instant visual impact in terms of flower number and plant size. It is more important to offer pack grown plants earlier in the year (late August / early September) to allow them time to develop after they have been planted out. To minimise losses in pack production ensure the plants are spaced appropriately and that any specification for flower

number is achievable without loss of plant quality. Consider the use of plant growth regulators to limit plant stretch during production.

**4. Container / soil planting.** The more vigorous midi / medium (and possibly large cyclamen) are potentially useful for soil planting / landscape use as they gave rise to moderate levels of ground cover with their foliage and provided dramatic flower colour during late autumn. Conversely there is a need to ensure sufficient numbers of compact varieties are used in larger pots and containers.

**5. Need for promotion.** Many of the people who assessed the trials were familiar with cyclamen but were unaware of the use of miniature cyclamen as an autumn bedding plant. There is therefore a need to provide guidance on the use of miniature cyclamen as autumn bedding plants and how to maintain them to maximise their potential.

## Science Section

### Introduction

Miniature cyclamen (*C. persicum* type) have been offered as a pot plant product grown in a 9cm pot for many years. Originally open pollinated (such as the Dresden types), recent plant breeding programmes have produced a wide range of uniform F1 hybrid types. Around 10 years ago other uses for miniature cyclamen commenced on the continent, such as planting flowering material outside in the autumn. This has since developed further and cyclamen are now used from the late summer onwards in patio containers and baskets, both in gardens and amenity areas. This trend for using miniature cyclamen as bedding plants, reached the UK several years ago. Since then several UK growers have developed rapidly expanding markets for miniature cyclamen in double six packs (as opposed to 9cm pots) for various outlets, especially multiple retail outlets.

Whilst Defra statistics indicate there were around 5.5–6 million cyclamen of all sizes grown in the UK in 2003 (Defra 2003), the various seed suppliers have indicated that some 16 million seed were sold in the UK during 2004, of which it is estimated that upwards of 14 million were miniature cyclamen, around 3 million being pack grown (anon 2005). Assuming only moderate germination rates it appears that the market for miniature cyclamen in the UK is much larger than the national records indicate.

At least 15 separate series of miniature cyclamen are currently available, mainly F1 hybrid types, the most popular series being Miracle (Goldsmiths) and Metis (Morel). Many of these series are available in a wide flower colour range. Whilst these series have been assessed for use as pot plants, no independent assessments exist for their use as late summer / autumn bedding plants grown outside either in containers or directly in the soil. The only assessments that have been undertaken are 'in-house' assessments carried out by the plant breeding companies / seed houses covering their own range of products. Minimal shelf life and garden performance information exists on plants grown specifically for the bedding plant market in double six packs.

The objectives of this trial were threefold and included:

1. Assessment of as wide a range of miniature cyclamen series as possible for use as late summer / autumn bedding plants at two sites accessible to the public in the UK.
2. Assessment of the range of cyclamen grown for both shelf life and garden performance. Characteristics recorded during garden life included: the extent and longevity of flowering, presence of recognisable flower scent, weather and

cold tolerance (both plant and flowers), ability to provide ground cover and disease susceptibility.

3. Obtain feedback from the gardening public on the range of cyclamen examined.



## Materials and Methods

### Production and marketing assessments

Seed of eleven different miniature and two medium sized / midi cyclamen series were requested from a range of suppliers through January and February 2005 as listed below in Table 1.

**Table 1.** Miniature and medium sized cyclamen series by supplier

Supplier	Variety
BallColegrave / Goldsmiths	Sterling Silver*, Miracle and Midori
Eyraudplants	Mini F1 Compact, Sunkiss, Mini Astree and Mini Star.
Morel	Metis
Syngenta	Libretto
Schoneveld	Mini Winter, Compact, Original and Macro*.

\* Medium / midi sized series

Wherever possible two separate flower colours (pink and white) and a mixed range of colours were sought for each series. In a small number of cases specific flower colours could not be obtained or other varieties were sent in error and could not be validated until the plants came into flower as detailed in Table 2.

**Table 2.** Amendments to the list of miniature cyclamen series / varieties

Requested variety	Actual variety provided
Metis pink	Metis scarlet salmon
Midori mixed	Unavailable
Mini Winter neon pink	Mini Winter mixed
Mini Winter white	Mini Winter mixed
Miracle mixed	Transplanted later into packs only
Original mixed	Unavailable
Original white	Original neon pink
Sterling Silver mixed	Silverado scarlet
Libretto (pink, white and mixed)	Transplanted later into packs only

All the seed except 'Libretto' were sown upon receipt at W.J. Findon and Son and raised as a commercial plug crop. In the case of Libretto, plug plants were supplied directly by Syngenta (the plants were grown in a 72 cell plug tray from a week 14 sowing). As the seeds arrived over a number of weeks, three

separate sowings had to be undertaken during weeks 8, 11 and 15. All the seed were sown into 240 plug trays. Full cultural production details are presented in Appendix 1.

All the cyclamen seedlings produced at W.J. Findon and Son were transported to Kinglea Plants, where they were machine transplanted. Material was transplanted on 13 June 2005 into both 9cm pots and 8cm square pots, 6 per plastic outer tray (the equivalent of a retail double six pack) with the exception of the various Libretto varieties and Miracle mixed which were transplanted into packs on 8 July 2005.

At transplanting, the plugs were graded by size and the numbers transplanted recorded (Figure 9, Appendix 2 and Table 4). As expected, the later sowing gave rise to the smallest plugs at transplanting, however with the exception of the Sterling Silver (rose and white), Silverado scarlet, Midori white and Miracle white all the plugs were of a satisfactory size at transplanting. The actual number of seedlings transplanted per variety varied depending upon the original number of seed supplied by the breeders and the germination rate attained.

After transplanting the pots and packs were labelled and laid down on production beds (myex over soil) to be grown on as shown in Figures 10 and 11, Appendix 2. The seedlings transplanted into pots were placed down in outer trays of 18 whilst the 'pack' material was placed down as units of 6 plants per tray at the final spacing. Full cultural production details are presented in Appendix 1.

The plants were regularly inspected for the first sign of flower bud development. The start of marketing (week number) was noted for each variety when a certain level of flower development had occurred, for pots this was 50% of plants showing 2-3 open flowers and for packs 50% of packs showing 2 open flowers. Production times from sowing to marketing were then calculated.

When a sufficient number of plants had reached specification (Kinglea Plants specifications for pot and pack grown plants can be found in Appendix 3) for each variety (a minimum of 18 plants in pots and 4 packs for each variety) a range of physical parameters was recorded and scores attributed. These records were taken during weeks 35, 38 and 39, with the bulk of the plants being recorded through week 38 (Table 3 summarises the week the plant assessment was undertaken for each variety in the trial).

Those varieties reaching marketing well in advance of the others (those coming into flower during weeks 33, 34 and 35) and those producing large numbers of flowers early on had their open flowers removed by hand following recording in attempt to ensure that most varieties had reached a similar level of development prior to the start of the shelf life and garden performance assessments.

The following physical parameters and scores were recorded at the marketing assessment:

- **Plant height**, in centimetres from the growing media surface to the top of the foliage.
- **Plant width**, in centimetres across the widest part of the plant.
- **Foliage size**. Average leaf length from the 'shoulder' of the leaf to the leaf tip. Based on three size categories – score 1: up to 40 mm, score 2: 40–60 mm and score 3: 60 mm plus. (See Figure 12, Appendix 2).

**Table 3.** Week number of plant assessment per variety

Variety	Week number of recording - pots	Week number of recording - packs
Compact neon pink	38	38
Compact white	35	38
Compact mixed	38	38
Macro Pastel neon pink	38	38
Macro Pastel white	38	38
Macro Pastel mixed	38	38
Metis scarlet salmon	35	35
Metis white	35	35
Metis mixed	35	35
Mini Winter mixed	38	38
Original neon pink	35	38
Mini Astree rose	38	38
Mini Astree white	38	38
Mini Astree mixed	35	35
Mini F1 Compact 45 RV (rose)	38	38
Mini F1 Compact 5 BA (white)	38	38
Mini F1 Compact mixed	38	35
Mini Star rose	35	35
Mini Star white	38	35
Mini Star mixed	38	38
Sunkiss rose	38	38
Sunkiss white	38	38
Sunkiss mixed	38	38
Libretto pink		39
Libretto white		39
Libretto mixed		39
Midori deep rose	38	38
Midori white	38	39
Miracle deep rose	38	38
Miracle white	38	39
Miracle mixed		39
Sterling Silver rose	38	38
Sterling Silver white	38	39
Silverado scarlet	38	39

- **Foliage colour.** Based on a grading system to describe the level of variegation and depth of background green on the leaf. A – dark green leaf with marbling. B – dark green leaf with solid marble band in leaf. C – Light green leaf with marbling. D – Light green leaf with solid marble band in leaf. E – Green leaf with no marbling. F – Silver variegation in leaf. (See Figure 13, Appendix 2).
- **Flower number.** A count of all open flowers present on the plant.
- **Flower size.** Average flower size from the base of the flower to the tip of the petal. Based on three size categories – score 1: up to 20 mm, score 2: 20–30 mm and score 3: 30 mm plus. (See Figure 14, Appendix 2)
- **Flower (stem) height,** in centimetres. Length of the flower stem from the top of the foliage to the top of the flower.
- ***Botrytis* score.** Based on a scoring system of 0–3. Score 0: no visible signs of disease, score 1: low level noted around base of the plant, score 2: moderate level of disease noted around base of plant and on older foliage and score 3: disease clearly evident reducing plant quality.
- **Fragrance.** A record of whether scent was present or not.
- **Overall quality score.** Based on a scoring system of 0–5 for pots and packs, score 0: very poor, score 3: marketable and score 5: excellent quality. (See Figure 15, Appendix 2).

The data from 18 individual pots and 4 packs (6 plants per pack) per variety were used to calculate the average figures.

Missing (dead) plants and plants deemed unmarketable were also recorded at the marketing assessment so that a percentage marketable figure could be calculated for each variety.

### **Shelf life assessment**

Following the marketing assessment, plants were selected to go into the shelf life trial for a period of 4 weeks. Six pots and one pack (6 plants) from each variety were placed into the shelf life trial on 26 September 2005. The shelf life facilities were constructed at Kinglea Plants in the corner of the main glasshouse used for seed sowing. This corner of the glasshouse had a whitewashed roof and one metal and one glass side (this reduced light levels, relative to those experienced outside by 90%, as recorded by a light meter). A door next to the benching permitted good ventilation and the whole area was also artificially lit with fluorescent lights. The benching had dual level shelving and the cyclamen were stood down on capillary matting covered with white micro-perforated polythene (Figure 16, Appendix 2). The plants were placed on the shelving pot and pack thick and watered by hand from below using a watering can. No liquid feeds or pesticides were applied during the shelf life period, dying leaves and flowers were removed by hand at each assessment. A pre-shelf life assessment of the plants

was undertaken on the 28 September 2005 and then weekly assessments occurred thereafter (6 October, 12 October, 19 October and 26 October 2005).

At each assessment the following parameters were recorded:

- **Quality score.** Based on a scoring system of 0–5 for pots and packs, score 0: very poor, score 3: marketable and score 5: excellent quality.
- **Foliage colour.** Based on a scoring system of 1–3 to record any reduction in colour relative to the start of the trial. Score 3: no loss of colour, score 2: slight loss of colour, score 1: loss of colour clearly evident.
- **Flower number.** The total number of open flowers per plant recorded.
- **Number of dead flowers or flowers removed.**
- **Plant habit.** A written description.
- ***Botrytis* score.** Based on a scoring system of 0–3, score 0: no visible disease, score 1: low level of disease noted around base of plant, score 2: moderate level of disease evident around the base of the plant and on older foliage, score 3: disease clearly evident reducing plant quality.
- **Fragrance.** A record of whether scent was present or not.
- **Further comments.** This covered flower colour fade, flower position, flower size, any signs of plant stretch when significant.

Summaries of the average quality scores for each variety (pot and pack grown plants) per week over the four-week period of the shelf life trial were then generated.

### **Garden performance assessment**

Plants destined for the garden performance assessment were selected for dispatch on the 26 September 2005 and delivered the following day via commercial transport. The plants were delivered to two sites, RHS Wisley in Surrey and Springfields Festival Gardens in Lincolnshire. Planting occurred at RHS Wisley (Portsmouth Trial Ground) on 29 September 2005 and at Springfields Festival Gardens on the following day, 30 September 2005. Both pack and pot grown plants were planted into the soil and large plastic containers (Figures 17 and 18, Appendix 2).

### ***Soil planted material***

The areas at both sites were prepared and maintained by RHS Wisley and Springfields Festival Gardens staff respectively. The trial / display beds at both sites were dug over before planting and at Springfields Festival Gardens a general purpose organic fertiliser was added at 35g per square metre to the freshly created beds. Planting and labelling occurred under ADAS supervision. 12 plants per variety were planted in each plot, 6 pot grown plants in one half of the plot and 6 pack grown plants in the other half. The plants were planted 20cm x 20cm centre to centre in a block 3 x 4 plants. The trial was not replicated or statistically analysed. A one-metre guard strip was left between each plot.

### ***Container planted material***

50cm diameter pots were selected for use in the trial (terracotta coloured pots at Springfields Festival Gardens and black pots at RHS Wisley). Both sets were filled with a standard peat based general-purpose growing media (no extra nutrients were added). Planting and labelling occurred under ADAS supervision. Ten plants per variety were planted into each container, 5 pot grown plants in one half of the container and 5 pack grown plants in the other half. The trial was not replicated or statistically analysed. The containers were stood adjacent to the relevant varieties planted in the soil.

Weather data (maximum and minimum temperatures and rainfall) was recorded at RHS Wisley and obtained from HRI Kirton for Springfields Festival Gardens for the period of the trial September – December 2005 (Appendix 4).

The plants were assessed approximately 2, 4 and 8 weeks after planting on the following days: RHS Wisley – 15 and 29 October and 24 November 2005, Springfields Festival Gardens – 11 and 27 October and 23 November 2005. The following parameters were recorded at each assessment:

- **Foliage height**, in centimetres from the soil / growing media surface to the top of the foliage.
- **Plant width**, in centimetres measured at the widest point of the plant.
- **Flower number**. The total number of open flowers per plant.
- **Botrytis score**. Based on a scoring system of 0–3, score 0: no visible disease, score 1: low level of disease noted around base of plant, score 2: moderate level of disease evident around the base of the plant and on older foliage, score 3: disease clearly evident reducing plant quality.
- **Weather tolerance**. Based on a scoring system of 0–3, score 3: good tolerance, little or no signs of damage, score 2: evidence of weather damage to flowers with limited foliage damage, score 1: clear evidence of weather damage to both flowers and foliage, score 0: plant ruined by weather.
- **Quality score**. Based on a scoring system of 0–5 for pots and packs, score 0: very poor, score 3: average and score 5: excellent quality.
- **Fragrance**. A record of whether scent was present or not.
- **Further comments**. This covered flower colour fade, foliage colour, plant vigour when significant.

Summaries of the average quality scores for each variety (pot and pack grown plants) per week over the eight-week period of the garden performance trial were then generated.

### **Public assessment**



On two separate dates, 15 and 29 October 2005 (approximately 2 and 4 weeks post planting) open days were arranged where the public could view the plants in the trial at each site. The public were invited to select their top three varieties grown in both the soil and in containers and asked to note the most appealing attribute of the varieties selected. An information sheet and questionnaire were created to achieve this (Appendix 5). A total of 139 questionnaires were completed at both sites and the information generated was summarised.

## Results and Discussion

### Production and marketing assessments

#### *(a). Germination rates and plug production*

The germination rate achieved for most of the miniature cyclamen varieties was good, over 90% for many of the varieties examined in the trial (Table 4). However, a small number of varieties had lower germination rates (64–79%) including Mini Star white, Mini Star mixed, Silverado scarlet, Sunkiss white and Sunkiss mixed. All of the varieties sown in weeks 8 and 11 produced plug plants of sufficient size by the transplanting date (13 June 2005). It was not always necessarily the case that the earliest sowings gave rise to the largest plug plants, several of the varieties sown in week 8 only produced plugs of an average size (3–4 true leaves).

The later sowing (week 15) did not allow sufficient time for the production of a plug plant of satisfactory size by transplanting. As can be seen from Table 4, many of the plugs supplied from the week 15 sowing were less developed having only 2 true leaves at transplanting and had to be handled with care.

#### *(b). Finished plant production*

The production times from sowing to the start of marketing for all the miniature cyclamen varieties examined in the trial varied from 22 to 31 weeks for pot grown material and 21 to 33 weeks for pack grown material as presented in Table 5. When viewed by sowing date, the more extreme differences in production times were recorded for the varieties sown in week 8. The Compact, Macro Pastel and Mini Winter series were slower to develop, taking 5–6 weeks longer when pot grown to produce a finished product compared to the Metis series sown in the same week.

Differences in the production times between the miniature cyclamen series from later sowings was much less, typically around 2–3 weeks. Differences in the production times between varieties in the same series were usually no more than 1–2 weeks, although on a small number of occasions 4 week time differences were recorded. Such differences will hamper attempts at crop programming.

In the main the time taken to produce a finished plant in a 9cm pot was less than that of a plant in a unit of six plants. Canopy cover was often achieved quicker with the pack grown plants but flower production was generally slower with many of the varieties.

In terms of total production times, the later sowings during week 15 produced finished plants in an average of 24 weeks compared to 29 weeks from a week 8

sowing. For growers producing their own miniature cyclamen plants from seed this difference of 5 weeks is significant and it may mean sowing can be delayed for several weeks at the beginning of the year, helping to reduce any required heat input. However, as a consequence plant material would not be ready until mid-September onwards.

The physical measurements of each variety at the point of marketing are presented in Table 6 and photographs in Figure 1. The following is a summary of each series:

**Table 4.** Miniature cyclamen transplanting information

Variety	Sowing week	Percentage germination	Average plug grade	Number transplanted into pots	Number transplanted into packs
Compact neon pink	8	95	3	43	44
Compact white	8	98	3	90	94
Compact mixed	8	97	3	52	47
Macro Pastel neon pink	8	82	4	42	44
Macro Pastel white	8	97	3	51	46
Macro Pastel mixed	8	84	3	44	42
Metis scarlet salmon	8	92	4	129	163
Metis white	8	85	4	143	144
Metis mixed	8	95	4	146	141
Mini Winter mixed	8	95	3	39	42
Original neon pink	8	86	4	93	84
Mini Astree rose	11	99	4	117	115
Mini Astree white	11	96	4	113	113
Mini Astree mixed	11	98	3	122	113
Mini F1 Compact 45 RV (rose)	11	99	3	139	113
Mini F1 Compact 5 BA (white)	11	92	3	125	111
Mini F1 Compact mixed	11	94	4	75	110
Mini Star rose	11	93	4	113	109
Mini Star white	11	64	4	85	88
Mini Star mixed	11	70	4	82	79
Sunkiss rose	11	85	4	96	108
Sunkiss white	11	75	4	83	95
Sunkiss mixed	11	79	4	99	90
Libretto pink*	14		3		72
Libretto white*	14		3		72
Libretto mixed*	14		3		66
Midori deep rose	15	92	3	156	221
Midori white	15	86	2	198	185
Miracle deep rose	15	88	3	219	210
Miracle white	15	91	2	228	222
Miracle mixed *	15	92	4		72
Sterling Silver rose	15	86	2	176	176
Sterling Silver white	15	94	2	100	100
Silverado scarlet	15	68	2	222	216

Key

Plugs transplanted 13 June 2005 except those marked \* which were transplanted 8 July 2005.

Plug grade

Grade 1 - seedling with one true leaf

Grade 2 - seedling with two true leaves

Grade 3 - seedling with 3-4 true leaves (average grade)

Grade 4 - seedling with 5 plus leaves and moderate habit (good grade)

Grade 5 - seedling with 5 plus leaves and good habit (excellent grade)

(See Figure 9, Appendix 2 for photographic record of plug sizes).

**Table 5.** Production times for the pot and pack grown miniature cyclamen varieties

Variety	Sowing week	Start of marketing - pots (week number)	Time from sowing (number of weeks)	Start of marketing - packs (week number)	Time from sowing (number of weeks)
Compact neon pink	8	39	<b>31</b>	41	<b>33</b>
Compact white	8	35	<b>27</b>	39	<b>31</b>
Compact mixed	8	38	<b>30</b>	39	<b>31</b>
Macro Pastel neon pink	8	39	<b>31</b>	39	<b>31</b>
Macro Pastel white	8	39	<b>31</b>	40	<b>32</b>
Macro Pastel mixed	8	38	<b>30</b>	40	<b>32</b>
Metis scarlet salmon	8	34	<b>26</b>	34	<b>26</b>
Metis white	8	33	<b>25</b>	32	<b>24</b>
Metis mixed	8	33	<b>25</b>	33	<b>25</b>
Mini Winter mixed	8	40	<b>32</b>	40	<b>32</b>
Original neon pink	8	35	<b>27</b>	40	<b>32</b>
Mini Astree rose	11	36	<b>25</b>	37	<b>26</b>
Mini Astree white	11	37	<b>26</b>	37	<b>26</b>
Mini Astree mixed	11	35	<b>24</b>	35	<b>24</b>
Mini F1 Compact 45 RV (rose)	11	36	<b>25</b>	37	<b>26</b>
Mini F1 Compact 5 BA (white)	11	36	<b>25</b>	37	<b>26</b>
Mini F1 Compact mixed	11	36	<b>25</b>	35	<b>24</b>
Mini Star rose	11	35	<b>24</b>	34	<b>23</b>
Mini Star white	11	37	<b>26</b>	35	<b>24</b>
Mini Star mixed	11	36	<b>25</b>	37	<b>26</b>
Sunkiss rose	11	39	<b>28</b>	37	<b>26</b>
Sunkiss white	11	38	<b>27</b>	39	<b>28</b>
Sunkiss mixed	11	38	<b>27</b>	39	<b>28</b>
Libretto pink*	14			37	<b>23</b>
Libretto white*	14			38	<b>24</b>
Libretto mixed*	14			39	<b>25</b>
Midori deep rose	15	40	<b>25</b>	41	<b>26</b>
Midori white	15	38	<b>23</b>	37	<b>22</b>
Miracle deep rose	15	39	<b>24</b>	41	<b>26</b>
Miracle white	15	37	<b>22</b>	37	<b>22</b>
Miracle mixed*	15			36	<b>21</b>
Sterling Silver rose	15	40	<b>25</b>	41	<b>26</b>
Sterling Silver white	15	40	<b>25</b>	41	<b>26</b>

Silverado scarlet	15	39	<b>24</b>	39	<b>24</b>
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\* Plugs transplanted 8 July 2005.

### ***Compact series***

A relatively vigorous upright series, especially the neon pink variety. Dark green leaves with a solid marble band. Slow to produce flower. Moderate sized flowers borne well above the foliage. Mixed variety consisted mainly of purple flowers. Performed well in 9cm pots but the mixed and neon pink varieties were a little vigorous in packs. Leaf scorch noted on the white variety in packs.

### ***Macro Pastel series***

A very vigorous series with an open growth habit and large leaves (the series was medium sized rather than miniature in stature). Light / dark green leaves with a solid marble band. Slow to produce flower and limited numbers produced, but the flowers were moderate to large in size. The mixed variety consisted mainly of pink flowers. A large plant for 9cm pot and pack production. Leaf size reduced when grown in packs.

### ***Metis series***

A moderately vigorous, upright series. Dark green leaves with marbling / solid marble band. Moderate sized flowers borne well above the foliage. Good mix of flower colour in the mixed variety. Good level of flower production. Suited to both 9cm pot and pack production. Leaf scorch noted on white and mixed varieties in packs. Fragrant flowers depending upon flower colour.

### ***Mini Winter series (mixed variety only)***

A moderately vigorous variety. Dark green leaves with a solid marble band. Good mix of flower colour, but slow to come into flower. Suited to 9cm pots, a little vigorous in packs. Leaf scorch noted on pack grow material.

### ***Original series (neon pink only)***

A relatively compact variety, with a mounded growth habit. Dark green leaves with a solid marble band. Good flower production in pots, but very slow to come into flower in packs. Suited to 9cm pot production and pack production.

### ***Mini Astree series***

A compact series with variable growth habit. Both leaf colour and the level of marbling variable. Good level of flower production (except mixed), but primarily pinks / reds in the mixed variety. Suited to 9cm pot and pack production (sometimes a little too compact), some *Botrytis* noted in pack production.

### ***Mini F1 Compact series***

The pink flowered variety was compact relative to the white flowered variety. Distinctive leaf marbling noted with white flowered variety. Good level of flower production. Flowers borne well above foliage. Mainly pink / purple flower colours in the mixed variety. Suited to 9cm pot production, the white variety was a little vigorous in packs.



### ***Mini Star series***

A compact series of variable habit. Small, dark green leaves with solid marble band. Moderate level of flower production. Good mix of flower colour in the mixed variety. Suited to 9cm pot and pack production (pink flowered variety slightly more vigorous in packs than the white flowered variety).

### ***Sunkiss series***

The white flowered and mixed varieties were moderately compact whilst the pink flowered variety was relatively vigorous. Habit was variable and leaf colour was generally dark green with a solid marble band. The mixed variety consisted mainly of pink flowers with the odd red and white flower colour. The flowers were fragrant. Suited to both 9cm pot and pack production, though the pink flowered variety was more vigorous.

### ***Libretto series (pack production only)***

A compact series with small leaves. Leaves dark in colour with and without a marble band. Flower size was moderate. Mixed variety consisted mainly of pink and purple flowers and was later to come into flower. Suited to pack production.

### ***Midori series (no mixed variety)***

A compact series with a tight ball shaped habit. Leaf colour dark green with a solid marble band. Moderate to small sized flowers borne well above the foliage. Some plants struggled to fill a 9cm pot. *Botrytis* noted in the pack grown plants. Flowers were fragrant.

### ***Miracle series***

A compact uniform series. Leaf colour primarily dark green with a solid marble band. Moderate sized flowers borne well above the foliage. Good number of flowers produced, good range of flower colour in the mixed variety. Suitable for both 9cm pot and pack production, although *Botrytis* was noted in the pack grown plants. Flowers were fragrant.

### ***Sterling Silver series***

A very vigorous series with an open growth habit and large silver variegated leaves (the series was medium sized rather than miniature in stature). Slow to produce flower and limited numbers produced, but the flowers were moderate to large in size. A large plant for 9cm pot and pack production. Flowers were fragrant.

### ***Silverado scarlet***

A moderately compact variety with variable growth habit. Leaves have a silver variegation that contrasted well with the flower colour. Moderately sized flowers borne well above the foliage. Suited to 9cm pot and pack production. *Botrytis* was noted in the pack grown plants.

The percentage marketability for each variety was calculated for the period from transplanting to marketing to give an appreciation of the potential wastage with each series (Table 7). As can be seen from the data the wastage levels varied from 0–57%. Levels were not only variable between series but also in many cases between varieties within each series. The highest wastage levels were for the pack produced Macro Pastel, however this variety was vigorous and many plants were downgraded on quality, the plants stretching badly in the packs. In other series / varieties losses were due to disease (*Botrytis* and root diseases) and poor plant habit.

**Table 6.** Average physical measurements and quality scores at the point of marketing for each miniature cyclamen variety (pot and pack grown)

Variety	Foliage Height (cm)	Plant Width (cm)	Foliage Size (score)	Foliage Colour	Flower Number	Flower Size (score)	Flower Height (cm)	Botrytis Score	Fragrance	Pot Score	Pack Score
Compact neon pink	9.3	20.7	2	B	3.1	2	4.4	0.2	Yes	4.6	
Compact neon pink	8.7	14.7	2	B	0.7	2	4.5	0.7	Yes		3.3
Compact white	6.9	15.0	2	B	4.9	2	4.0	0.2	Slight	4.4	
Compact white	8.0	12.3	2	B	3.7	2	4.2	1.7	Slight		2.7
Compact mixed	9.5	20.0	2	B	6.8	2	4.8	0.2	Yes	4.4	
Compact mixed	8.8	13.3	2	B	3.7	2	4.0	1.3	Yes		2.7
Macro Pastel neon pink	10.7	21.9	2 (3)	B	3.2	3 (2)	5.0	0.3	Slight	3.9	
Macro Pastel neon pink	9.5	18.0	2	B	3.7	2	3.8	0.1	Slight		2.0
Macro Pastel white	9.7	21.0	2 (3)	B (D)	2.9	2 (3)	5.2	0.2	No	4.7	
Macro Pastel white	10.8	14.3	3	B/D	2.3	2	3.5	2.0	No		2.0
Macro Pastel mixed	9.6	20.2	2 (3)	B (D)	1.8	2	4.8	0.0	Slight	4.4	
Macro Pastel mixed	8.5	14.2	2	B	1.7	2	3.8	0.3	Slight		2.7
Metis scarlet salmon	7.5	15.6	2	B	4.1	2	4.4	0.0	Slight	4.6	
Metis scarlet salmon	7.8	14.5	2	B	13.0	2	4.2	0.3	Slight		4.7
Metis white	6.9	14.5	2	A (B)	4.5	2	5.3	0.1	Slight	3.7	

Metis white	8.0	14.7	2	A (B)	21.7	2	5.0	1.0	Slight		4.0
Metis mixed	7.0	15.0	2	B	5.0	2	4.9	0.0	Slight	4.4	
Metis mixed	7.2	13.5	2	B (A)	9.0	2	4.2	0.7	Slight		4.0

**Table 6 Cont.** Average physical measurements and quality scores at the point of marketing for each miniature cyclamen variety (pot and pack grown)

Variety	Foliage Height (cm)	Plant Width (cm)	Foliage Size (score)	Foliage Colour	Flower Number	Flower Size (score)	Flower Height (cm)	Botrytis Score	Fragrance	Pot Score	Pack Score
Mini Winter mixed	9.3	19.7	2	B	2.8	2	4.1	0.2	No	3.8	
Mini Winter mixed	7.5	12.2	2	B/D	3.3	2	3.7	1.7	No		2.3
Original neon pink	6.4	15.0	2	B	3.4	2	3.6	0.2	Slight	4.5	
Original neon pink	7.8	14.3	2	B	0.0	-	-	1.3	-		3.3
Mini Astree rose	6.7	16.3	2	B	5.4	2/3	5.4	0.2	V. slight	4.0	
Mini Astree rose	7.5	12.3	2	B	7.3	2	4.2	1.3	V. slight		4.0
Mini Astree white	7.2	16.2	2	D/B	4.7	2	4.7	0.1	V. slight	4.3	
Mini Astree white	6.0	11.8	2	D	6.0	2	4.5	1.0	V. slight		3.0
Mini Astree mixed	6.2	13.7	2	A (B)	2.4	2	4.2	0.3	Slight	2.4	
Mini Astree mixed	5.2	12.0	2	A (B)	4.3	2	3.8	0.3	Slight		3.3
Mini F1 Cpt 45 RV	6.7	13.5	2	B (A)	4.7	2	3.2	0.1	Slight	4.2	

Mini F1 Cpt 45 RV	7.0	11.3	2	B	7.0	2	2.3	1.0	Slight		4.7
Mini F1 Cpt 5 BA	8.4	19.2	2	A/B	4.1	2	4.8	0.0	Slight	4.7	
Mini Cpt 5 BA	8.5	13.2	2	B	5.0	2	4.5	0.7	Slight		3.7
Mini Cpt mixed	8.0	17.6	2	B (A)	6.7	2	5.2	0.1	Slight	4.6	
Mini Cpt mixed	7.0	13.2	2	B (A)	6.0	2	4.2	1.0	Slight		3.7

**Table 6 Cont.** Average physical measurements and quality scores at the point of marketing for each miniature cyclamen variety (pot and pack grown)

Variety	Foliage Height (cm)	Plant Width (cm)	Foliage Size (score)	Foliage Colour	Flower Number	Flower Size (score)	Flower Height (cm)	Botrytis Score	Fragrance	Pot Score	Pack Score
Mini Star rose	6.3	13.1	2	B	3.0	2	4.2	0.2	Slight	3.3	
Mini Star rose	6.2	13.8	1	B	9.7	2	2.5	1.0	Slight		4.3
Mini Star white	6.6	14.6	2 (1)	B	4.9	2	3.5	0.3	No	4.3	
Mini Star white	5.7	12.3	2	B	4.3	2	3.3	0.3	No		3.7
Mini Star mixed	7.3	15.1	2 (1)	B	6.0	2	4.0	0.2	No	4.5	
Mini Star mixed	4.7	9.5	2	B/D	9.7	1	2.7	0.7	No		3.7
Sunkiss rose	7.7	18.4	2 (3)	B	4.2	2	5.5	0.3	Yes	4.2	
Sunkiss rose	9.5	13.7	3	B	6.0	2	3.7	1.7	Yes		2.3
Sunkiss white	7.5	16.9	2	B (D)	2.9	2	3.4	0.4	Yes	3.5	
Sunkiss white	5.0	11.8	2	B	4.0	2	3.2	1.0	Yes		3.7
Sunkiss mixed	7.7	18.8	2	B (D)	3.1	2	4.7	0.2	Yes	4.2	
Sunkiss mixed	6.3	8.2	2	B	5.0	2	3.7	1.0	Yes		3.0
Libretto pink	7.3	11.0	1	A	9	2	4.0	0.7	No		4.3
Libretto white	5.5	11.2	2	B	4.3	2	4.0	0.7	No		4.7

Libretto mixed	6.3	11.7	2	A/B	4.3	2	3.8	0.3	No		3.7
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**Table 6 Cont.** Average physical measurements and quality scores at the point of marketing for each miniature cyclamen variety (pot and pack grown)

Variety	Foliage Height (cm)	Plant Width (cm)	Foliage Size (score)	Foliage Colour	Flower Number	Flower Size (score)	Flower Height (cm)	Botrytis Score	Fragrance	Pot Score	Pack Score
Midori Deep rose	6.9	15.7	2	B	2.2	2	5.1	0.0	No	4.5	
Midori Deep rose	6.7	13.7	2	B	7.0	2	4.2	1.7	No		3.7
Midori white	6.5	14.5	2	B	2.7	2	4.3	0.0	V. slight	4.2	
Midori white	7.2	11.8	2	B	7.3	1	4.2	1.7	V. slight		3.0
Miracle deep rose	6.8	15.5	2 (1)	B (A)	1.7	2	4.9	0.3	Yes	4.3	
Miracle deep rose	6.8	13.3	1	B/A	2.7	2	3.8	1.0	Yes		4.7
Miracle white	6.4	15.4	2	B (A)	4.3	2	4.0	0.1	Yes	4.2	
Miracle white	6.8	12.0	1	B	10.3	2	4.2	1.7	Yes		3.3
Miracle mixed	5.8	11.7	2/1	B	13	2	3.3	0.7	Yes		3.3
Sterling Silver rose	9.0	20.1	2 (3)	F	2.1	2 (3)	4.4	0.2	Yes	4.6	
Sterling Silver rose	9.5	17.0	2	F	1.3	2	4.2	0.3	Yes		2.7
Sterling Silver white	7.9	19.1	2 (3)	F	2.4	2	4.6	0.2	Yes	4.5	
Sterling Silver white	7.5	15.5	2	F	2.3	2	3.2	0.7	Yes		2.3
Silverado scarlet	7.0	14.7	2	F	2.2	2	5.0	0.1	No	4.4	



Silverado scarlet	8.0	13.0	2	F	3.0	2	5.3	1.0	No		2.3
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Key to Table 6

**Foliage size** – average leaf length from the ‘shoulder’ of the leaf to the leaf tip. Based on three size categories – score 1: up to 40 mm, score 2: 40–60 mm and score 3: 60 mm plus.

**Foliage colour** – based on a grading system to describe the level of variegation and depth of background green on the leaf. A – dark green leaf with marbling. B – dark green leaf with solid marble band in leaf. C – Light green leaf with marbling. D – Light green leaf with solid marble band in leaf. E – Green leaf with no marbling. F – Silver variegation in leaf.

**Flower size** – average flower size from the base of the flower to the tip of the petal. Based on three size categories – score 1: up to 20 mm, score 2: 20–30 mm and score 3: 30 mm plus.

**Botrytis score** – based on a scoring system of 0–3. Score 0: no visible signs of disease, score 1: low level noted around base of the plant, score 2: moderate level of disease noted around base of plant and on older leaves and score 3: disease clearly evident reducing plant quality.

**Overall quality score** –based on a scoring system of 0–5 for pots and packs, score 0: very poor, score 3: marketable and score 5: excellent quality.

**Foliage size score, foliage colour and flower size** – figures or letters separated by ‘/’ denotes equal numbers of each type recorded against the variety, figures or numbers in brackets denotes these were recorded but to a lesser extent.

Figure 1. Photographic record of each miniature cyclamen series / variety



Compact neon pink



Macro Pastel neon pink



Metis scarlet salmon



Mini Winter mixed



Original neon pink



Mini Astree rose

Figure 1. Cont Photographic record of each miniature cyclamen series / variety



Mini F1 Compact 45RV



Mini Star mixed



Sunkiss rose



Libretto pink



Midori deep rose



Miracle deep rose

**Figure 1. Cont** Photographic record of each miniature cyclamen series / variety



Sterling Silver rose



Silverado scarlet

**Table 7.** Percentage marketable plants per miniature cyclamen variety

Variety	Percentage marketable plants - pots	Percentage marketable plants - packs
Compact neon pink	95%	71%
Compact white	80%	87%
Compact mixed	92%	71%
Macro Pastel neon pink	90%	57%
Macro Pastel white	84%	43%
Macro Pastel mixed	77%	43%
Metis scarlet salmon	89%	100%
Metis white	91%	88%
Metis mixed	85%	100%
Mini Winter mixed	90%	100%
Original neon pink	91%	93%
Mini Astree rose	68%	95%
Mini Astree white	86%	72%
Mini Astree mixed	80%	100%
Mini F1 Compact 45 RV (rose)	59%	100%
Mini F1 Compact 5 BA (white)	77%	61%
Mini F1 Compact mixed	77%	89%
Mini Star rose	93%	89%
Mini Star white	74%	100%
Mini Star mixed	80%	77%
Sunkiss rose	91%	53%
Sunkiss white	73%	80%
Sunkiss mixed	83%	87%
Libretto pink		100%
Libretto white		100%
Libretto mixed		100%



Midori deep rose	98%	92%
Midori white	94%	83%
Miracle deep rose	96%	94%
Miracle white	89%	87%
Miracle mixed		83%
Sterling Silver rose	91%	72%
Sterling Silver white	85%	69%
Silverado scarlet	88%	78%

(Figures calculated for the period from transplanting to marketing).

### Shelf life assessments

As can be seen from Tables 8, 9 and 10 plant quality deterioration through the shelf life period was relatively slow, especially for the pot grown material. In the case of all the pot grown plants a marketable quality was maintained until week 3 of shelf life. The pack grown plants did not perform quite as well, but the vast majority of the plants remained marketable for 2 weeks through shelf life. Varieties that appeared to have the best shelf life (when pot grown) included – Mini F1 Compact 45RV, Compact neon pink, Mini Astree mixed and Midori deep rose. Midori deep rose, Compact neon pink, Mini Astree white and Sunkiss mixed all maintained their quality as pack grown plants. Losses in quality were most significant for the Macro Pastel and Sterling Silver series due to stretching and poor habit.

In terms of foliage colour, a slight paling was noted towards the end of shelf life with several varieties, but the decline was not really significant and probably resulted from a combination of falling nutrient levels in the growing media and low light levels in the shelf life area. Lower leaf yellowing was also noted from week 2–3 onwards.

Flower production throughout shelf life was good for most varieties both in pots and packs. Series producing large numbers of flowers early in the shelf life trial included: Metis (pots), Mini Compact, Mini Star and Miracle (packs). The most floriferous series included: Metis, Mini Star, Midori and Miracle. The Macro Pastel series was reluctant to flower in both pots and packs.

The number of dead flowers recorded per series was a factor of total flower production. Those series that were the most floriferous usually had the greatest number of dead flowers. However, in some cases a number of varieties had a comparatively greater number of dead flowers per total produced and some less so by the end of shelf life. This could be an important factor as it may well have an influence on consumer selection once the plants are displayed in the retail environment. Those varieties which had a greater number of good relative to dying flowers included: Compact neon pink, Metis white, Midori rose, Mini Astree white, Mini Star white, Miracle rose and Silverado scarlet. Those varieties that had a

greater number of dying flowers relative to good flowers included: Compact mixed, Compact white, Mini Compact 45RV, Mini Compact mixed, Metis mixed, Metis.

**Table 8.** Miniature cyclamen average shelf life scores

Average shelf life scores		Week 0	Week 1	Week 2	Week 3	Week 4
Quality score	Pot	4.8	4.6	4.5	3.9	3.0
	Pack	4.7	4.4	3.8	2.7	2.0
Foliage colour	Pot	3.0	3.0	3.0	2.9	2.7
	Pack	3.0	3.0	3.0	2.9	2.7
Flower number	Pot	4.7	6.1	7.0	7.4	7.2
	Pack	6.3	9.8	12.9	17.3	19.8
Dead flower number	Pot	0.0	0.6	0.9	1.7	1.9
	Pack	0.0	0.4	1.2	2.6	2.3
<i>Botrytis</i> score	Pot	0.0	0.1	0.3	0.5	0.5
	Pack	0.0	0.6	1.1	1.0	1.2

Quality scores based on a system of 0–5 for pots and packs, score 0: very poor, score 3: marketable and score 5: excellent quality. Foliage colour scores based on a system of 1–3 to record any reduction in colour relative to start of trial. Score 3: no loss of colour, score 2: slight loss of colour, score 1: loss of colour clearly evident. *Botrytis* scores based a scoring system of 0–3, score 0: no visible disease, score 1: low level of disease noted around base of plant, score 2: moderate level of disease evident around base of plant and on older foliage, score 3: disease clearly evident reducing plant quality.

scarlet and Original neon pink.

*Botrytis* was more evident on the pack grown miniature cyclamen than on the pot grown plants and caused reductions in plant quality towards the end of shelf life.

Significant disease levels were recorded on the following varieties by the end of shelf life: Macro Pastel white, Metis scarlet salmon, Mini Star mixed, Mini Star rose, Miracle rose, Miracle white, Silverado scarlet and Sunkiss white. *Botrytis* had a more limited effect on the pot grown plants, indeed on several occasions some of the early disease outbreaks had disappeared by the following shelf life assessment. Although of less significance *Botrytis* was noted on the following pot grown varieties by the end of shelf life: Compact neon pink, Midori white, Original neon pink and Sunkiss mixed.

Flower fragrance was a feature of many series and was particularly noticeable with the following series: Metis (excluding scarlet salmon), Midori, Miracle and Sterling Silver. With some series flower fragrance faded with time in shelf life, for example Mini Astree, Mini Compact and Sunkiss whilst no or very limited fragrance was recorded for Compact neon pink, Macro Pastel, Metis scarlet salmon and Silverado scarlet.



**Table 9.** Average quality scores per variety for each week of shelf life (pot grown)

Variety	Pre-shelf life	Week 1	Week 2	Week 3	Week 4
Compact neon pink	5.0	4.8	4.8	4.5	3.7
Compact white	5.0	4.8	4.5	4.5	2.8
Compact mixed	5.0	4.8	4.8	4.3	3.3
Macro Pastel neon pink	4.8	4.3	4.2	3.7	2.7
Macro Pastel white	4.7	4.7	4.7	4.0	2.8
Macro Pastel mixed	5.0	4.8	4.8	4.2	2.8
Metis scarlet salmon	5.0	4.7	4.5	4.0	3.3
Metis white	5.0	4.7	4.7	4.0	3.3
Metis mixed	5.0	4.8	4.7	3.8	2.8
Mini Winter mixed	5.0	4.7	4.5	4.2	3.2
Original neon pink	5.0	4.7	4.7	4.0	3.0
Mini Astree rose	4.8	4.2	4.2	3.5	3.5
Mini Astree white	4.8	4.5	4.5	3.7	3.2
Mini Astree mixed	5.0	4.8	4.8	4.0	3.5
Mini F1 Compact 45 RV (rose)	5.0	5.0	5.0	4.7	3.8
Mini F1 Compact 5 BA (white)	5.0	4.8	4.8	4.3	3.3
Mini F1 Compact mixed	5.0	4.7	4.7	3.8	3.2
Mini Star rose	5.0	5.0	4.8	3.5	2.5
Mini Star white	4.5	4.2	4.2	3.5	2.7
Mini Star mixed	4.7	4.0	3.8	3.5	2.8
Sunkiss rose	4.8	4.5	4.3	3.7	2.8
Sunkiss white	4.7	4.2	4.2	3.7	3.2
Sunkiss mixed	4.8	4.5	4.5	3.7	2.3
Libretto pink					
Libretto white					
Libretto mixed					
Midori deep rose	4.8	4.8	4.8	4.8	3.5
Midori white	4.5	4.7	4.7	4.0	2.3
Miracle deep rose	4.8	4.8	4.8	4.2	3.3
Miracle white	4.8	4.5	4.3	4.2	2.8
Miracle mixed					
Sterling Silver rose	4.5	4.3	4.3	3.7	2.7
Sterling Silver white	4.8	4.0	3.8	3.3	2.5
Silverado scarlet	4.8	4.8	4.2	3.7	2.7
<b>Average</b>	<b>4.8</b>	<b>4.6</b>	<b>4.5</b>	<b>3.9</b>	<b>3.0</b>

Based on a scoring system of 0-5, score 0 represented poor quality plants, score 3 represented marketable plants and score 5 excellent plants. (Scores based on the average of six plants per variety).

**Table 10.** Quality scores per variety for each week of shelf life (pack grown)

Variety	Pre-shelf life	Week 1	Week 2	Week 3	Week 4
Compact neon pink	5.0	5.0	4.0	3.0	3.0
Compact white	5.0	5.0	5.0	3.0	2.0
Compact mixed	4.0	4.0	4.0	2.0	2.0
Macro Pastel neon pink	4.0	4.0	4.0	2.0	1.0
Macro Pastel white	4.0	3.0	3.0	2.0	2.0
Macro Pastel mixed	4.0	2.0	2.0	2.0	2.0
Metis scarlet salmon	4.0	5.0	4.0	3.0	2.0
Metis white	5.0	5.0	4.0	3.0	2.0
Metis mixed	4.0	4.0	4.0	3.0	2.0
Mini Winter mixed	4.0	4.0	4.0	3.0	2.0
Original neon pink	5.0	5.0	4.0	3.0	2.0
Mini Astree rose	5.0	5.0	4.0	2.0	2.0
Mini Astree white	5.0	5.0	5.0	4.0	3.0
Mini Astree mixed	5.0	4.0	4.0	2.0	2.0
Mini F1 Compact 45 RV (rose)	5.0	5.0	5.0	3.0	2.0
Mini F1 Compact 5 BA (white)	5.0	5.0	4.0	3.0	2.0
Mini F1 Compact mixed	4.0	4.0	3.0	2.0	2.0
Mini Star rose	5.0	5.0	4.0	2.0	1.0
Mini Star white	5.0	5.0	3.0	3.0	2.0
Mini Star mixed	5.0	5.0	4.0	2.0	2.0
Sunkiss rose	4.0	4.0	3.0	2.0	2.0
Sunkiss white	4.0	3.0	3.0	2.0	2.0
Sunkiss mixed	5.0	5.0	5.0	4.0	3.0
Libretto pink	5.0	5.0	3.0	2.0	1.0
Libretto white	5.0	5.0	5.0	3.0	2.0
Libretto mixed	5.0	5.0	3.0	3.0	2.0
Midori deep rose	5.0	5.0	5.0	4.0	4.0
Midori white	5.0	5.0	4.0	3.0	2.0
Miracle deep rose	5.0	5.0	4.0	3.0	2.0
Miracle white	5.0	5.0	4.0	3.0	2.0
Miracle mixed	5.0	5.0	4.0	3.0	2.0

Sterling Silver rose	4.0	3.0	3.0	2.0	2.0
Sterling Silver white	4.0	3.0	3.0	3.0	2.0
Silverado scarlet	4.0	4.0	4.0	3.0	2.0
<b>Average</b>	<b>4.7</b>	<b>4.4</b>	<b>3.8</b>	<b>2.7</b>	<b>2.0</b>

Based on a scoring system of 0–5, score 0 represented poor quality plants, score 3 represented marketable plants and score 5 excellent plants. (Scores based on one pack of six plants per variety).

## Garden performance assessments

### (a). Trial site comparison

The two sites used in the trial were not only different in their geographical location but also in their aspect and exposure. The site at RHS Wisley (Portsmouth Trial Ground) was on a slope facing south, however the trial site was towards the bottom of a valley surrounded by trees where cold air could be trapped creating a frost pocket. In contrast the Springfields Festival Gardens site was a flat bed in full open sunlight but directly exposed to the wind and prevailing weather conditions. The overall averages for each parameter recorded for all the varieties (from pack and pot production, planted in the soil and containers) for each assessment date at each site are presented in Table 11.

**Table 11.** Parameter averages per trial site for the three assessment dates

Parameter	RHS Wisley			Springfields Festival Gardens		
	15.10.05	29.10.05	24.11.05	11.10.05	27.10.05	23.11.05
Av. foliage height (cm)	8	9	9*	8	9	9*
Av. plant width (cm)	15	15	17*	14	15	16*
Av. flower number per plant	4	3	0*	5	5	1*
Av. <i>Botrytis</i> score	1	1	1*	0	0	1*
Av. weather tolerance score	3	3	1*	3	2	2*
Av. Plant quality score	4	4	2*	4	4	3*

\* Frost damage to plants

*Botrytis* score based on a scoring system of 0–3, score 0: no visible disease, score 1: low level of disease noted around base of plant, score 2: moderate level of disease evident around the base of the plant and on the older foliage, score 3: disease clearly evident reducing plant quality. Weather tolerance based on a scoring system of 0–3, score 3: good tolerance, little or no signs of damage, score 2: evidence of weather damage to flowers with limited foliage damage, score 1: clear evidence of weather damage to both flowers and foliage, score 0: plant ruined by weather. Quality score based on a scoring system of 0–5 for pots and packs, score 0: very poor, score 3: average and score 5: excellent quality.

As can be seen, average plant sizes were similar at both sites with a small amount of growth (or possibly just canopy expansion) occurring over the period of the trial. The average flower number was slightly higher at the Springfields Festival Gardens site whilst *Botrytis* was slightly more prevalent at the RHS Wisley site on the lower foliage of plants. Weather tolerance and plant quality scores were similar for both sites.

The average scores for many of the recorded parameters remained approximately constant until the final assessments at each site. Just before the final assessment, each trial site experienced six consecutive nights of frost, the RHS Wisley site experiencing the more severe frosts of the two sites (Appendix 4) with a minimum temperature of  $-5.8^{\circ}\text{C}$  recorded on 18 November 2005. This left the plants damaged, especially at the RHS Wisley site and they never fully recovered. Figure 2 details the damage to container planted material whilst Figure 3 details damage to the soil planted material. On average the soil planted material appeared less damaged than the container planted material, but both sets of plants were no longer viable for display purposes. All the open flowers on the plants had collapsed and even many of the buds that were still below the leaf canopy were damaged and failed to open. The foliage also eventually collapsed and *Botrytis* developed on the damaged plant tissue.

Both sets of plants were removed from the trial sites about 2–3 weeks after the photographs were taken (mid December). All the plants at RHS Wisley were disposed of, but the container planted material at the Springfields Festival Gardens site were held outside over winter to see if the miniature cyclamen corms would survive through to the spring (even if the foliage / flowers did not). However, the frosts and winter weather had also damaged the corms and re-growth did not occur the following year.

**Figure 2.** Frost damage (water soaked and collapsed tissue) to container planted miniature cyclamen (RHS Wisley)



**Figure 3.** Frost damage (water soaked and collapsed tissue) to soil planted miniature cyclamen (RHS Wisley)





**(b). The relative performance of pot and pack grown miniature cyclamen planted in the soil and in containers**

As described in the methods and materials section, both pot and pack grown plants of each variety were planted in the soil and containers at each site. The overall averages for each parameter recorded for all the varieties from pot and pack production planted in both the soil and in containers on all assessment dates are presented in Table 12.

**Table 12.** Parameter averages for pot and pack grown miniature cyclamen planted in the soil and containers

Parameter	Soil planted		Container planted	
	Pot grown	Pack grown	Pot grown	Pack grown
Av. foliage height (cm)	9	7	10	8
Av. plant width (cm)	18	14	15	13
Av. flower number per plant	6	2	5	2
Av. <i>Botrytis</i> score	0.3	0.0	1.0	0.6
Av. weather tolerance score	2	2	2	2
Av. Plant quality score	4	3	4	3

*Botrytis* score based on a scoring system of 0–3, score 0: no visible disease, score 1: low level of disease noted around base of plant, score 2: moderate level of disease evident around the base of the plant and on older foliage, score 3: disease clearly evident reducing plant quality. Weather tolerance based on a scoring system of 0–3, score 3: good tolerance, little or no signs of damage, score 2: evidence of weather damage to flowers with limited foliage damage, score 1: clear evidence of weather damage to both flowers and foliage, score 0: plant ruined by weather. Quality score based on a scoring system of 0–5 for pots and packs, score 0: very poor, score 3: average and score 5: excellent quality.

Figure 4 gives an indication of the relative levels of development of pot and pack grown plants planted in the soil and in containers during October 2005.

**Figure 4.** Soil and container planted miniature cyclamen (pot and pack grown)





Soil planted – back six plants pot grown, front six plants pack grown.

Container planted – five left plants pot grown, five right plants pack grown.

Plant vigour was greatest in the container planted material, however competition for space within the container limited the lateral expansion of each plant (depending upon variety). Therefore as can be seen from Table 12 the highest average plant heights were recorded for container grown material, whilst the greatest plant widths were recorded for soil planted material. Differences between pot and pack grown plants were obvious at the start of the trial (as to be expected because of size differences in the starting material) but became less so towards the end of the trial, especially with the more vigorous varieties. The pot grown plant material made an instant impact after planting in terms of plant size and flower number, whilst an earlier planting date would have allowed further development of the pack grown material prior to the onset of colder weather in mid November.

A difference in flower number was clearly evident between pot and pack grown plants, less so between soil and container planting. The pot grown plants were able to produce more flower bud in a shorter period of time relative to the pack grown plants.

*Botrytis* became more of an issue towards the end of the trial in the container planted material. As the plants developed and began competing for space *Botrytis* began developing on the lower foliage and stems of plants, causing the odd plant death. A low level of plant losses was also recorded for the soil planted material.

Overall there were limited differences in weather tolerance between the pot and pack grown material and between the material planted in the soil and in containers (except as mentioned before in response to the frosts at the end of trial which appeared to affect the container planted material at the RHS Wisley site more severely than the soil planted material).

In terms of the quality plant scores achieved, the pot grown miniature cyclamen scored better than the pack grown plants, which was to be expected as the plants were larger and had more flower bud. The relative quality of both the pot and pack grown plants was maintained for around 6 weeks after planting with a decline at the end (especially at the RHS Wisley site) primarily due to frost damage (Table 13). An earlier planting date (from early September onwards) would no doubt have extended this garden performance period for several more weeks and allowed further development, especially of the pack grown plants.

**Table 13.** Average quality scores over time for pot and pack grown miniature cyclamen planted in the soil and in containers

Parameter	RHS Wisley			Springfields Festival Gardens		
	15.10.05	29.10.05	24.11.05	11.10.05	27.10.05	23.11.05
Av. soil planted / pot grown	4	4	3	5	5	4
Av. soil planted / pack grown	3	3	2	3	3	3
Av. container planted / pot grown	4	4	1	5	4	3
Av. container planted / pack grown	3	3	1	4	4	3

Quality score based on a scoring system of 0-5 for pots and packs, score 0: very poor, score 3: average and score 5: excellent quality.

***(c). Miniature cyclamen variety comparison***

A summary of the average recorded measurements and scores for all the miniature cyclamen varieties (pack and pot production, soil and container planted) is presented in Table 14.

Plant development post planting

The more vigorous series (the medium sized / midi series as opposed to the miniature series) produced the largest plants post planting. These series such as Macro Pastel and Sterling Silver produced better levels of ground cover when planted into the soil but were a little too vigorous when planted 10 plants per container. Conversely some of the more compact series such as Mini Star, Libretto, Midori and Miracle produced only minimal ground cover when planted in the soil and struggled to fill the container.

#### Flower production post planting

Flower number varied considerably between series and varieties, the more floriferous varieties included Metis scarlet salmon, Midori deep rose and Miracle deep rose. Several of the series including Macro Pastel, Sunkiss, Libretto and Sterling Silver produced only a modest number of flowers over the garden performance trial period.

**Table 14.** Average recorded measurements and scores per miniature cyclamen variety

Variety	Average recorded measurements and scores						
	Height (cm)	Width (cm)	Flower No.	Botrytis score	Weather Tolerance	Quality Score	Fragrance
Compact neon pink	9	16	3	0.7	2	4	√
Compact white	9	15	3	0.8	2	3	
Compact mixed	10	17	2	0.7	2	4	
Macro Pastel neon pink	11	19	2	0.6	2	4	
Macro Pastel white	11	17	2	0.5	2	4	
Macro Pastel mixed	10	17	2	0.5	2	3	
Metis scarlet salmon	9	16	7	0.7	2	3	
Metis white	8	15	3	0.7	2	3	
Metis mixed	8	15	4	0.7	2	3	
Mini Winter mixed	8	15	4	0.8	2	3	
Original neon pink	9	15	3	0.8	2	4	
Mini Astree rose	8	15	4	0.7	2	4	
Mini Astree white	7	14	2	0.5	2	3	
Mini Astree mixed	8	15	4	0.7	2	3	√
Mini F1 Copt 45 RV (rose)	8	12	4	0.5	2	3	
Mini F1 Copt 5 BA (white)	9	16	5	0.7	2	4	√
Mini F1 Compact mixed	9	16	5	0.7	2	4	√
Mini Star rose	8	14	5	0.7	2	3	√
Mini Star white	9	14	3	0.7	2	3	
Mini Star mixed	8	14	5	0.7	2	3	
Sunkiss rose	10	17	3	0.3	2	4	
Sunkiss white	7	14	1	1.0	2	3	
Sunkiss mixed	9	16	2	0.7	2	4	
Libretto pink*	7	14	2	0.0	2	3	
Libretto white*	6	12	2	0.0	2	3	
Libretto mixed*	7	14	2	0.2	2	3	
Midori deep rose	9	15	6	0.5	2	4	√√
Midori white	8	14	4	0.3	2	4	√
Miracle deep rose	8	14	6	0.5	2	4	√√
Miracle white	7	14	3	0.5	2	3	√√
Miracle mixed*	7	13	2	0.0	2	3	
Sterling Silver rose	10	18	3	0.7	2	4	√
Sterling Silver white	9	16	2	0.5	2	3	
Silverado scarlet	8	15	3	0.5	2	3	

\* pack grown only

*Botrytis* score based on a scoring system of 0–3, score 0: no visible disease, score 1: low level of disease noted around base of plant, score 2: moderate level of disease evident around base of plant and on older foliage, score 3: disease clearly evident reducing plant quality. Weather tolerance based on a scoring system of 0–3, score 3: good tolerance, little or no signs of damage, score 2: evidence of weather damage to flowers with limited foliage damage, score 1: clear evidence of weather damage to both flowers and foliage, score 0: plant ruined by weather. Quality score based on a scoring system of 0–5 for pots and packs, score 0: very poor, score 3: average and score 5: excellent quality. Fragrance – noted as evident on most assessment days (√√) and evident on some assessment days (√). Fragrance was present on other varieties but was not consistently so.

**Table 15.** Average quality scores over time per miniature cyclamen variety

Variety	Average Quality Score					
	RHS Wisley			Springfields Festival Gardens		
	15.10.05	29.10.05	24.11.05	11.10.05	27.10.05	23.11.05
Compact neon pink	3.5	3.75	2.0	4.25	4.5	3.5
Compact white	3.75	3.75	1.75	4.25	3.75	2.75
Compact mixed	3.75	4.25	2.0	4.5	4.0	3.25
Macro Pastel neon pink	4.0	4.25	2.25	4.25	4.5	3.5
Macro Pastel white	3.75	3.75	2.0	4.5	3.75	3.75
Macro Pastel mixed	3.5	4.25	2.0	4.0	4.0	3.25
Metis scarlet salmon	4.25	3.75	1.5	4.0	4.0	3.25
Metis white	3.25	3.75	1.0	4.25	3.75	3.0
Metis mixed	3.75	3.75	1.25	4.0	3.5	3.25
Mini Winter mixed	3.5	3.75	1.5	4.5	3.5	3.0
Original neon pink	3.75	3.75	2.25	4.25	4.0	3.25
Mini Astree rose	3.25	4.25	3.0	4.25	4.25	3.5
Mini Astree white	3.0	2.75	1.5	4.5	4.25	2.75
Mini Astree mixed	3.75	3.5	2.25	4.0	3.75	2.75
Mini F1 Copt 45 RV (rose)	4.5	4.0	2.5	4.25	3.75	3.75
Mini F1 Copt 5 BA (white)	3.75	4.25	2.5	4.0	4.0	3.75
Mini F1 Compact mixed	4.0	4.25	2.5	4.25	4.25	3.5
Mini Star rose	4.25	3.75	1.5	4.0	3.75	3.25
Mini Star white	3.75	3.75	2.25	4.0	3.75	3.0
Mini Star mixed	3.75	4.0	1.75	4.0	3.75	2.5
Sunkiss rose	4.0	4.25	1.75	4.5	4.25	3.25
Sunkiss white	3.0	3.25	1.75	3.5	3.25	2.25
Sunkiss mixed	3.75	3.25	2.0	4.5	4.0	3.25
Libretto pink*	3.5	3.5	2.5	3.0	3.0	3.0
Libretto white*	3.5	3.0	2.0	3.5	3.0	3.5
Libretto mixed*	3.0	4.0	2.5	3.0	3.0	3.0
Midori deep rose	4.25	4.25	1.25	4.25	4.25	3.75
Midori white	3.75	4.0	2.0	4.25	4.25	4.0
Miracle deep rose	4.0	4.25	1.25	4.25	4.25	3.5
Miracle white	3.5	4.0	1.0	4.25	4.0	3.5
Miracle mixed*	3.0	2.5	1.5	4.0	3.5	3.0
Sterling Silver rose	3.75	4.25	2.25	4.25	4.25	4.0
Sterling Silver white	3.5	3.75	1.75	4.0	4.0	3.5
Silverado scarlet	3.75	4.25	1.0	4.5	4.0	3.25

\* pack grown only

Quality score based on a scoring system of 0–5 for pots and packs, score 0: very poor, score 3: average and score 5: excellent quality.

#### Disease susceptibility post planting

With the exception of the occasional dead plant, *Botrytis* did not appear to be a particular problem post planting for most of the trial. Sunkiss white, Original neon pink, Mini Winter mixed and Compact white had the highest average recorded *Botrytis* levels, but they were often below levels of significance. Later in the trial *Botrytis* became more prevalent on the more vigorous varieties planted in containers and on frost damaged plant tissue.

#### Weather tolerance post planting

Although there were no difference between the average scores for weather tolerance differences between series / varieties / flower colours were noted. White flowers were often more prone to weather damage and required frequent dead heading (Figure 5). Many of the pink flowered varieties suffered from a flower bleach, sometimes the bleach was only evident in the tips of the petals, other times the bleach was more widespread, as shown in Figure 6. Leaf bronzing / speckling was also evident on some varieties in the trial including Mini Star mixed, Compact neon pink, Compact white, Original neon pink, Sterling Silver white, Miracle white and Metis white (Figure 7).

#### Quality post planting

Differences in average quality were noted between varieties, as can be seen in Table 14 average scores were either 3 or 4. To provide a more detailed summary of average quality over the period of the garden performance trial, average scores were calculated for each variety on each assessment date at each site and are presented in Table 15. In many cases the quality scores recorded were slightly higher at the Springfields Festival Gardens site relative to the RHS Wisley site. Most of the quality scores recorded at the RHS Wisley site improved with time, until the final assessment, whereas at the Springfields Festival Garden site most of the scores declined from the first assessment onwards.

Excluding the final assessment at each site, the quality scores varied from 4.5 to 2.5. Varieties with higher quality scores at both sites (at least 4.0 on each assessment) included Marco Pastel neon pink, Mini F1 Compact mixed, Sunkiss rose, Midori deep rose and Miracle deep rose. As can be seen from the quality scores on the last assessment dates, the plants at RHS Wisley suffered relatively badly compared to those at Springfields Garden Festivals. Differences in the scores on the final assessment may indicate possible potential differences in cold tolerance between varieties, although realistically the exposure of the planting site will be the determining factor for garden performance from mid November onwards.

#### Fragrance

Over the whole trial period, fragrance was most notable on Midori deep rose, Miracle deep rose and Miracle white. Fragrance was also noted on some assessment days with the following varieties: Compact neon pink, Mini Astree



mixed, Mini F1 Compact 5 BA, Mini F1 Compact mixed, Mini Star rose, Midori white and Sterling Silver rose.

**Figure 5.** Weather damage to flowers of Miracle white



**Figure 6.** Flower colour bleach on Mini Astree rose



**Figure 7.** Leaf bronzing / speckling on the foliage of miniature cyclamen



### **Public assessments**

A similar number of assessments were completed by the public for the two trial sites, 64 at RHS Wisley and 75 at Springfield Festival Gardens. The first event on the 15 October 2005 attracted approximately twice the number of assessors, relative to the second on the 29 October 2005. At the RHS Wisley site many of the people who assessed the plants were older / middle aged couples or individuals with some gardening knowledge, younger individuals / couples made up a smaller proportion of the assessors. The majority of the questionnaires were completed by females. At the Springfields Festival Gardens site the range of people assessing the trial was similar, however a greater number of male individuals assessed the trial whilst waiting for their partners.

Most of the people who scored the plants recognised the plants as miniature cyclamen and several enquired about particular varieties and cultural recommendations having not considered them as autumn bedding plants before.

The selections made by the public (top three varieties grown in the soil and top three in containers) were converted into a scoring system. Three points were allocated for a first place selection, two points for a second place selection and one point for a third place selection. The points accumulated for each variety using this scoring system are presented in Table 16.

**Table 16.** Summary of miniature cyclamen public assessments

Variety	RHS Wisley				Springfields Festival Gardens			
	15 October		29 October		15 October		29 October	
	Soil	Pot	Soil	Pot	Soil	Pot	Soil	Pot
Compact neon pink	0	2	0	0	0	6	0	0
Compact white	0	0	0	0	0	0	0	0
Compact mixed	2	1	3	4	9	10	5	15
Macro Pastel neon pink	6	1	4	1	2	1	15	5
Macro Pastel white	7	4	4	2	7	0	3	3
Macro Pastel mixed	3	0	2	0	5	1	0	0
Metis scarlet salmon	23	22	6	0	15	10	15	5
Metis white	0	1	0	0	5	5	1	0
Metis mixed	9	2	2	3	18	5	1	0
Mini Winter mixed	1	3	0	1	4	7	0	9
Original neon pink	0	0	0	0	1	2	0	0
Mini Astree rose	0	0	0	0	10	5	4	0
Mini Astree white	0	0	0	0	0	1	0	0
Mini Astree mixed	3	10	1	0	18	29	0	1
Mini F1 Compact 45 RV (rose)	3	0	3	0	0	1	2	0
Mini F1 Compact 5 BA (white)	25	<b>60</b>	10	11	12	9	<b>27</b>	10
Mini F1 Compact mixed	15	7	0	8	<b>36</b>	8	3	7
Mini Star rose	12	29	1	0	3	3	0	2
Mini Star white	0	3	0	0	0	0	0	0
Mini Star mixed	0	0	0	0	3	4	0	0
Sunkiss rose	2	1	1	5	10	6	1	2
Sunkiss white	0	0	0	0	0	0	0	0
Sunkiss mixed	0	1	0	0	23	7	0	4
Libretto pink	7	0	0	2	0	3	0	0
Libretto white	3	0	4	4	2	5	0	0
Libretto mixed	0	0	0	3	1	2	0	0
Midori deep rose	18	10	13	28	16	26	23	22
Midori white	0	1	7	3	9	3	3	0
Miracle deep rose	26	49	9	8	19	20	5	23
Miracle white	0	0	0	0	0	12	2	0
Miracle mixed	0	0	0	0	0	0	0	0
Sterling Silver rose	14	7	17	10	32	15	11	6
Sterling Silver white	2	3	7	1	7	9	10	3
Silverado scarlet	<b>69</b>	28	<b>36</b>	<b>32</b>	26	<b>63</b>	15	<b>33</b>

Scoring system based on 3 points for a first place selection of the variety, 2 points for a second place selection of the variety and 1 point for a third place selection. The total scores for each variety by soil, container and site were then calculated.

A similar range of varieties proved the most popular at each site both planted in the soil and in containers (Table 17). Selection appeared to be based primarily on visual appearance – either flower number / flower colour or the overall impact of flower and foliage. Silverado scarlet was selected due to the combination of the scarlet flowers and silver variegated foliage, Mini Compact 5 BA was selected due its distinctively marbled foliage, Sterling Silver pink was particularly popular in the soil due to its vigour, silver foliage and large pink flowers and Miracle deep rose, Midori deep rose and Metis scarlet salmon were selected due to their bold flower colours (Figure 8). A few people appreciated the fragrance produced by the flowers and this may have increased the popularity of some series such as the Midori and Miracle series.

Some varieties were more popular in containers (for example the more compact varieties such as Miracle deep rose, Mini Star rose and Mini Astree mixed) whilst others (for example the more vigorous varieties such as Sterling Silver rose and Mini F1 Compact mixed) were more popular when planted in the soil. In the case of Silverado scarlet this proved more popular in the soil at RHS Wisley whilst it was more popular in containers at Springfields Festival Gardens.

**Table 17.** Top five miniature cyclamen varieties as selected by the public

<b>RHS Wisley</b>	<b>Springfields Festival Gardens</b>
Silverado scarlet	Silverado scarlet
Mini Compact 5 BA	Midori deep rose
Miracle deep rose	Miracle deep rose
Midori deep rose	Sterling Silver pink
Metis scarlet salmon	Mini Compact 5 BA



Figure 8. Top miniature cyclamen varieties as selected on the public open days



Silverado  
Mini F1 Compact 5 BA

scarlet



Miracle  
Sterling Silver pink

deep

rose



Midori  
Metis scarlet salmon

deep

rose



## Conclusions

### Production

The germination rates attained for many of the varieties was good, in excess of 90%, although for a number of varieties – Mini Star white, Mini Star mixed and Silverado scarlet germination was 70% or less, a factor which needs to be taken into account when producing these varieties from seed.

Sowings in weeks 8 and 11 produced plugs of sufficient size at transplanting for crops destined for a marketing period of week 33 onwards (late August to early September). The later sowing (week 15) produced less developed plugs at transplanting that did not give rise to marketable plants until mid September onwards. However, the time taken to produce a marketable crop from a week 15 sowing relative to a week 8 sowing was on average around 5 weeks less.

Production times (sowing to final product) were less for pot grown plants relative to pack grown plants, but this will be determined to a large extent by the final specification for each, pack production times would be shorter if the specification for flower number per pack was less demanding.

Production times from sowing were found to be 21 weeks onwards, from a week 15 sowing, 23 weeks onwards from an earlier sowing. The difference in production times between series from the same sowing date was up to 5–6 weeks. Differences between varieties in the same series was usually no more than 1–2 weeks, which eases the problem of trying to obtain a range of flower colours for a particular series on a specific marketing date. There were exceptions to this however, the variety Compact white when pot grown was 3–4 weeks earlier than the mixed and pink variety, whilst pack grown Midori and Miracle white were 4 weeks earlier than the deep rose variety.

The fourteen different cyclamen series / varieties examined in the trial varied in their suitability to 9cm pot and pack production. Two of the series (Macro Pastel and Sterling Silver) were medium / midi series rather than miniature and were vigorous. The miniature varieties Compact neon pink, Compact mixed and Mini F1 Compact white were also relatively vigorous and further work using a more intensive chemical plant growth regulator programme is required to ascertain their suitability to pack (and to a lesser extent pot) production. As a result of their vigour, all these series / varieties had high levels of recorded wastage for pack production (and to a lesser extent pot production). The remaining series and varieties were of a vigour more suited to pack and 9cm pot production, although the Mini Astree Series, Mini Star Series and Midori series were quite compact and sometimes struggled to fill a 9cm pot.

The series / varieties also varied in other ways, a number were very floriferous early in the trial, for example Metis, whereas other series / varieties were very slow to come into flower including Macro Pastel, Sterling Silver, Original neon pink and Mini Winter mixed. A number had interesting foliage patterns / bold leaf variegation – Mini F1 Compact white, Sterling Silver and Silverado scarlet. Several appeared more prone to *Botrytis*, especially when grown in packs including Mini Astree series, Midori series, Miracle series and Silverado scarlet.

## Shelf life

With a moderate level of plant care including watering the plants from below where possible and removing dying flowers and leaves, plant quality through the shelf life period was maintained. A marketable quality was maintained for 3 weeks with all of the pot grown plants and a marketable quality of 2 weeks was attained with most of the pack grown plants. Varieties that appeared to have the best shelf life when pot grown included – Mini F1 Compact 45RV, Compact neon pink, Mini Astree mixed and Midori deep rose. Midori deep rose, Compact neon pink, Mini Astree white and Sunkiss mixed all maintained their quality as pack grown plants. Losses in quality were most significant for the Macro Pastel and Sterling Silver series due to stretching and poor plant habit.

Throughout shelf life the most floriferous series were Metis, Mini Star, Midori and Miracle, the Macro Pastel series was reluctant to flower in both pots and packs.

*Botrytis* was primarily a problem on the pack grown plants through shelf life, on several occasions *Botrytis* outbreaks were noted on the pot grown plants but the disease often disappeared by the following assessment.

Flower fragrance was noticeable throughout shelf life with several of the series including: Metis (excluding scarlet salmon), Midori, Miracle and Sterling Silver.

## Garden performance

The two sites used in the trial (RHS Wisley and Springfields Festival Gardens) provided a good test for the plants in terms of their relative aspect and exposure. Differences in plant performance, primarily flower production and levels of *Botrytis*, were noted between the two sites, on average the plants at the Springfields Festival Gardens site produced more flowers and suffered less from *Botrytis*. Frosts at both sites during the second week in November caused damage to the plants (flowers and foliage) and brought the trials to a halt.

Differences between soil and container planted material were noted. Material planted in containers was generally the most vigorous, but competition for space limited the final plant size. *Botrytis* was also more prevalent in the container planted material.

Differences between pot and pack grown plants were obvious in the trial especially at the beginning. The pot grown plants were larger and had a greater number of flowers, making an instant impact after planting. However, differences in plant size between pot and pack grown plants became less as the trial progressed, an earlier planting date would have permitted further development of the pack grown plants.

On average only a small amount of growth (which may just have been leaf canopy expansion) occurred following planting out. The more vigorous series (Macro Pastel and Sterling Silver) produced the largest plants post planting and were suited to soil planting where the foliage canopy gave good levels of ground cover. These two series proved to be too vigorous when planted 10 plants per 50cm diameter container. Conversely the more compact series (Mini Star, Libretto, Midori and Miracle)

produced only minimal ground cover when planted in the soil and often struggled to fill the container.

The varieties that had been the most floriferous through production and shelf life continued to produce the highest number of flowers after planting (Metis scarlet salmon, Midori deep rose and Miracle deep rose). Macro Pastel, Sunkiss, Libretto and Sterling Silver produced only modest numbers of flower.

Post planting *Botrytis* was not a major problem, especially early in the trial. Later in the trial the disease became more prevalent on the more vigorous varieties planted in containers and on frost damaged plant tissue.

Differences in weather tolerance were noted. Many of the white flowered varieties were prone to flower damage and required frequent dead heading, whilst the pink flowered varieties suffered from a flower bleach of varying severity. Leaf bronzing / speckling was evident on several varieties including Mini Star mixed, Compact neon pink, Compact white, Original neon pink, Sterling Silver white, Miracle white and Metis white.

Over the whole trial period, fragrance was most notable on Midori deep rose, Miracle deep rose and Miracle white.

The average post planting quality scores were similar for all the varieties examined in the trial, with slightly higher scores being recorded for Marco Pastel neon pink, Mini F1 Compact mixed, Sunkiss rose, Midori deep rose and Miracle deep rose.

### **Public assessment**

The selections made by the public appeared to be based primarily on the visual appearance of the plants, generally bold flower colours and or flower number. Foliage colour and foliage colour relative to flower colour were also important, hence the selection of Silverado scarlet as the favourite variety at both sites. Habit, plant vigour and flower fragrance were of less importance. From the general feedback gained on the open days there is an apparent need to educate the public about the use of miniature cyclamen as autumn bedding plants. This is an important exercise to ensure future repeat purchases by the public.

## **Technology Transfer**

The following technology transfer activities relate to the project:

- Formal presentation and trial walk – BBPA Technical Committee held on 13 October 2005 at RHS Wisley.
- Formal presentation and trial walk – HDC / BBPA cyclamen growers walk held at Opperman Nurseries and Springfields Festival Gardens on 27 October 2005.
- Formal presentation – HDC / BBPA poinsettia and cyclamen open day held at HRI Wellesbourne on 22 November 2005.
- Production of final report (PC 235), May 2006.

## References

Annon (2005). Communications between H. Kitchener and plant breeding companies and between W. Brough and commercial production nurseries.

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## Appendix 1

### Miniature cyclamen: plug plant cultural details - W.J. Findon and Son

<b>Tray</b>	Modiform 240 tray, cell volume 7.3cc.
<b>Growing media</b>	80% young blonde peat, 10% dark peat, 10% clay screened to 8mm, with 0.75g/l PG Mix 14:16:18 and pH corrected to pH 5.5.
<b>Germination</b>	Sown trays placed in germinator (in the dark) and held at 16°C for 21 days. Trays were then placed into a glasshouse with fogged conditions at 20°C and kept moist.
<b>Plug culture</b>	<p>Sown trays received a drench using carbendazim at 28 days. Plugs were fed at every watering with a background feed of 75ppm N and 75ppm K. Main feeds applying 150ppm N: 25ppm P: 125ppm K were applied from day 35 weekly and from day 49 twice per week.</p> <p>Growing temperatures – from day 35, plants were moved to a glasshouse with shading (screens close at light levels &gt;200W/m<sup>2</sup>) and temperatures 16°C day and 18°C night (with +2°C to vent). Screen settings were raised to 350W/m<sup>2</sup> and temperatures lowered to 12°C day and 14°C night for the last 21 days of cropping.</p> <p>From day 42 until despatch, plugs received fungicide sprays every 14 days as a preventative measure against <i>Botrytis</i>. These included rotational use of chlorothalonil, Captan and Amistar. 14 days prior to shipping plugs received a drench of carbendazim.</p> <p>No insecticides were used.</p>
<b>Total crop time</b>	Between 70 – 84 days.



### Miniature cyclamen: finished plant cultural details – Kinglea Plants

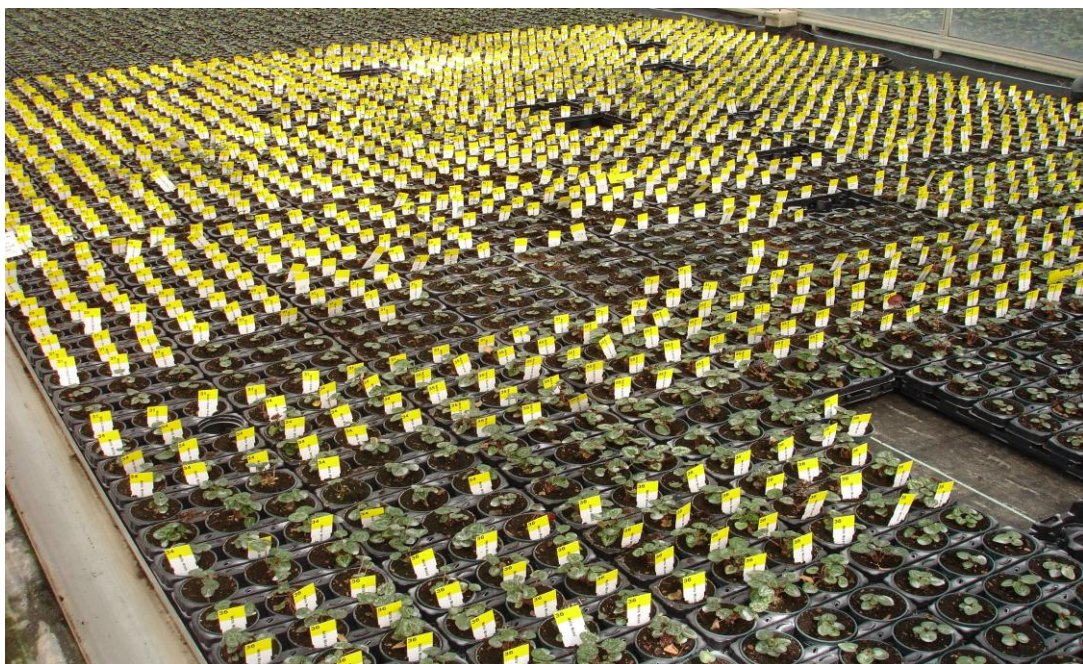
<b>Tray</b>	Square 8cm pots, 6 per plastic outer tray and 9cm round pots.
<b>Growing media</b>	Proprietary medium – Sinclair cyclamen mix.
<b>Plant culture</b>	<p>Production – on the floor polythene and perforated plastic cover over soil.</p> <p>Growing temperatures – pipe heating, heating at 5°C and venting at 10°C.</p> <p>Humidity – 85%, maximum ventilation whenever possible.</p> <p>Light levels – white shade applied to glass to keep light levels below 600 lux per m<sup>2</sup>.</p> <p>Irrigation – plants watered with overhead gantry (pipes fitted to nozzles so that water is applied to base of plants) or watered by hand.</p> <p>Nutrition – high potash and low calcium liquid feeds (made from straights) applied at every watering.</p> <p>Pesticide applications – programme based around Rovral WP, Decis and Dymamec for disease and pest control.</p> <p>Growth control – weekly application of daminozide at 1g per litre from week 21 to week 28.</p> <p>Spacing – 9cm pots – placed down pot thick and then from week 28 spaced at 30 plants per m<sup>2</sup>. Pack production – placed down at 20 plants per m<sup>2</sup>.</p>

**Appendix 2**

**Figure 9.** Miniature cyclamen plug size grade range (left to right grades 1 to 5).



**Figure 10.** Pot grown miniature cyclamen post transplanting







**Figure 11.** Pack grown miniature cyclamen post transplanting



**Figure 12.** Leaf size range in the miniature cyclamen



Assessment system – First leaf (left) – size 1: up to 40 mm, second leaf – size 2: 40 mm – 60 mm and third leaf – size 3: 60 mm plus.



**Figure 13.** Range of leaf colour and markings in miniature cyclamen foliage.



Assessment system – First column (left) – Type E: green leaf no marbling. Second column (top 2) – Type A: dark green leaf with marbling. Second column (bottom 2) – Type C: light green leaf with marbling. Third column (top 2) – Type B: dark green leaf with solid marbled band. Third column (bottom 2) – Type D: light green leaf with solid marbled band. Fourth column – Type F: silver variegation in leaf.

**Figure 14.** Flower size range in miniature cyclamen



Assessment system – First flower (left) – size 1: up to 20 mm, second flower – size 2: 20–30 mm and third flower – size 3: 30 mm plus.



**Figure 15.** Finished pot grown miniature cyclamen quality grade



Left to right – grades 0–5 of improving plant quality.

**Figure 16.** Shelf life facilities at Kinglea Plants







**Figure 17.** Trial layout at RHS Wisley



**Figure 18.** Trial layout at Springfield Festival Gardens







### Appendix 3

#### Finished product specification for pack and pot raised miniature cyclamen



Requirement – 5–8cm in height with a canopy spread of 8–12cm. 8–12 open flowers (minimum of 2 open flowers) plus visible flower bud.



Requirement – 5-8cm in height with a canopy spread of 11-16cm. 6-10 open flowers (minimum of 4 open flowers) plus flower bud below the foliage.

## Appendix 4

### Meteorological data for the period of the garden performance trial (September - December 2005)

(a). RHS Wisley

Date Sept	Temp Max°C	Temp Min°C	Rain mm	Date Oct	Temp Max°C	Temp Min°C	Rain mm	Date Nov	Temp Max°C	Temp Min°C	Rain mm	Date Dec	Temp Max°C	Temp Min°C	Rain mm
1	30.4	16.7	0.0	1	19.6	9.6	1.5	1	15.4	8.1	6.7	1	9.3	-0.7	0.4
2	23.4	11.0	0.0	2	16.5	7.3	1.3	2	17.2	8.9	6.8	2	9.5	6.5	24.2
3	23.8	12.4	0.0	3	15.8	2.3	0.0	3	17.5	14.0	11.2	3	10.8	6.0	14.4
4	26.0	12.6	0.0	4	16.2	4.1	0.0	4	16.1	7.5	2.5	4	10.5	2.5	0.0
5	28.2	17.4	13.9	5	17.1	5.3	0.0	5	13.8	3.1	0.0	5	9.6	2.2	0.0
6	22.0	14.2	0.2	6	16.0	12.5	0.0	6	14.8	7.4	0.4	6	8.0	0.0	0.0
7	22.5	10.2	0.0	7	15.8	13.6	0.0	7	13.9	7.8	6.3	7	6.2	-1.4	0.0
8	25.7	13.0	0.0	8	17.7	12.8	0.2	8				8	7.9	1.1	7.8
9	24.4	10.2	0.0	9	19.3	3.6	1.7	9				9	7.3	-0.7	0.2
10	25.4	13.8	6.3	10	17.2	6.3	0.0	10				10	3.4	-2.0	0.0
11	24.7	15.0	41.8	11	21.8	15.3	0.0	11	14.6	11.9	4.0	11	8.9	-3.0	0.2
12	16.5	14.1	0.4	12	21.9	16.5	0.2	12	14.0	6.0	2.0	12	6.5	-1.3	0.0
13	21.8	8.8	0.0	13	19.2	12.0	9.3	13	11.9	-0.9	0.0	13	8.6	3.3	0.0
14	22.7	15.2	0.0	14	14.8	11.8	0.2	14	10.0	-1.6	0.2	14	6.7	2.6	0.2
15	23.4	14.0	2.8	15	16.4	12.4	0.0	15	10.4	0.3	1.0	15	8.9	6.0	0.0
16	20.7	10.7	6.3	16	21.5	6.9	0.0	16	12.0	2.5	0.2	16	10.6	6.0	0.0
17	15.8	2.1	0.2	17	19.4	11.1	1.7	17	8.2	-3.2	1.0	17	12.5	-1.6	0.0
18	16.7	5.1	0.0	18	19.3	8.5	0.0	18	7.3	-5.8	0.2	18	3.9	-6.0	0.0
19	16.6	12.9	0.0	19	13.9	10.2	3.0	19	7.6	-4.0	0.0	19	8.4	-3.1	0.4
20	19.6	8.1	0.0	20	16.8	9.2	13.3	20	4.0	-3.7	0.2	20	9.2	-3.5	0.0
21	21.9	13.4	0.0	21	16.5	9.7	8.2	21	5.8	-5.0	0.2	21	8.8	-0.7	0.2
22	21.4	7.4	0.0	22	17.3	10.5	0.2	22	6.6	-2.4	0.2	22	10.6	4.9	0.0
23	21.4	7.3	0.0	23	16.5	5.3	0.2	23	8.4	0.4	0.2	23	10.5	5.7	0.0
24	18.4	3.6	3.0	24	16.2	10.2	7.0	24	5.0	1.3	0.0	24	9.3	6.5	0.0
25	18.2	11.2	0.0	25	16.7	12.9	16.0	25	9.6	-1.3	1.2	25	11.5	1.9	0.0
26	20.9	9.5	0.2	26	17.7	12.2	0.0	26	3.4	-0.7	0.0	26	7.3	-1.6	0.0
27	17.4	13.4	3.0	27	19.3	14.1	0.0	27	6.6	0.8	0.6	27	5.3	-2.5	0.4
28	20.1	7.0	0.0	28	20.6	13.1	2.7	28	4.0	1.3	0.0	28	2.2	-3.2	0.6
29	15.5	7.7	4.4	29	17.6	10.6	0.9	29	4.8	-2.1	0.4	29	1.6	-2.7	0.4
30	16.7	9.9	2.5	30	18.5	13.7	0.0	30	6.2	-4.3	0.0	30	3.1	-2.3	3.6
				31	19.4	12.3	0.8					31	10.0	1.8	8.6

(No data for 8, 9 and 10 November 2005).

Month	Av. Max. temp (°C)	Av. Min. temp (°C)	Total rain (mm)
September	21.4	10.9	84.9
October	17.8	10.2	68.4
November	10.0	1.7	45.4

December	8.0	0.7	61.6
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(b). HRI Kirton (Springfields Festival Gardens)

Date Sept	Temp Max°C	Temp Min°C	Rain mm	Date Oct	Temp Max°C	Temp Min°C	Rain mm	Date Nov	Temp Max°C	Temp Min°C	Rain mm	Date Dec	Temp Max°C	Temp Min°C	Rain mm
1	22.6	15.0	0.1	1	15.2	8.7	0.2	1	15.6	8.9	4.3	1	8.3	-0.6	0.0
2	19.9	11.6	0.0	2	14.3	6.6	0.0	2	17.9	7.6	3.3	2	6.7	5.0	0.3
3	23.7	12.0	0.0	3	14.7	7.8	0.0	3	16.6	12.7	0.0	3	8.2	6.2	0.9
4	27.3	14.6	15.9	4	16.2	10.4	0.0	4	12.2	7.2	0.0	4	8.9	2.7	0.2
5	24.1	15.9	0.5	5	16.4	5.3	0.0	5	14.6	3.4	0.7	5	8.2	2.3	0.0
6	24.0	13.6	0.0	6	16.2	10.1	0.0	6	14.1	6.7	4.0	6	6.9	1.0	1.4
7	22.8	13.2	0.0	7	16.4	13.4	0.0	7	12.8	7.3	0.0	7	7.2	-0.1	0.0
8	23.2	14.4	0.0	8	18.1	12.4	6.0	8	16.1	9.2	2.6	8	9.3	0.6	0.0
9	23.8	12.4	22.4	9	15.1	5.9	0.0	9	11.1	5.1	0.5	9	5.9	-0.9	0.0
10	17.6	16.7	3.6	10	21.8	6.6	0.0	10	14.8	4.0	0.0	10	8.4	-0.6	0.0
11	17.0	14.1	0.1	11	21.3	13.3	1.2	11	13.9	10.6	1.8	11	10.0	5.3	0.0
12	20.0	10.5	0.0	12	20.7	15.0	2.5	12	10.6	4.0	0.1	12	8.9	3.4	0.0
13	22.7	10.4	0.0	13	13.4	11.7	0.0	13	10.3	1.9	0.0	13	6.3	0.2	0.1
14	20.4	14.7	0.0	14	15.6	10.6	0.0	14	10.7	-0.4	1.4	14	7.8	0.3	0.4
15	15.0	10.1	9.1	15	13.3	11.9	0.0	15	11.3	3.6	0.0	15	11.4	1.9	0.1
16	14.1	8.2	0.0	16	17.2	11.5	0.0	16	6.9	2.7	0.0	16	10.3	4.7	0.0
17	15.2	4.5	0.0	17	17.3	11.3	0.0	17	6.2	-0.3	0.0	17	2.4	0.4	0.0
18	18.5	9.9	0.0	18	13.7	10.4	6.9	18	5.6	-2.0	0.0	18	5.7	-3.6	0.0
19	17.0	13.1	0.0	19	15.2	10.9	1.5	19	5.2	-2.1	0.0	19	7.7	-3.0	0.7
20	21.3	12.1	0.0	20	15.0	8.1	0.3	20	6.9	-2.4	0.0	20	7.3	0.0	0.1
21	20.4	10.8	0.0	21	15.8	9.3	2.9	21	4.1	-2.7	0.0	21	9.4	2.0	0.1
22	20.8	11.4	0.0	22	14.9	10.2	0.0	22	6.4	-1.5	0.0	22	9.5	4.0	0.0
23	17.1	9.6	3.8	23	14.0	8.9	13.3	23	6.8	1.7	0.0	23	10.8	6.1	0.0
24	15.4	3.9	0.2	24	17.2	9.3	3.6	24	10.0	-1.7	0.0	24	10.2	2.7	0.0
25	20.0	10.0	4.7	25	15.4	12.5	0.0	25	4.3	-1.0	6.9	25	5.9	-0.8	0.2
26	16.8	8.0	0.1	26	17.3	9.6	0.0	26	5.4	0.0	6.5	26	6.4	1.1	2.3
27	18.7	12.4	0.0	27	19.7	13.0	0.6	27	5.1	1.4	0.1	27	2.4	-0.3	1.5
28	15.6	6.6	2.7	28	17.3	13.8	0.6	28	3.9	0.4	0.6	28	0.2	-4.6	3.5
29	15.4	7.4	3.4	29	17.2	11.3	0.0	29	4.2	-0.2	0.0	29	1.5	-5.9	1.2
30	21.3	9.5	3.0	30	19.4	13.6	0.5	30	7.9	-2.6	0.2	30	4.2	-4.5	8.8
				31	13.7	11.9	1.2					31	7.2	0.2	0.1

Month	Av. Max. temp (°C)	Av. Min. temp (°C)	Total rain (mm)
September	19.7	11.2	69.6
October	16.4	10.5	41.3
November	9.7	2.7	33.0
December	7.2	0.8	21.9



## Appendix 5

### Public information and scoring sheets

#### Mini-Cyclamen Evaluation Trial at RHS Wisley and Springfields



Mini-cyclamen have been grown commercially for many years for sale as pot plants / conservatory plants. In recent years there has been a trend towards using mini-cyclamen as autumn bedding plants for use in hanging baskets, patio containers and even directly planted into the soil. This trial is an evaluation of 14 non-hardy types of mini-cyclamen (many of which are relatively new) to find out their potential as autumn bedding plants. The trial is an attempt to evaluate weather tolerance, plant vigour and habit, disease resistance and overall quality. From each type, 3 flower colours have been selected – pink (or as close to pink as possible), white and mixed. Each flower colour has been planted both in the soil and in containers. The trial will be open for public assessment on the following days –

15 October 2005 and 29 October 2005

For further details contact





### Mini-Cyclamen Evaluation Trial - Record Sheet



- Mini-cyclamen have been grown commercially for many years for sale as pot plants / conservatory plants.
- This trial is an evaluation of 14 types of non-hardy mini-cyclamen to find out their potential as autumn bedding plants.
- The trial is an attempt to evaluate weather tolerance, plant vigour and habit, disease resistance and overall quality.
- From each type, 3 flower colours have been selected – pink (or as close to pink as possible), white and mixed. Each flower colour has been planted both in the soil and in containers.
- Each flower colour has been given a unique number for recording purposes.
- **Could you please spare 5-10 minutes to look over the trial and pick your top three favourite selections planted in the soil and your top three planted in containers and record the details on the form below. Could you then please hand the form into a member of staff attending the trial. Many thanks for your co-operation.**

Date:
Evaluation Site:

	Cyclamen variety number	Reason for selection (please tick as appropriate)				
		Flower colour	Plant habit	Scent	Foliage	Other
Soil Planted						
1						
2						
3						
Container Planted						
1						
2						

3						
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