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The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

AUTHENTICATION

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

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Grower Summary

Headline

This project has demonstrated the potential to grow a number of new cut flower crops commercially for the UK market. This may be best done under Spanish tunnels to avoid adverse weather conditions, especially for high value crops.

Background and expected deliverables

The Cut Flower Trials Centre (CFC) was established as a result of a need identified by the industry itself. It was decided that the best location for the Centre would be Warwick HRI's Kirton site (KRC) which has a long track record of cut flower R&D and is situated in the heart of the Lincolnshire cut flower production, processing and packing industry. The project is jointly funded by the EU Lincolnshire Fenlands LEADER+ programme and the HDC. To ensure the level of accountability required for EU funding, a limited company - The Cut Flower Centre Ltd - was set up to be the 'delivery vehicle' for the funding. The whole project has been driven by the industry via a Management Group (MG) made up of growers, packers, supermarkets and other representatives of the industry. The MG, in consultation with the wider industry, specified all of the work to be done, and KRC was then commissioned as the contractor to undertake the work on behalf of the MG. This is very important because it has ensured that the project is led by the industry itself.

The deliverables of the project are expected to be:

- Demonstrate, trial and problem-solve cut-flower production
- Develop 'Best Practice' for the most promising varieties and transfer this knowledge to growers
- Evaluate selected crops on a commercial scale
- Promote UK cut-flower production to consumers
- Stimulate further R&D and promotional projects for the CFC.

It was anticipated that not all of these deliverable would be achieved in year 1, especially regarding developing 'Best Practice', which will mainly be achieved in year 2. The unusually wet weather during the summer of 2007 hindered the team achieving some of the deliverables, especially for the outdoor crops, most of which were unmarketable.

It is anticipated that the CFC will be a much longer term project than the initial 2007-2008 period. The MG is therefore actively seeking further funding streams to enable the trials to continue beyond 2008.

Summary of the project and main conclusions

- The project has developed a closer working relationship between the industry and its customers, with representatives of all levels of the supply chain being actively involved in the Management Group (MG).
- UK supermarkets are actively looking to source certain UK cut-flower lines as a direct result of the 2007 trial. These include pinks and 'German' asters, with others being considered in the light of the coming 2008 trials.
- The unusually wet weather during the summer of 2007 highlighted the need to use semi-protected structures, such as Spanish tunnels, to maintain the quality required by the UK market place. The wet weather of 2007 meant that flowers from most of the outdoor trials were unmarketable.
- Despite the problems during 2007 the trial has delivered some meaningful results and a number of market opportunities for the commercial production of 'new' crops during the 2008 season.

Ageratum

A single variety, Blue Horizon, was included in the project as a demonstration. It was transplanted to tunnels and outside plots on 25 May 2007. The plantings produced their first flowers between 29 June and 1 July. When cropped in mid-August the stems grown outside were taller and lighter (means of 42cm and 17g) than those from tunnels (31cm and 19g). There was sufficient interest in the ageratum plots from major retailers to justify including ageratum in the 2008 trials, when some newer, vegetatively produced varieties will be included if they can be sourced.

Godetia

Four cultivars of the Grace F1 series were transplanted to outside plots and tunnels on 25 May and 19 June 2007 as a demonstration. The trial demonstrated the potential of godetia for production in the UK, and generated interest amongst some retailers.

Larkspur

Eight varieties were raised from seed and transplanted to outdoor plots on 25 May 2007. The plants were so severely affected by the excessively wet weather that no meaningful results could be obtained this year. As an indication, however, varieties Single Red, Single White and Sydney Pink coped better with these conditions than the others.

In addition, nine varieties were transplanted into outside plots on two dates, 25 May and 22 June 2007. As with the demonstration plots the trial was very severely affected by the excessively wet weather, and as a consequence no meaningful results could be obtained.

Aster (*Aster ericoides*)

Three September-flowering varieties, Caityn Moerlyn, Cirina Dark and Monte Euro Mooercassino, were planted in tunnels on 20 June 2007. The potential of the crop will be assessed in 2008.

Cynara

Two new, coded varieties, 3222 and 3223, were transplanted to outside and tunnel plots on 30 May 2007. This crop should demonstrate its full potential in 2008. Variety 3222 appears to be especially vigorous.

Echinops

One variety, Veitch's Blue, was transplanted to tunnel and outside plots on 2 May 2007. Under protection, echinops was seriously affected by mildew, with a poor overall appearance. Both outside and protected plots started to produce flowers in late-June/early-July.

Eryngium

Seven varieties (including one un-named new line) of eryngium were transplanted into outside plots and tunnels on 23 April or 13 June 2007 (depending on delivery date). The plants in this demonstration presented a number of problems. Belladonna was the most attractive flower and produced the most flower stems. Blue Bell was very variable in height and plants were shy to flower. Ellabella, Marbella and 3221 were slow to flower. Farid was very poor grown in outside plots. Purple Sheen had tip-burn on the flower heads and no plants were cropped. As a biennial, the eryngium crop is expected to reach its full potential in 2008.

Grasses (ornamental)

Four ornamental grasses were transplanted to outdoor plots between 30 May and 19 June 2007. All four grasses started flowering 5 to 6 weeks after transplanting. *Setaria italica* produced taller and much heavier stems (85cm, 29g) than the *Panicum* varieties (60-70cm, 10-11g). While the market for ornamental grasses is likely to remain limited, the trial demonstrated that there is no reason why UK growers should not be able to fulfil the needs of the UK market.

Pinks (spring- and autumn-planted)

Bright Eyes, Lily the Pink, Monica Wyatt and Rose Monica were transplanted on 30 April 2007 to outdoor plots and tunnels, and all plantings started to produce flowers in the second week of July. Monica Wyatt performed strongly, producing a large number of stems. The tunnel-raised plants produced more stems per plant and heavier stems than those grown outdoors, though there were marked differences in productivity between varieties: for example, the flower production of Lily the Pink grown under protection was relatively low. A further seven varieties (Lily the Pink, Monica Wyatt, Rose Monica, Dancing Queen, Devon Cream, Grans Favourite and Rose Monica) were transplanted on 15 October 2007 to tunnels only, and the results for these will be given in the 2008 report.

While pinks may be considered to be an old fashioned product, this trial enabled a younger generation of retail buyers to look at it again. As a direct result of the trial, one major UK retailer intends to use the product in 2008. The trial also demonstrated the need to produce the crop under some protection if stem length and overall quality are to be guaranteed.

Phlox

Following the late delivery of plants, four varieties were transplanted to a tunnel on 20 June 2007. This was too late to produce many meaningful results in the first year, and Icecap and Miss Marple failed to flower in the outside plots within the main project period. The crop should reach its full potential in 2008. For plants grown in tunnels, there were large between-variety differences in stem weight for stems of similar length (means between 46 and 58cm): Miss Marple produced the heaviest stems (56g) and Miss Fiona the lightest (34g). Despite this poor performance as a result of late planting, the phlox demonstration generated much interest amongst the UK retailers that viewed it.

Samples of the phlox from the tunnels were subjected to vase-life testing. All four varieties exceeded their expected 5-day vase-life by 2 or more days. Sugar Missy had the longest vase-life, nearly 9 days, and showed significantly greater water uptake than the other three cultivars. By vase-day 5 leaf quality was excellent in all varieties, but flower quality was poorer (with a low score of 3.3 for Ice Cap) and vase water was generally turbid.

Sedum

Eight varieties of sedum were transplanted both to tunnels and outdoor plots on 12 July 2007, following late delivery of the plants. This meant that the stems were very short, and the plots have been grown-on to determine their potential in 2008.

Solidago

Solidago media was transplanted to a Spanish tunnel on 23 April 2007. This crop was included by one of the In-Kind suppliers as for a 'look see' of their new cultivars.

Veronica

Four varieties of veronica were transplanted to tunnels and outside plots on 20 June 2007. In the tunnel Blue Spark was the first variety to flower (25 July) and Pink Spark the latest (15 August), while in outside plots all four cultivars began flowering in early August. Lodging was noted as a problem in some plants. All varieties produced considerably longer and heavier when tunnel-grown; overall, stems were 55% longer and 78% heavier when grown under protection.

Brassica (ornamental)

Four F1 varieties (Crane Pink, Crane White, Red Crane and Rose Crane) were direct-drilled into outside plots on 12 July, 1 August and 28 August 2007. However, problems with delivery and the wet season of 2007 meant that very few meaningful results could be obtained this year.

Delphinium

The effects of planting date on continuity were investigated in thirteen varieties including three main series (Scent, Takii Aurora and Pan American Guardian), Belladonna Blue Shadow and a new line, Blue Donna Imperial. The transplanting dates into both outside plots and tunnels were 25 May, 04 June and 03 July 2007.

Several cultivars from the first planting in tunnels developed moderate to severe mildew symptoms, a problem that may need to be addressed in future trials. Some plants from the third planting, particularly Takii Aurora lines, and especially Light Blue, produced short or very short, poor quality stems. Mean stem lengths and weights were recorded for the first, and most successful, planting, and showed that tunnel-raised stems were consistently heavier, though not consistently longer, than those from plants grown outside. Flowers were produced over the period from week 27 to week 36. Despite three plantings and up to 15 cultivars being trialled, however, there were still breaks in continuity, particularly in weeks 29 and 33-34. Continuity needs to be investigated further to ensure that the crop is economically viable.

Dianthus (annual)

The effects of planting date and cultivar on continuity and vase-life were investigated in eleven varieties, including several from the Amazon and Sweet series, Bodestolz and two un-named lines. The plants were transplanted to tunnels and outside plots on 30 May and 25

June 2007. Tunnel-raised stems were consistently heavier and longer than those raised outside. The results demonstrated the clear potential of this crop for UK production, with flowers being picked from week 27 to week 36 - though with some gaps (weeks 28, 34 and 35). Further investigations are required into scheduling and the economics of production.

Samples of eight selected cultivars were subjected to vase-life testing. Mean vase-life varied from 7 days (for Sweet Red) to 14 days (for Amazon Rose Magic), and these differences were clearly reflected in the extent of water uptake in the different cultivars. Leaf quality was good throughout, but flower quality was poorer than most in Sweet Scarlet and lowest in Sweet Red. Generally, there were no water clarity issues.

Zinnia

Ten varieties were grown for testing vase-life and especially stem strength. They were direct-drilled outside on 25 May 2007, direct-drilled in tunnels on 13 June 2007, and grown as plugs and transplanted to outside plots and tunnels on 03 July 2007. Marketable stems were obtained from many of the plots but, as anticipated, vase-life and neck-strength were the key issues that would affect any future development of this crop. The trial identified Yellow Flame as the variety with the highest stem strength, and this and some other varieties will be investigated further in 2008.

Samples of six selected cultivars were subjected to vase-life testing. Stems were harvested at three stages of maturity and treated after cutting by standing in either CVBn or RVB Clear flower food prior to testing. Using marginal means for the six cultivars, vase-life ranged from 5.2 (Sun Cherry) to 8.9 days (Canary Bird), and Sun Cherry also had the lowest flower quality score while the score for Canary Bird was among the highest. Considering cropping stage, cropping at Stage 1 resulted in the longest mean vase-life (7.8 days) and highest mean flower quality score, while cropping at Stages 2 or 3 gave a vase-life of 6.1 or 6.2 and lower quality scores. Post-harvest treatment in CVBn produced a longer vase-life (7.1 days) and a higher quality score than treating in RVB Clear (6.5 days).

Antirrhinum

An extensive commercial evaluation of antirrhinum was undertaken in 2007. This produced useful experience with the crop, demonstrated the value of outdoors growing, and identified a number of good cultivars. However, only 74% of the plants reached the high specification demanded by a UK supermarket, and at the poor price that could be obtained - 20p per stem - the crop is uneconomic, except, perhaps, for a very specialised niche market. It was considered that the specification was set at an unachievable level.

German Asters

Trials plots of German asters were planted on two growers holdings. Unfortunately the main trial site for the German asters was severely waterlogged and had to be ploughed in. However a smaller trial on the second nursery demonstrated enough interest amongst supermarkets to justify considering a larger scale commercial trial (under protection) in 2008. The varieties that showed most promise were Gal, Steestern, Igle and Krallen.

Financial benefits

The report covers the first year of a two-year trial, and so, as yet, there are no specific financial benefits to report.

Action points for growers

- Liaise with your customers to ensure you are growing what they need – there is currently enormous potential for UK flower growers providing they are producing the right product of a suitable quality at an economically viable price.
- Consider production under Spanish tunnels. The 2007 season clearly demonstrated the problems associated with outdoor cut flower production.
- Closely follow the 2008 trials, as much of the work will not come to fruition until the second year of the trial.

Science Section

Introduction

Despite consumer trends that have led to a huge increase in the sales of cut-flowers in the UK over the past 10 years, fewer than ever of these flowers are grown in the UK, the great bulk of them being imported. This is despite (1) the UK producer's advantage of closeness to the market and (2) the suitability of the UK climate to grow many of the popular species either in the open or in semi-protected structures such as Spanish tunnels.

One contributory factor is a lack of know-how – not surprising, perhaps, given that the number of potential species runs into hundreds and that the seed houses are producing huge numbers of new cultivars and other introductions. But innovation is the key to a successful UK cut-flower industry. It is necessary to identify those desirable products that can be grown well and efficiently under UK conditions and which appeal to both mass and niche markets. However our industry, both nationally and regionally lacks a commercially oriented, independent test centre where a wide range of cut-flower species and varieties can be conveniently grown in comparative plots, thereby allowing the best varieties to be selected and further investigated and husbandry protocols to be developed under typical UK climatic, cultural and economic conditions.

Therefore the industry itself identified the need to establish a Cut-Flower Trials Centre (CFC) for the UK and specifically for Lincolnshire, where a high proportion of these crops are grown and where UK fresh produce logistics are also concentrated. All levels of the supply chain of the local cut flower industry came together to develop the proposal and establish a company (The Cut Flower Centre Ltd) as the legal vehicle to administer the funding. The trials are being undertaken on contract by The Kirton Research Centre (situated within the main cut flower growing area of Lincolnshire) (KRC) and the overall direction of the project is being steered and overseen by a Management Group (MG) consisting of local growers, marketing companies, supermarkets, seed suppliers and consultants.

Because of the importance of the horticultural industry in rural Lincolnshire, funding for this project has also come from the EU via the Lincolnshire Fenlands LEADER+ programme.

The aims of the CFC are to:-

- Demonstrate, trial and problem-solve cut-flower production
- Develop 'Best Practice' and provide technology transfer for growers
- Evaluate selected crops on commercial farms

- Promote UK – and specifically Lincolnshire - cut-flower production to consumers
- Stimulate further R&D and promotional projects for the cut-flower sector

These are specific aims, but there is also a ‘bigger picture’: to grow the concept of a dynamic UK cut-flower industry that is confident, world-class, and not dependent on what is left to grow after imports have satisfied the bulk of the market.

Materials and methods

Trials and husbandry

The species and cultivars trialled in 2007 are listed in Table 1, along with the dates of transplanting or direct-drilling and whether grown in outside plots or under Spanish tunnels. Transplanted crops were either obtained as ‘plugs’ or were raised from seed in cellular trays at The Kirton Research Centre of Warwick HRI, Kirton, Lincolnshire (KRC). For seed raising at KRC several types of cellular tray were used, as appropriate, from 96- to 308-celled trays.

Except for trials on antirrhinum and German asters (see below) the trials were grown at KRC, where the soil type is a medium silt typical of south Lincolnshire. The general layout of the trials is shown in Figure 1. The larkspur and ornamental brassica trials were replicated, with three randomised blocks; other demonstrations were not replicated. The individual plots were 2m-long in Spanish tunnels and 3m-long in outdoor plots.

Crop husbandry protocols were agreed between KRC staff and members of the Management Group (MG), and aimed to achieve good commercial practice adapted as necessary to suit small trial plots. All transplanting was done through black carrot polythene film, using either standard 2.0m-wide film (for 2-year-down and some 1-year-down plantings) or biodegradable 1.2m-wide film (for 1-year-down plantings in replicated blocks). Planting dates and the spacing between plants were appropriate to the species trialled, and plants were supported by netting and pinched where appropriate. A liquid feed was made up of 1000L of water with magnesium sulphate (50.6kg), mono-potassium phosphate (77.0kg), dissolved iron (10.0L) and nitric acid (40.6L), diluted at 1:200 and applied to outside plots on six occasions (starting 4 August and ending 6 September) and to tunnel plots on seven occasions (starting 27 July and ending 19 October). Weeds in direct-drilled (non-mulched) plots were removed by hand. As needs arose several insecticide and fungicide applications were made, usually across all extant plots unless there was a particular problem with a specific crop; all pesticides were applied according to recommendations. In all, 25 pesticide applications were made on various of the crops between 09 July and 07 November 2007;

the insecticide products utilised were Hallmark, Calypso, Aphox and Majestik, and the fungicides were Stroby WG, Plover, Nimrod, Solfa WG, Bravo 500 and Systhane 20EW.

A large commercial evaluation of antirrhinum was grown on a nursery in south Lincolnshire, some 12km south-south-west of the Kirton site. Many cultivars were grown, including some new numbered cultivars, and including the following: (Potomac Series) Dark Orange, Pink, Ivory White, Pink, Rose, Early Pink, Plum, Royal, Apple Blossom, Early White, Yellow, Cherry Rose and Crimson Red; (Opus Series) Plum Blossom, Lavender, Red, Rose, Pink, White and Apple Blossom; (Axiom Series) Yellow Improved, Bronze, Pink, Paper White, Dark Orange, Dark Rose and Deep Rose. Over a 4000m² site, antirrhinums were planted in beds worked with a bed former so that the slightly raised beds allowed water to run off. They were transplanted through carrot film at a planting rate of 64/m². Support netting was provided and this was shaded from the wind. To control pests and diseases the crop was sprayed with Amistar and Fubol Gold (twice) for downy mildew, with Plenum for aphids, with Ambush for caterpillars and with Rovral for *Botrytis*.

Commercial evaluations of German asters were planted at two commercial nurseries in south Lincolnshire, but were ruined by the excessive rain which fell this year and were ploughed in. However, despite these problems the market potential of the German asters was identified by both retailers and growers and it is anticipated that a large commercial trial will be undertaken in 2008 using protected facilities.

Table 1. Cut-flower species and varieties trialled in 2007 (listed in alphabetical order).

<i>Species and purpose of trial</i>	<i>Varieties (with Series names underlined)</i>	<i>Transplanting or drilling dates</i>	<i>Outside or tunnel</i>	<i>Target picking stages</i>
Ageratum (<i>Ageratum houstonianum</i>)	Blue Horizon	25 May (transplanted)	Both	-
Demonstration				
Aster (<i>Aster ericoides</i>)	Caityn Moerlyn Cirina Dark Monte Euro Moercassino	20 June (transplanted)	Tunnel	30% of florets open
Demonstration				
Brassica (ornamental) (<i>Brassica</i> sp.)	Crane Pink F1 Crane White F1 Red Crane F1 Rose Crane F1	12 July 01 August 28 August (direct drilled)	Outside	50% white showing on head
Variety and drilling date trial				
Cynara (<i>Cynara cardunculus</i>)	3222 (new un-named line) 3223 (new un-named line)	30 May (transplanted)	Both	-
Demonstration				
Delphinium (<i>Delphinium elatum</i>)	Scent White Pink Rose	25 May 04 June 03 July (transplanted)	Both	1/3rd of flower column open, 2/3rds in bud

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Planting date, cultivar and continuity trial	Sky Blue				
	Centurion Blue				
	<u>Takii Aurora</u>				
	Light Blue				
	Light Purple				
	Blue				
	Lavender				
	Deep Purple				
	<u>Pan American Guardian</u>				
	(planting 1 only)				
Lavender					
Blue					
White					
	Belladonna Blue Shadow				
	(planting 2 only)				
	Blue Donna Imperial (new line)				
	(planting 2 only)				
Dianthus (annual) (<i>Dianthus barbatus</i>)	<u>Amazon</u>	30 May	Both	Stage 2	
	Neon Cherry	25 June			
	Neon Purple	(transplanted)			
	Rose Magic				
Planting date, cultivar, continuity and vase-life trial	Bodestolz				
	<u>Sweet</u>				
	Coral				
	Purple				
	Red				
	Scarlet				
	White				
		3850 (new un-named line)			
		4244 (new un-named line)			
	Echinops (<i>Echinops</i> sp.)	Veitch's Blue	2 May (transplanted)	Both	Stage 2
Demonstration					
Eryngium (<i>Eryngium</i> sp.)	Belladonna	23 April to	Both	Pronounced, well developed cone showing true colour and green stems	
	Blue Bell	13 June			
	Ellabella	(transplanted)			
	Demonstration	Farid			
		Marbella			
		Purple Sheen			
		3221 (new un-named line)			
		(Blue Glitter was originally included in the trials list but was not delivered.)			
	Godetia (<i>Godetia grandiflora</i>)	<u>Grace F1</u>	25 May	Both	-
		Rose with Pink	19 June		
	Salmon	(transplanted)			
	Red				
Demonstration	Shell Pink				
Grasses (ornamental) (<i>Panicum</i> and	<i>Panicum elegans</i> Frosted	30 May to	Outside	55-60cm stems	
	Explosion	19 June			
	<i>Panicum virgatum</i>	(transplanted)			

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<i>Setaria</i> spp.)	<i>Panicum virgatum</i> Fontane <i>Setaria italica</i>			
Demonstration				
Larkspur (<i>Delphinium consolida</i>)	Early Bird Giant Imperial Braveheart Single Blue Single Deep Blue	25 May (transplanted)	Outside	Stage 2, spike length 17-20cm
Demonstration	Single Red Single White Sublime Lilac Sydney Pink			
Larkspur (<i>Delphinium consolida</i>)	Kingsize Scarlet Sublime Deep Blue Sydney Lilac Sydney Rose Sydney White Blue Picote Light Blue Sydney Purple Sydney White	25 May 22 June (transplanted)	Outside	Stage 2, spike length 17-20cm
Cultivar and planting date trial				
Pink (spring-planting) (<i>Dianthus</i> sp.)	Bright Eyes Lily the Pink Monica Wyatt Rose Monica	30 April (transplanted)	Both	Calyx just broken and showing colour
Variety demonstration				
Pink (autumn-planting) (<i>Dianthus</i> sp.)	Lily the Pink Monica Wyatt Rose Monica Dancing Queen Devon Cream Grans Favorite Rose Monica	15 October (transplanted)	Tunnel	Calyx just broken and showing colour
Variety demonstration				
Phlox (<i>Phlox paniculata</i>)	Icecap Miss Marple Miss Fiona Sugar Missy	20 June (transplanted)	Tunnel	Self-supporting stem, spike size 8cm minimum
Demonstration				
Sedum (<i>Sedum spectabile</i>)	Telephilium Munstead Dark Red Superior Pink Hybrida Autumn Joy Spectabile Brilliant Telephilium Carl Superior White Herbstfeude Matrona	12 July (transplanted)	Outside	Half florets showing colour, 300g bunch
Variety demonstration				
Solidago (<i>Solidago media</i>)	<i>Solidago media</i>	23 April (transplanted)	Tunnel	Stage 2, weight 15g
Demonstration				
Veronica (<i>Veronica</i> sp.)	Blue Spark Lavender Spark Pink Spark White Spark	20 June (transplanted)	Both	-
Demonstration				
Zinnia (<i>Zinnia elegans</i>)	Canary Bird Cerise Queen Luminosa Meteor Orange King Purple Prince	25 May (direct drilled) 13 June (direct drilled) 03 July (transplanted)	Outside Tunnel Both	Stage 2
Cultivars and stem strength trial				

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<i>Species and purpose of trial</i>	<i>Varieties (with Series names underlined)</i>	<i>Transplanting or drilling dates</i>	<i>Outside or tunnel</i>	<i>Target picking stages</i>
	Yellow Flame			
	Sun Cherry (tunnel only, date 3)			
	Sun Red (tunnel only, date 3)			
	Sunshine Mix (tunnel only, date 3)			

Cropping records

Stems were picked from each crop at the appropriate stage of flower development (see Table 1). Records made included the yield of stems, cropping dates and the length and weight of stems. In the tables of results, the start of cropping refers to the date the first marketable stems were available. For determining mean lengths and weights, usually 20 cropped stems were taken at random and measured individually. For zinnia, where stem strength is an issue, this was assessed at harvest on 10 stems of each variety: each stem was waved in a standard fashion and scored on a one to three scale (1, stem easily broken; 2, stem bends but does not break; 3, stem remains rigid). Flowers from the annual dianthus, antirrhinum, phlox and zinnia trials were subjected to vase-life testing (see below). Owing to the unseasonably wet weather in 2007, some of the outdoor crops were unmarketable and so resources were concentrated on assessing the successful crops. Under Results, all figures quoted are means unless stated otherwise, and all dates are expressed in the UK 'DD/MM' (day/month) format.

Vase-life trials

Stems from the annual dianthus, antirrhinum, phlox and zinnia trials were subjected to a standard vase-life test procedures. Freshly harvested stems were sorted and checked for marketable quality. All stems were re-cut with sharp secateurs and the lower leaves (and any damaged leaves that might foul the vase-water) were removed.

For annual dianthus and phlox, one bunch of ten stems of each variety was placed in a clean vase (1.2L capacity) with 1.0L of tap-water containing Pokon & Chrysal Universal Flower Food powder.

For antirrhinum three vase-life tests were set up, all using eight cultivars (listed under Results). Flowers were supplied by the commercial nursery carrying out the trial and transported vertically in buckets of water to Kirton on 20 August 2007.

1. Variety trial: the vase-life of the eight varieties was compared. After harvest (outdoors) all stems were placed in buckets containing CVBn at the growers. For each cultivar five or six stems were placed in a clean vase (1.2L capacity) with 1.0L of tap-water containing Pokon & Chrysal Universal Flower Food powder.
2. Post-harvest treatment trial: bunches of the eight cultivars were placed in buckets to receive one of seven treatments at the growers: (1) AVB then dry to packers; (2) AVB

then RVB Clear to packers; (3) AVB then CVBn to packers; (4) RVB Clear throughout; (5) CVBn throughout; (6) and (7) plain water. On receipt at Kirton the stems were placed in the vase-life room for 4 days (store phase), the stem bases of treatment (1) first being re-cut and stems from treatments (1) to (6) placed in water with a Professional 2 NG T-bag and stems from treatment (7) in plain water. All stems were then transferred to vases as described under Trial 1, except that for treatment (7) the vases contained plain water. For each of the seven treatments four 'replicate' vases were set up, replicate 1 containing three stems each of cultivars 1 and 2, replicate 2 containing three stems each of cultivars 3 and 4, and so on.

3. Vase treatment trial: bunches of the eight cultivars were placed in buckets containing either CVBn (treatments 1-3) or plain water (treatment 4) at the growers. On receipt at Kirton the stems were placed in the vase-life room for 4 days (store phase), the stems from treatments (1) to (3) being placed in water with a Professional 2 NG T-bag and stems from treatment (4) in plain water. Stems were then transferred to vases containing (1) Pokon & Chrysal Universal Flower Food powder, (2) Pokon & Chrysal Lily and Alstroemeria Flower Food Powder, (3) Pokon & Chrysal Bulb Flower Food Powder or (4) plain water. For each of the four treatments four 'replicate' vases were set up as described for Trial 2.

For zinnia, the trial was extended to cover three cropping stages (1, flower open; 2, one cluster of stamens visible; 3, two clusters of stamen visible) and included a post-harvest treatment in either CVBn or RVB Clear for 24 hours at 2-5°C in the dark. Following this, all stems were transferred to water containing one Professional 2 NG T-bag for a simulated transport period of 24 hours under the same conditions as post-harvest, followed by a 96-hour period in the same conditions as the vase-life test itself (see below). Six cultivars were tested, placing three stems of each of two varieties in a clean vase (1.2L capacity) with 1.0L of tap-water containing Pokon & Chrysal Universal Flower Food powder.

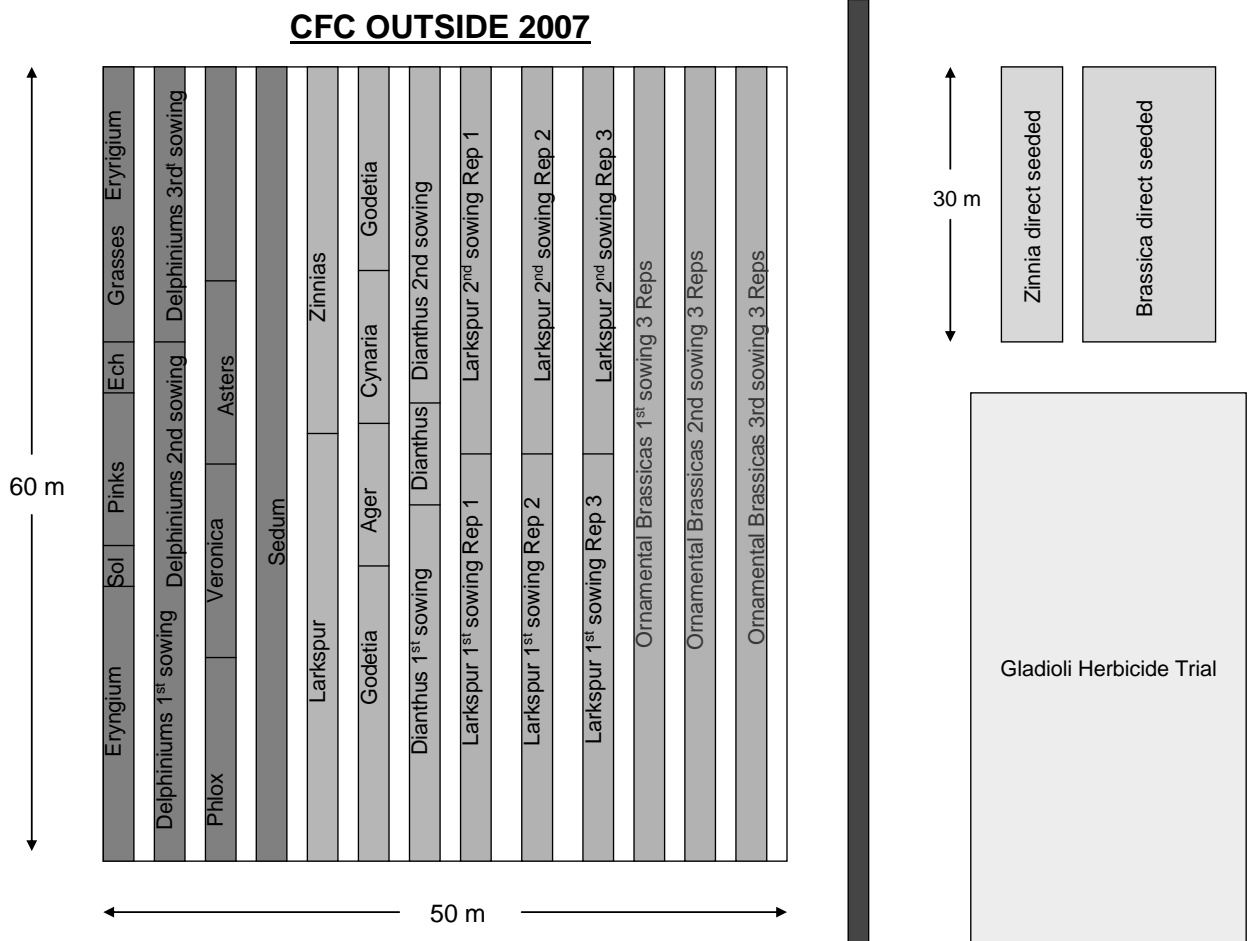
Vases were placed on the bench of a vase-life room (20°C, ca. 60% relative humidity, and tubular florescent lamps producing 1000 lux at flower height on for 12 hours per day). Stems were examined frequently, recording the date when each stem reached its end-point of vase-life, in zinnia taken as when 50% of the ray-florets had wilted, and, in the other species, when more than 50% of the florets on a stem had started to wilt or drop petals. If a stem reached its end-point before the main assessment date it was left in the vase until that time; thereafter stems were discarded individually as they reached their end-point. The main assessment was carried out on vase-day 5 (5 days after flowers went into vases) for phlox, zinnia and antirrhinum, and on vase-day 7 for annual dianthus. Each stem was scored for flower and leaf quality and each vase for water clarity, on a scale of 1 to 5, a score of 5 always representing the highest quality (Table 2). Observations were continued until each

stem had reached its end-point. The volume of liquid remaining at the end of vase-life was noted so water uptake could be measured.

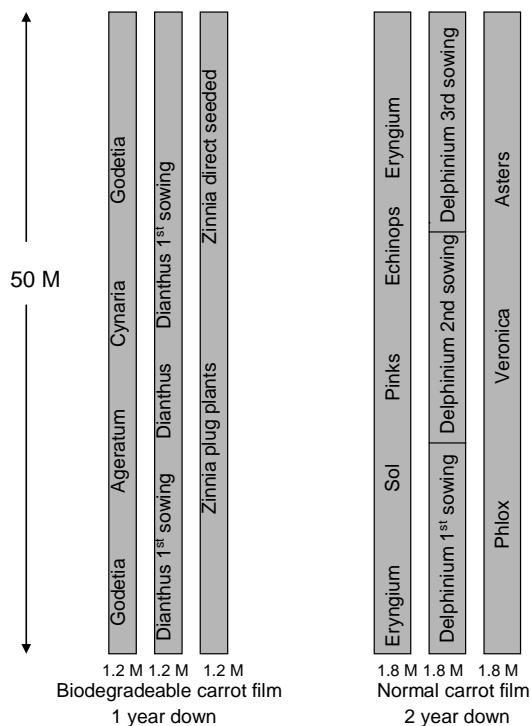
Table 2. Quality scores used in vase-life testing.

<i>Score</i>	<i>Flower or leaf quality</i>
1	Very poor quality, consumers would discard
2	Poor quality, most consumers would discard
3	Reasonable quality, most consumers would not yet discard
4	Good quality, consumers would not discard
5	Very good quality
<i>Score</i>	<i>Water clarity</i>
1	Poor clarity
3	Moderate
5	Good

Figure 1. The layout of plantings in 2007 at KRC in outdoor (field) plots (above) and Spanish tunnels (below).



CFTC TUNNELS 2007



Results

The results are presented grouped into (1) species or variety demonstrations, (2) full trials and (3) commercial evaluations.

Results of demonstrations – annual species

Ageratum

A single variety, Blue Horizon, was included in the project as a demonstration. It was transplanted to tunnels and outside plots on 25 May 2007. The plantings produced their first flowers between 29 June and 1 July. When cropped in mid-August the stems grown outside were taller and lighter (means of 42cm and 17g) than those from tunnels (31cm and 19g). There was sufficient interest in the ageratum plots from major retailers to justify including ageratum in the 2008 trials, when some newer, vegetatively produced varieties will be included if they can be sourced.

Godetia

Four cultivars of the Grace F1 series were transplanted to outside plots and tunnels on 25 May and 19 June 2007 as a demonstration. The data are summarised in Table 3.

The cultivar Rose with Pink produced inferior quality blooms and flowers were poor from the second planting. However, the trial demonstrated the potential of godetia for production in the UK, and generated interest amongst some retailers.

Table 3. Summary of flowering data for godetia cultivars grown at Kirton in 2007.

<i>Cultivar</i>	<i>Planting and date</i>	<i>Start of cropping</i>		<i>Stem length (cm)</i>		<i>Stem weight (g)</i>	
		<i>Tunnel</i>	<i>Outside</i>	<i>Tunnel</i>	<i>Outside</i>	<i>Tunnel</i>	<i>Outside</i>
Rose with Pink	1 (25/05)	25/07	25/07	38	29	29	22
Salmon	1	25/07	25/07	42	32	30	23
Shell Pink	1	02/08	02/08	41	34	30	32
Red	1	02/08	02/08	41	34	39	36

Larkspur

Eight varieties were raised from seed and transplanted to outdoor plots on 25 May 2007. The plants were so severely affected by the excessively wet weather that no meaningful results could be obtained this year. As an indication, however, varieties Single Red, Single White and Sydney Pink coped better with these conditions than the others.

Results of demonstrations – biennial and perennial species

Aster (*Aster ericoides*)

Three September-flowering varieties, Caityn Moerlyn, Cirina Dark and Monte Euro Mooercassino, were planted in tunnels on 20 June 2007. The potential of the crop will be assessed in 2008.

Cynara

Two new, coded varieties, 3222 and 3223, were transplanted to outside and tunnel plots on 30 May 2007. This crop should demonstrate its full potential in 2008. Variety 3222 appears to be especially vigorous.

Echinops

One variety, Veitch's Blue, was transplanted to tunnel and outside plots on 2 May 2007. Under protection, echinops was seriously affected by mildew, with a poor overall appearance. Both outside and protected plots started to produce flowers in late-June/early-July. The product generated interest amongst retailers and will be continued into 2008.

Eryngium

Seven varieties (including one un-named new line) of eryngium were transplanted into outside plots and tunnels on 23 April or 13 June 2007 (depending on delivery date). The data are given in Table 4.

The plants in this demonstration presented a number of problems. Belladonna was the most attractive flower and produced the most flower stems. Blue Bell was very variable in height and plants were shy to flower. Ellabella, Marbella and 3221 were slow to flower. Farid was very poor grown in outside plots. Purple Sheen had tip-burn on the flower heads and no plants were cropped. As a biennial, the eryngium crop is expected to reach its full potential in 2008.

Table 4. Summary of flowering data for *Eryngium* cultivars grown at Kirton in 2007.

Cultivar	Planting date	Start of cropping		Notes
		Tunnel	Outside	
Belladonna	23/04	29/06	25/07	Best looking variety
Blue Bell	23/04	15/08	20/08	Very variable in height and only about half flowering
Ellabella	23/04	25/07	06/09	Few flowers
Farid	23/04	09/07	25/07	Very poor in outside plots
Marbella	23/04	n.a. ¹	n.a.	Flowers failed to colour, not assessed
Purple Sheen	13/06	n.a.	n.a.	Flowers failed to colour, not assessed; tip burn on heads prior to flowering
3221	13/06	n.a.	06/09	Flowers in tunnels failed to colour, not assessed

¹ n.a., not assessed

Grasses (ornamental)

Four ornamental grasses were transplanted to outdoor plots between 30 May and 19 June 2007. The results are given in Table 5.

All four grasses started flowering 5 to 6 weeks after transplanting. *Setaria italica* produced taller and much heavier stems (85cm, 29g) than the *Panicum* varieties (60-70cm, 10-11g).

While the market for ornamental grasses is likely to remain limited, the trial demonstrated that there is no reason why UK growers should not be able to fulfil the needs of the UK market.

Table 5. Summary of flowering data for ornamental grasses grown in outdoor plots at Kirton in 2007.

<i>Cultivar</i>	<i>Planting date</i>	<i>Start of cropping</i>	<i>Stem length (cm)</i>	<i>Stem weight (g)</i>
<i>Panicum elegans</i> Frosted Explosion	30/05	05/07	69.6	11.0
<i>Panicum virgatum</i>	30/05	09/07	70.0	10.0
<i>Setaria italica</i>	13/06	02/08	85.4	29.0
<i>Panicum virgatum</i> Fontane	19/06	02/08	60.4	10.0

Pinks (spring- and autumn-planted)

Bright Eyes, Lily the Pink, Monica Wyatt and Rose Monica were transplanted on 30 April 2007 to outdoor plots and tunnels, and all plantings started to produce flowers in the second week of July. Figure 2 shows the continual pattern of cropping for these between July and November. Monica Wyatt performed strongly, producing a large number of stems. Stem numbers and weights are summarised in Table 6. The tunnel-raised plants produced more stems per plant and heavier stems than those grown outdoors, though there were marked differences in productivity between varieties: for example, the flower production of Lily the Pink grown under protection was relatively low.

A further seven varieties (Lily the Pink, Monica Wyatt, Rose Monica, Dancing Queen, Devon Cream, Grans Favourite and Rose Monica) were transplanted on 15 October 2007 to tunnels only, and the results for these will be given in the 2008 report.

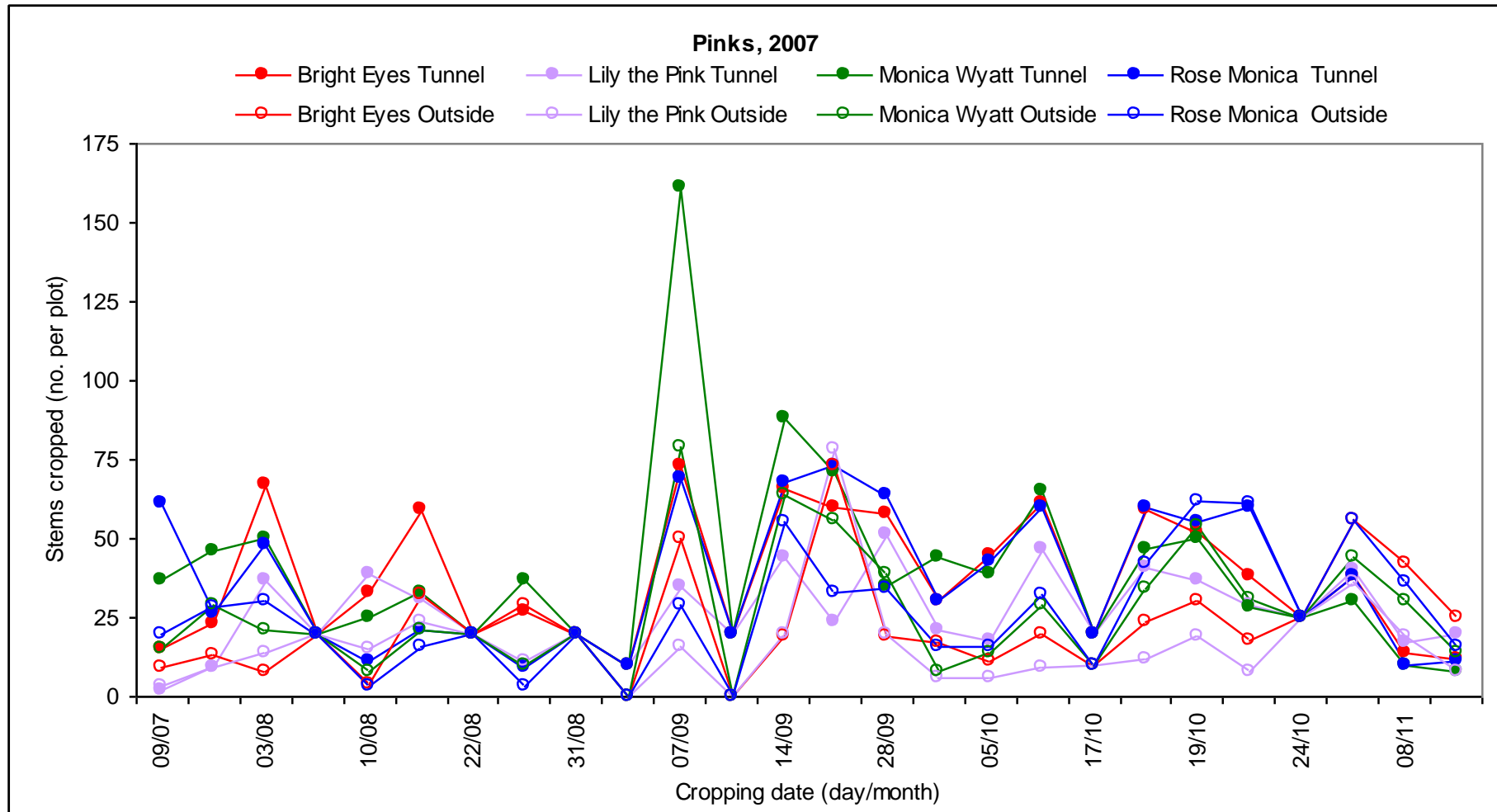
While pinks may be considered to be an old fashioned product, this trial enabled a younger generation of retail buyers to look at it again. As a direct result of the trial, one major UK retailer intends to use the product in 2008. The trial also demonstrated the need to produce the crop under some protection if stem length and overall quality are to be guaranteed.

Table 6. Summary of stems per plant and stem weights for spring-planted pinks grown at Kirton in 2007.

<i>Location and variety</i>	<i>No. stems per plant</i>	<i>20-stem weight (g)</i>		<i>Mean stem weight (g)</i>
		<i>Picked 08/08</i>	<i>Picked 22/08</i>	
Tunnel-grown				

Bright Eyes	4.2	500	325	20.6
Lily the Pink	2.9	605	375	24.5
Monica Wyatt	4.4	445	425	21.8
Rose Monica	3.7	505	410	22.9
Outside-grown				
Bright Eyes	2.7	315	220	13.4
Lily the Pink	2.6	445	320	19.1
Monica Wyatt	3.4	460	330	19.8
Rose Monica	3.4	380	335	17.9

Figure 2. The pattern of flower cropping for spring-planted pinks grown in tunnels or outdoor plots at Kirton in 2007.



Phlox

Following the late delivery of plants, four varieties were transplanted to a tunnel on 20 June 2007. This was too late to produce many meaningful results in the first year, and Icecap and Miss Marple failed to flower in the outside plots within the main project period. The results are given in Table 7. The crop should reach its full potential in 2008. For plants grown in tunnels, there were large between-variety differences in stem weight for stems of similar length (means between 46 and 58cm): Miss Marple produced the heaviest stems (56g) and Miss Fiona the lightest (34g).

Samples of the phlox from the tunnels were subjected to vase-life testing (Table 8). All four varieties exceeded their expected 5-day vase-life by 2 or more days. Sugar Missy had the longest vase-life, nearly 9 days, and showed significantly greater water uptake than the other three cultivars. By vase-day 5 leaf quality was excellent in all varieties, but flower quality was poorer (with a low score of 3.3 for Ice Cap) and vase water was generally turbid.

Despite this poor performance as a result of late planting, the phlox demonstration generated much interest amongst the UK retailers that viewed it.

Table 7. Summary of flowering data for phlox cultivars grown at Kirton in 2007.

Cultivar	Planting date	Start of cropping		Tunnel-raised crops	
		Tunnel	Outside	Stem length (cm)	Stem weight (g)
Icecap	20/06	19/09	n.a. ¹	53.0	40.5
Miss Marple	20/06	05/09	n.a.	55.0	56.0
Miss Fiona	20/06	03/08	06/09	46.4	34.0
Sugar Missy	20/06	05/09	06/09	58.5	37.5

¹ n.a., poor flowers, not assessed

Table 8. The vase-life and quality of phlox bouquets assessed on vase-day 5.

Variety	Leaf quality score (1-5)	Flower quality score (1-5)	Vase-life (days)	Water clarity score (1-5)	Water uptake (ml/vase)
Ice Cap	4.8	3.3	7.5	3	920
Miss Fiona	4.7	3.7	7.5	2	950
Miss Marple	4.5	4.1	7.2	4	920
Sugar Missy	4.6	4.0	8.8	3	1170

Sedum

Eight varieties of sedum were transplanted both to tunnels and outdoor plots on 12 July 2007, following late delivery of the plants. This meant that the stems were very short, and the plots have been grown-on to determine their potential in 2008.

Solidago

Solidago media was transplanted to a Spanish tunnel on 23 April 2007. This crop was included by one of the In-Kind suppliers as for a 'look see' of their new cultivars

Veronica

Four varieties of veronica were transplanted to tunnels and outside plots on 20 June 2007. Table 9 summarises the results.

In the tunnel Blue Spark was the first variety to flower (25 July) and Pink Spark the latest (15 August), while in outside plots all four cultivars began flowering in early August. Lodging was noted as a problem in some plants. All varieties produced considerably longer and heavier when tunnel-grown; overall, stems were 55% longer and 78% heavier when grown under protection.

Table 9. Summary of flowering data for veronica grown at Kirton in 2007.

<i>Cultivar</i>	<i>Planting date</i>	<i>Start of cropping</i>		<i>Stem length (cm)</i>		<i>Stem weight (g)</i>	
		<i>Tunnel</i>	<i>Outside</i>	<i>Tunnel</i>	<i>Outside</i>	<i>Tunnel</i>	<i>Outside</i>
Blue Spark	20/06	25/07	09/08	58.4	39.9	22.0	16.5
Lavender Spark ¹	20/06	02/08	09/08	55.0	26.5	37.4	16.3
Pink Spark	20/06	15/08	02/08	72.7	48.0	42.3	18.5
White Spark	20/06	02/08	09/08	66.3	49.1	24.0	19.0

Results of trials

Brassica (ornamental)

Four F1 varieties (Crane Pink, Crane White, Red Crane and Rose Crane) were direct-drilled into outside plots on 12 July, 1 August and 28 August 2007. However, problems with delivery and the wet season of 2007 meant that very few meaningful results could be obtained this year.

Delphinium

The effects of planting date on continuity were investigated in thirteen varieties including three main series (Scent, Takii Aurora and Pan American Guardian), Belladonna Blue Shadow and a new line, Blue Donna Imperial. The transplanting dates into both outside plots and tunnels were 25 May, 04 June and 03 July 2007. Data from the trial are summarised in Table 10.

Several cultivars from the first planting in tunnels developed moderate to severe mildew symptoms, a problem that may need to be addressed in future trials. Some plants from the third planting, particularly Takii Aurora lines, and especially Light Blue, produced short or very short, poor quality stems. Mean stem lengths and weights were recorded for the first, and most successful, planting, and showed that tunnel-raised stems were consistently heavier, though not consistently longer, than those from plants grown outside.

Flowers were produced over the period from week 27 to week 36. Despite three plantings and up to 15 cultivars being trialled, however, there were still breaks in continuity, particularly

in weeks 29 and 33-34 (Figure 3). Continuity needs to be investigated further to ensure that the crop is economically viable.

Dianthus (annual)

The effects of planting date and cultivar on continuity and vase-life were investigated in eleven varieties, including several from the Amazon and Sweet series, Bodestolz and two un-named lines. The plants were transplanted to tunnels and outside plots on 30 May and 25 June 2007. Data from the trial are summarised in Table 11.

Tunnel-raised stems were consistently heavier and longer than those raised outside. The results demonstrated the clear potential of this crop for UK production, with flowers being picked from week 27 to week 36 - though with some gaps (weeks 28, 34 and 35) (Figure 4). Further investigations are required into scheduling and the economics of production.

Samples of eight selected cultivars were subjected to vase-life testing (Table 12). Mean vase-life varied from 7 days (for Sweet Red) to 14 days (for Amazon Rose Magic), and these differences were clearly reflected in the extent of water uptake in the different cultivars. Leaf quality was good throughout, but flower quality was poorer than most in Sweet Scarlet and lowest in Sweet Red. Generally, there were no water clarity issues.

Table 10. Summary of flowering data for *Delphinium elatum* cultivars grown at Kirton in 2007.

Cultivar	Planting no. and date	Start of cropping		Stem length (cm)		Stem weight (g)		Notes
		Tunnel	Outside	Tunnel	Outside	Tunnel	Outside	
Scent White	1 (25/05)	02/08	25/07	112	61	123	40	-
Scent Pink	1	01/07	09/07	110	71	120	53	-
Scent Rose	1	25/07	02/08	113	68	99	49	-
Scent Sky Blue	1	02/08	02/08	112	76	98	47	-
Scent Centurion Blue	1	02/08	02/08	117	71	115	33	Serious mildew in tunnel
Takii Aurora Light Blue	1	29/06	09/07	99	59	84	59	Serious mildew in tunnel
Takii Aurora Light Purple	1	29/06	25/07	93	64	72	54	Serious mildew in tunnel
Takii Aurora Blue	1	09/07	25/07	102	67	70	44	-
Takii Aurora Lavender	1	01/07	09/07	108	65	107	56	-
Takii Aurora Deep Purple	1	22/06	29/06	99	60	105	47	Mildew in tunnel
Pan Am Guardian Lavender	1	01/07	01/07	103	62	121	52	Mildew in tunnel
Pan Am Guardian Blue	1	22/06	04/07	86	61	142	58	-
Pan Am Guardian White	1	01/07	05/07	96	64	153	44	-
Scent White	2 (04/06)	02/08	02/08					-
Scent Pink	2	09/07	25/07					-
Scent Rose	2	25/07	25/07					-
Scent Sky Blue	2	15/08	02/08					-
Scent Centurion Blue	2	15/08	02/08					-
Takii Aurora Light Blue	2	25/07	25/07					-
Takii Aurora Light Purple	2	25/07	25/07					-
Takii Aurora Blue	2	25/07	25/07					-
Takii Aurora Lavender	2	25/07	25/07					-
Takii Aurora Deep Purple	2	09/07	25/07					-
Belladonna Blue Shadow	2	02/08	02/08					-
Blue Donna Imperial	2	02/08	02/08					-
Scent White	3 (03/07)	31/08	06/09					-
Scent Pink	3	31/08	06/09					-
Scent Rose	3	28/08	06/09					-
Scent Sky Blue	3	31/08	06/09					-
Scent Centurion Blue	3	28/08	06/09					-
Takii Aurora Light Blue	3	07/08	09/08					Poor quality, short in tunnel, very short outside
Takii Aurora Light Purple	3	07/08	09/08					-
Takii Aurora Blue	3	07/08	09/08					Poor quality, short in tunnel
Takii Aurora Lavender	3	02/08	09/08					Poor quality, short in tunnel

Takii Aurora Deep Purple	3	02/08	09/08	Poor quality, short in tunnel
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Figure 3. Mean first flower dates for annual dianthus cultivars and two transplanting dates grown at Kirton in 2007. The variety codes (A-M) follow the same order as in Table 10.

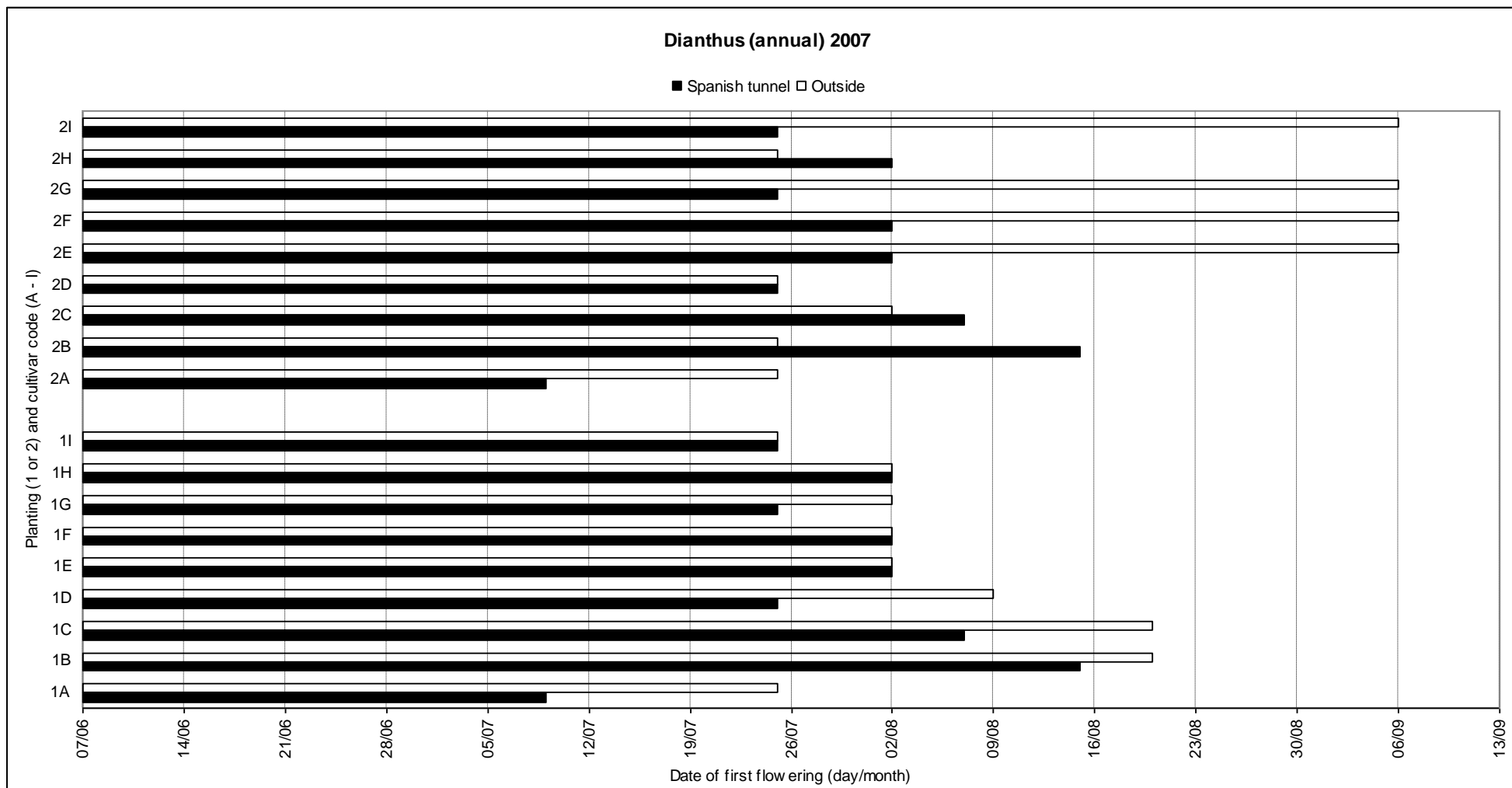


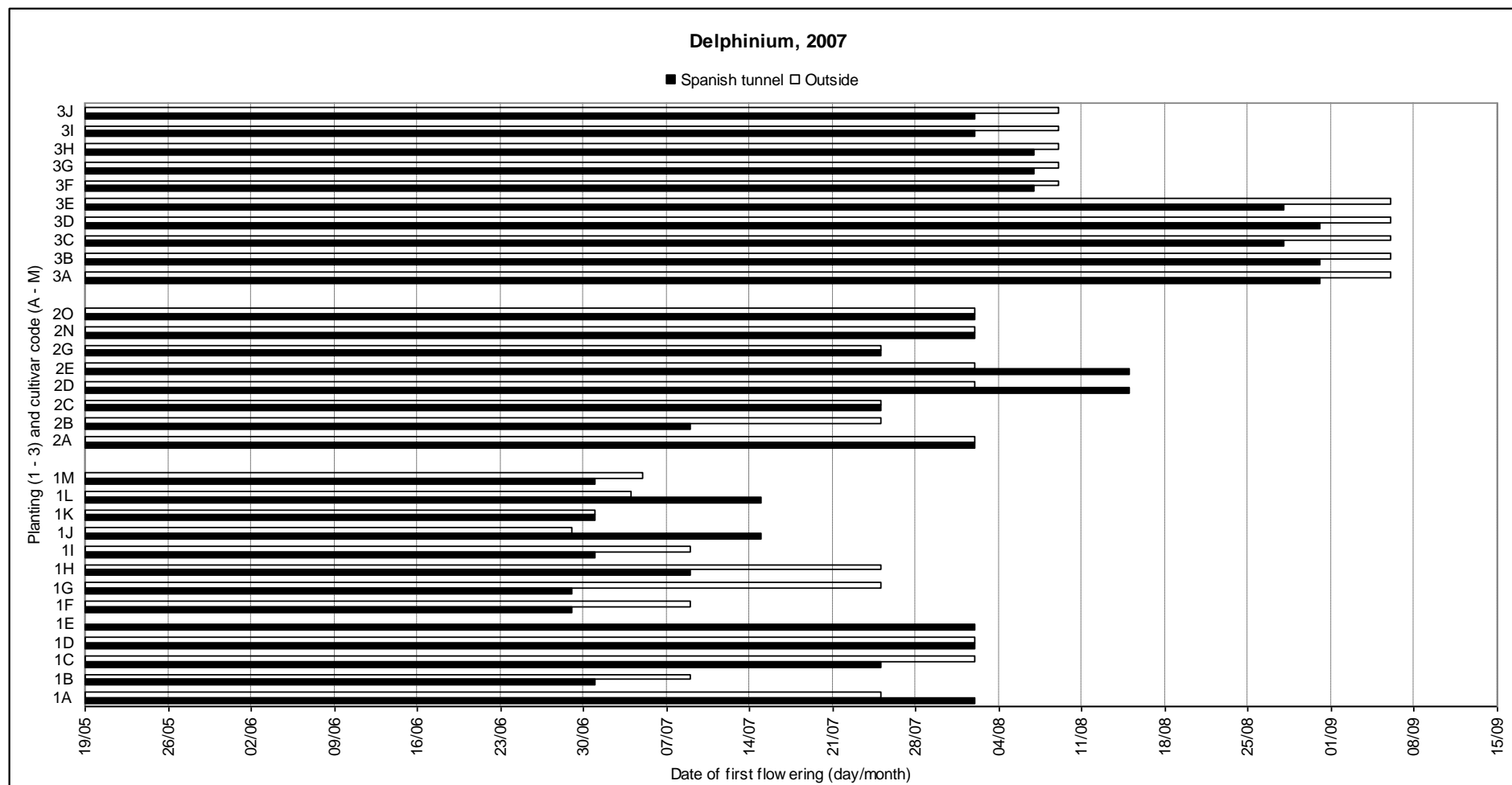
Table 11. Summary of flowering data for annual dianthus cultivars grown at Kirton in 2007.

<i>Cultivar</i>	<i>Planting no. and date</i>	<i>Start of cropping</i>		<i>Stem length (cm)</i>		<i>Stem weight (g)</i>	
		<i>Tunnel</i>	<i>Outside</i>	<i>Tunnel</i>	<i>Outside</i>	<i>Tunnel</i>	<i>Outside</i>
Amazon Neon Cherry	1 (30/05)	09/07	25/07	43	35	32	23
Amazon Neon Purple	1	15/08	20/08	52	48	54	56
Amazon Rose Magic	1	07/08	20/08	49	45	44	53
Bodestolz	1	25/07	09/08	50	28	24	16
Sweet Coral	1	02/08	02/08	56	35	28	21
Sweet Purple	1	02/08	02/08	53	35	29	19
Sweet Red	1	25/07	02/08	53	42	27	25
Sweet Scarlet	1	02/08	02/08	56	42	28	22
Sweet White	1	25/07	25/07	52	38	28	25
3850	1 (13/06)	26/07	25/07	52	35	17	24
4244	1 (19/06)	25/07	25/07	49	34	20	17
Amazon Neon Cherry	2 (25/06)	28/08	02/08				
Amazon Rose Magic	2	31/08	25/07				
Sweet Coral	2	15/08	06/09				
Sweet Purple	2	28/08	06/09				
Sweet Red	2	28/08	06/09				
Sweet Scarlet	2	31/08	25/07				
Sweet White	2	28/08	06/09				

Table 12. The vase-life and quality of tunnel-grown annual dianthus from planting 1, assessed on vase-day 5.

<i>Variety</i>	<i>Leaf quality score (1-5)</i>	<i>Flower quality score (1-5)</i>	<i>Vase-life (days)</i>	<i>Water clarity score (1-5)</i>	<i>Water uptake (ml/vase)</i>
Amazon Neon Cherry	4.8	4.0	11.1	4	1200
Amazon Neon Purple	5.0	4.7	12.1	3	1130
Amazon Rose Magic	4.9	4.6	14.3	5	1430
Sweet Coral	4.4	4.3	10.9	3	1170
Sweet Purple	4.7	4.5	10.4	5	970
Sweet Red	4.2	2.6	6.9	5	720
Sweet Scarlet	4.1	3.3	11.2	5	930
Sweet White	4.8	4.3	10.4	5	900

Figure 4. First flowering dates for *Delphinium elatum* cultivars and three transplanting dates grown at Kirton in 2007. The variety codes (A-M) follow the same order as in Table 12.



Larkspur

Nine varieties were transplanted into outside plots on two dates, 25 May and 22 June 2007. As with the demonstration plots (see above) the trial was very severely affected by the excessively wet weather, and as a consequence no meaningful results could be obtained.

Zinnia

Ten varieties were grown for vase-life and especially stem strength. They were direct-drilled outside on 25 May 2007, direct-drilled in tunnels on 13 June 2007, and grown as plugs and transplanted to outside plots and tunnels on 03 July 2007. The cropping results are shown in Table 13.

Marketable stems were obtained from many of the plots but, as anticipated, vase-life and neck-strength were the key issues that would affect any future development of this crop. The trial identified Yellow Flame as the variety with the highest stem strength (Table 13), and this and Meteor, Purple Prince & Uproar will be investigated further in 2008.

Samples of six selected cultivars were subjected to vase-life testing. Stems were harvested at three stages of maturity and treated after cutting by standing in either CVBn or RVB Clear flower food prior to testing. The results are shown in Table 14. Using marginal means for the six cultivars, vase-life ranged from 5.2 (Sun Cherry) to 8.9 days (Canary Bird), and Sun Cherry also had the lowest flower quality score while the score for Canary Bird was among the highest. Considering cropping stage, cropping at Stage 1 resulted in the longest mean vase-life (7.8 days) and highest mean flower quality score, while cropping at Stages 2 or 3 gave a vase-life of 6.1 or 6.2 and lower quality scores. Post-harvest treatment in CVBn produced a longer vase-life (7.1 days) and a higher quality score than treating in RVB Clear (6.5 days).

Table 13. Summary of flowering data for zinnia cultivars grown at Kirton in 2007. Stem strength scores determined for direct-drilled tunnel crop only.

Cultivar	Planting no. and date	Start of cropping		Stem length (cm)		Stem weight (g)		Stem strength score (1-3)	Notes
		Tunnel	Outside	Tunnel	Outside	Tunnel	Outside		
Canary Bird	1 (25/05)	-	25/07	-	28	-	12	-	-
Cerise Queen	1	-	07/08	-	25	-	14	-	Plant vigour poor outside
Luminosa	1	-	02/08	-	27	-	17	-	-
Meteor	1	-	02/08	-	25	-	14	-	-
Orange King	1	-	02/08	-	31	-	16	-	-
Purple Prince	1	-	02/08	-	28	-	16	-	-
Yellow Flame	1	-	25/07	-	19	-	10	-	-
Sun Cherry	1	-	25/07	-	24	-	18	-	-
Sun Red	1	-	02/08	-	22	-	19	-	-
Sunshine Mix	1	-	25/07	-	24	-	13	-	-
Canary Bird	2 (13/06)	07/08	-	44	-	24	-	2.1	-
Cerise Queen	2	15/08	-	41	-	20	-	2.0	-
Luminosa	2	07/08	-	38	-	19	-	2.1	-
Meteor	2	07/08	-	37	-	24	-	2.3	-
Orange King	2	07/08	-	40	-	24	-	2.3	-
Purple Prince	2	07/08	-	36	-	18	-	2.4	-
Yellow Flame	2	02/08	-	28	-	28	-	2.7	-
Sun Cherry	2	02/08	-	35	-	25	-	1.8	-
Sun Red	2	07/08	-	34	-	31	-	2.2	-
Sunshine Mix	2	02/08	-	36	-	29	-	1.9	-
Canary Bird	3 (03/07)	07/08	20/08	42	28	26	16	-	Pale plants outside
Cerise Queen	3	15/08	20/08	42	30	36	14	-	-
Luminosa	3	07/08	20/08	43	23	30	13	-	-
Meteor	3	15/08	20/08	43	30	33	15	-	-
Orange King	3	15/08	20/08	48	33	33	20	-	-
Purple Prince	3	15/08	20/08	42	29	28	17	-	-
Yellow Flame	3	07/08	20/08	35	16	31	9	-	-
Sun Cherry	3	07/08	n.a.	40	n.a.	33	n.a.	-	-
Sun Red	3	15/08	n.a.	38	n.a.	31	n.a.	-	-
Sunshine Mix	3	15/08	n.a.	38	n.a.	29	n.a.	-	-

Table 14. Vase-life and flower quality score (on vase-day 5) of zinnia cultivars following cropping at three stages and two post-harvest treatments. Figures are treatment means except for those in bold type which are marginal means for the indicated factors. For marginal means for cultivars, see last section of table.

Post harvest treatment	Variety	Flower quality score (1-5) after cutting at stages 1 - 3				Vase-life (days) after cutting at stages 1 - 3			
		1	2	3	Mean of all stages	1	2	3	Mean of all stages
CVBn	Meteor	4.0	3.3	4.0	3.8	7.7	5.7	7.5	7.0
	Canary Bird	5.0	3.3	3.0	3.8	14.5	7.7	7.0	9.7
	Yellow Flame	3.0	2.7	2.0	2.6	5.5	7.7	6.0	6.4
	Sun Cherry	3.0	1.0	2.7	2.2	7.7	4.0	4.7	5.5
	Purple Prince	3.7	3.0	n.a.	3.4	9.0	5.7	n.a.	7.4
	Orange King	3.3	2.3	4.5	3.4	7.7	5.3	8.5	6.6
	Mean of all in CVBn	3.7	2.6	3.2	3.2	8.7	6.0	6.7	7.1
RVB Clear	Meteor	3.3	2.7	3.3	3.1	7.7	5.7	6.3	7.9
	Canary Bird	2.3	4.0	2.7	3.0	7.7	10.3	5.7	7.9
	Yellow Flame	2.5	1.7	2.0	2.2	6.0	5.7	5.0	5.6
	Sun Cherry	2.0	3.3	1.7	2.3	4.3	6.0	4.3	4.9
	Purple Prince	3.0	2.3	n.a.	2.7	6.3	5.7	n.a.	6.0
	Orange King	3.5	1.0	3.0	2.5	9.0	3.7	7.0	6.6
	Mean of all in RVB	2.8	2.5	2.5	2.6	6.8	6.2	5.7	6.5
Mean of all above	3.3	2.6	2.9	2.9	7.8	6.1	6.2	6.7	
-	Meteor				3.5				7.5
	Canary Bird				3.4				8.9
	Yellow Flame				2.4				6.0
	Sun Cherry				2.3				5.2
	Purple Prince				3.1				6.7
	Orange King				3.0				6.6

Results of commercial evaluation

Antirrhinum

Sue Lamb writes: *'Until we undertook this trial we had not grown antirrhinums before at Lamb's Flowers. Previously, snaps had been sourced from Holland. The flowers are attractive, but relatively delicate, and we thought a more durable product might be obtained by production in the UK close to the markets. Another attraction was that, using outside beds, tunnels and cold glass, flowers could be cropped for 46 weeks of the year. The main question for us, and the reason for the commercial evaluation, was to find out whether the flowers could be managed down the line... could we handle and pack within a budget? No one can afford to make unrealistic promises to supermarkets!*

The soil structure here is a bodied loam which received a base dressing of 60 units N, 100 units each of potash and phosphate, over a 4000m² site. Antirrhinums were planted in beds worked with a bed former, so the slightly raised beds allowed water to run off. They were transplanted through carrot film at a planting rate of 64/m². Support netting was provided - and this had to be shaded from the wind because the flowers bruise easily. The nets had to be lifted regularly, keeping at foliage level to avoid damage to the flowers. To control pests and diseases the crop was sprayed with Amistar and Fubol Gold (twice) for downy mildew, with Plenum for aphids, with Ambush for caterpillars and with Roval for Botrytis.

Although 2007 was extremely wet the antirrhinum did not suffer as some crops would, though it was difficult getting enough good days to plant. Because of the weather it was not possible to apply the appropriate amounts of feed in the growing period. In 2007 certainly, using a raised bed system helped - the crop does not like to sit in water, this leading to plant stress and short stems. In a normal year antirrhinums would require irrigating!

Overall the Potomac series was the best and most even producer, though this may be different in a normal (drier) year. The most attractive variety was Apple Blossom. Deep Orange, Early White, Ivory White, Plum Blossom, Royal and Yellow were other good varieties. But we found it impossible to keep the aphid out of Cherry Rose. The stems were no better grown in tunnels than outside. They grow too fast in the warm, and come harder outside – a better product altogether.

Antirrhinum is basically a 10-week crop, and like most summer crops it closes up in the middle a bit depending on temperature. The costs, per 1000 plants, were about £10 to plant, £10 to crop and £20 to put down the line. Specifications demand a 40g stem, which is far too

ambitious - realistically it should be nearer 30 or 35 g. The problem is that the spec was originally set up at a time of year when quality is naturally higher. The plants were cropped every 48h with a bloom count of 5 open florets and a column length of 15cm. A length of 60cm was required and only 74% made this specification, so they need to fetch 19 or 20p per stem. This is different to other crops planted at 64/m², where 90 to 95% of the plants can be expected to reach the specification.

We will not be growing snaps again! The marketplace is different for the Dutch. They manage to grow snaps because they grow outdoors, large-scale, with lower costs and although the Dutch experience low prices of 17p - 18p, with their auction system they also have the pleasure of experiencing prices in excess of 30p. Compare our market with a flat 20p per stem. Growing snaps in the UK would only be possible on a very restricted scale for a niche market – and a very well researched market at that.'

Vase-life trials were carried out with antirrhinums, using the eight cultivars listed in Table 15.

Trial 1 – variety trial (Table 15)

All cultivars exceeded their guaranteed 5-day vase-life, with vase-lives between 6.2 (Opus Red) and 10.0 days (Apple Blossom). Leaf quality scores were high for all cultivars by vase-day 5, but flower quality scores were variable, from 2.8 (Opus Red again) to 4.6 (Apple Blossom again). Water clarity was good, except in a single cultivar (Yellow). The low water uptake of Opus Red may account for this cultivar's short vase-life and poor flower quality, but in Dark Orange the very high water uptake was not matched by an exceptional vase-life.

Table 15. The vase-life and quality of antirrhinum varieties assessed on vase-day 5 (Trial 1).

<i>Variety*</i>	<i>Leaf quality score (1-5)</i>	<i>Flower quality score (1-5)</i>	<i>Vase -life (days)</i>	<i>Water clarity score (1-5)</i>	<i>Water uptake (ml/vase)</i>
BP Dark Orange	5.0	3.3	8.5	5.0	790
BP Apple Blossom	4.6	4.6	10.0	5.0	530
C Opus Red	4.7	2.8	6.2	4.0	270
BP Cherry Rose	4.5	3.5	8.2	5.0	485
C White	5.0	3.4	8.8	5.0	480
CP Early Pink	5.0	4.2	8.4	4.0	420
C Axiom Bronze	4.8	3.0	7.0	4.0	405
BP Yellow	4.8	4.0	8.0	3.0	470

* B = Ball, P = Potomac and C = Combifleur.

Trial 2 - Post-harvest, in-store and consumer treatments (Table 16)

In trial 2 antirrhinums exceeded their guaranteed vase-life in all treatments, with vase-lives between 6.9 and 8.4 days. There were no leaf quality or water clarity issues, and flower

quality and water uptake were similar in all treatments, including the control in which water was used throughout.

Table 16. The vase-life and quality of mixed antirrhinum varieties assessed on vase-day 5 following various post-harvest, in-store and consumer treatments (Trial 2). Note that water uptake is in ml/stem not ml/vase.

Growers	Treatment		Leaf quality score (1-5)	Flower quality score (1-5)	Vase -life (days)	Water clarity score (1-5)	Water uptake (ml/stem)
	Store	Vase					
AVB-dry	T-bag	Food	4.7	3.6	6.9	4.8	17
AVB-RVB Clear	T-bag	Food	4.4	3.5	7.4	4.8	19
AVB-CVBn	T-bag	Food	4.8	3.4	7.3	5.0	19
RVB Clear	T-bag	Food	4.8	3.3	7.6	4.8	20
CVBn	T-bag	Food	4.7	3.7	7.3	5.0	20
Water	T-bag	Food	4.8	3.4	7.0	5.0	18
Water	Water	Water	4.8	3.6	8.4	5.0	22

Trial 3 – Vase treatments (Table 17)

In trial 3 antirrhinums exceeded their guaranteed vase-life in all treatments, with a vase-life of 6.6 for the water control and between 7.5 and 8.2 for the three flower food treatments. There were no water clarity issues. The water control had lower leaf and flower quality scores and lower water uptake than stems from any of the flower food treatments.

Table 17. The vase-life and quality of mixed antirrhinum varieties assessed on vase-day 5 following various vase treatments (Trial 3). Note that water uptake is in ml/stem not ml/vase.

Growers	Treatment		Leaf quality score (1-5)	Flower quality score (1-5)	Vase -life (days)	Water clarity score (1-5)	Water uptake (ml/stem)
	Store	Vase					
CVBn	T-bag	Universal	4.9	3.7	7.5	5.0	30
CVBn	T-bag	Lily and alstro	4.4	3.4	8.0	5.0	29
CVBn	T-bag	Bulb	4.8	3.4	8.2	5.0	38
Water	Water	Water	4.2	3.1	6.6	5.0	12

The three vase-life trials showed the potential for several cultivars of antirrhinum to perform well in the vase under a range of flower treatments. The reason for the discrepancy in the performance of the controls in trials 2 and 3 is, at this point, unexplained.

Discussion

Many useful observations and results have emerged from the first year of the Cut-Flower Trials Centre project. However, the main purpose of year 1 is as a stepping stone to planning and designing an ongoing series of trials. In this Discussion the emphasis will therefore be to outline the priorities for future work.

In 2007 many problems were encountered as a result of adversely wet weather, so in 2008 more trials will be carried out under Spanish tunnels. In addition to the demonstrations and trials listed below, it is also proposed to include work on amaranthus and spray carnations. In an amaranthus variety demonstration, five varieties will be planted outdoors in response to a specific industry request. In a spray carnation demonstration, four varieties will be planted under protection in week 12; the purpose of the trial will be to determine market potential and performance and to benchmark spray carnations against pinks.

Biodegradable polythene mulch was used to determine its suitability of cut flower production. While it performed adequately it was very “delicate” and was very difficult to work with to avoid damaging it.

Ageratum

In 2007 a single variety, Blue Horizon, was included in the project as a demonstration, generating sufficient interest from major retailers to justify including ageratum in 2008. The main purpose of the trial will be to determine market potential, continuity and performance of the different varieties. It is hoped to source two new cutting-raised varieties to benchmark against Blue Horizon. Planting will be under tunnels in weeks 12, 16 & 20.

Antirrhinum

An extensive commercial evaluation of antirrhinum was undertaken in 2007. This produced useful experience with the crop, demonstrated the value of outdoors growing, and identified a number of good cultivars. However, only 74% of the plants reached the high specification demanded by a UK supermarket, and at the poor price that could be obtained - 20p per stem - the crop is uneconomic, except, perhaps, for a very specialised niche market. It was considered that the specification was set at an unachievable level.

Aster (German)

Commercial evaluations of German asters were planted at two commercial nurseries, but were ruined by excessive rain. The crop is believed to have great potential for growing under protection in the UK, and it is hoped to set up another commercial evaluation in 2008. Gala

from Combifleur and Krallen from Ball will be the main varieties to be trialled. These will be plug-planted in weeks 12, 15, 27 and 30 under tunnels and 18, 21 and 24 outdoors. Plant spacing will be 36 to 42 per m². The same varieties will be direct-drilled in week 22 at 100 seeds per m².

Brassica (ornamental)

In 2007 problems with late delivery and wet conditions prevented useful information being collected. In 2008 the main purpose of the trial will be to determine continuity and performance of the different varieties, especially from direct-drilling, with a view to produce a UK protocol. It is proposed to trial both plugs and direct seeding. The proposal (via Combifluer) is to direct-drill in weeks 18, 21 and 24 using White Crane (white and red) and to plant plugs in week 26 using eight different varieties to assess the new genetics available.

Cynara

Following testing two varieties in the 2007 trial, a single variety will be planted outside and under tunnels in week 12 of 2008 as a simple 'look see'.

Delphinium

In the 2007 trial, despite having three plantings and up to 15 cultivars, there were still breaks in continuity, and, while the quality of stems from the first planting was good, quality was reduced in later plantings, with many very short stems. Continuity is the key issue that needs to be addressed with delphinium, if it is to be economically viable. It was felt that of all of the proposed trials, delphinium has the greatest potential for wide scale commercialization if the continuity issues could be resolved. There were a number of different strands to the trial. Discussions were instigated with Allen Langton to determine the key triggers initiating flowering. The provisional findings of the literature search are that for 'traditional' varieties, such as Pacific Giants, both day-length and temperature are probably the key factors, with planting date having less effect. However, this distinction appeared to be less clear-cut with the newer varieties, so that a literature search would be very worthwhile, avoiding the 'reinventing of the wheel' and providing a clearer direction for future trials. It is proposed that there will be both a protected and an outside trial at Kirton in 2008.

Because of the importance of a protected trial at Kirton it is desirable to design the trial on a commercial scale with plots of 25 meters per variety per planting. It is anticipated that four varieties will be used, Guardian Blue, Guardian Early Blue and Centurion Gentian Blue, with Early Blue being replaced with Aurora for the later plantings. Plantings will be in weeks 15, 17, 19 and 21. Spacing will initially be 32 plants per m². The plants will be sourced from Ball

(Guardian) and Combifleur (Centurion and Aurora). In an outdoor trial at Kirton the same varieties will be planted in 3m plots in week 17, 19 and 21. The comparison between indoor and outdoor should once and for all prove the superiority of the tunnel-grown crop - and hence the principle that it should command a premium price.

The issue of mildew on tunnel-grown delphiniums may also need to be addressed.

Dianthus (annual)

The 2007 results demonstrated the potential of annual dianthus as a crop for UK production, and the main purpose of any new trial would be to determine market potential, continuity, performance and cost effectiveness of the new F1 varieties. In the second year of trials it is proposed to evaluate Bodestoltz, three colours of Sweet, and one colour of Amazon; they will be planted in week 17 outside and in weeks 17, 19, 28 and 30 under tunnels. As vase-life appeared to be quite variable in different varieties, this factor should also be investigated.

Echinops

One demonstration variety was trialed in 2007 and will be continued into 2008.

Eryngium

A number of problems presented themselves in the 2007 trial, including variable stem length, a low yield of flowers, and tip-burn. The main purpose of the 2008 trial will be to compare variety performance and identify useful lines to mitigate these complaints. Cultivar Orion will be added to the trial in 2008.

Godetia

In the trial in 2007 it was seen that some varieties were unsuitable for cut-flower production; nevertheless, the potential of godetia for production in the UK was clearly demonstrated, generating considerable interest amongst some retailers. The main purpose of the 2008 trial will be to determine market potential, performance and vase-life of the different varieties. Two of the older varieties will be used to benchmark against Grace. Seed will be sown in weeks 10 and 20 and then transplanted under Spanish tunnels

Grasses (ornamental)

While the market for ornamental grasses is likely to remain limited, the initial trial in 2007 demonstrated there is no reason why UK growers should not be able to fulfil the needs of the

UK market. In 2008 two new grasses will be added the four planted in 2007, i.e. *Chasmanthium latifolium* and *Miscanthus sinensis* Malepartus. Planting will be in week 12, outdoors.

Larkspur

In 2007 the larkspur plantings failed as a result of excessively wet conditions, so further work will be undertaken under protection in 2008. The key aim of this trial will be to produce larkspur as a graded stem under Spanish tunnels. Two colours of Sydney (bicolour and pink) will be planted at 64, 80 and 100 per m². Plug plants will be used, planting in weeks 16, 19 and 23.

Pinks (spring- and autumn-planting)

Pinks may be considered an old fashioned product, but the trial carried out in 2007 enabled a younger generation of retail buyers to look at it again. As a direct result of that, particularly under protection, one major UK retailer intends to use the product in 2008. In 2008 the work will continue to determine the yield and quality of the second year crop from both the spring and autumn planting.

Phlox

In 2007 plantings were unavoidably made too late to produce many meaningful results, but despite this poor performance the phlox demonstration generated much interest amongst UK retailers. The main purpose of the 2008 trial will be to determine market potential, continuity, performance and vase-life of the different varieties. Crops will be grown under tunnels using 5 varieties planted in week 17.

Sedum

In 2007 eight sedum varieties were planted late, and the assessment of these will continue in 2008.

Solidago

The 2007 'look see' planting of Solidago will be left in place for 2008 to determine its market potential.

Veronica

For a number of reasons mainly centring on the imported price of the crop as well as a small production window, it was concluded that veronica was not a crop likely to be economic in the UK, and no further trials are planned.

Zinnia

Neck strength is the key issue that needs to be addressed with zinnia. In the 2007 trial, three varieties showed the most promise as regards neck strength - Meteor, Purple Prince and Yellow Flame – and these will be further investigated in 2008, along with a further cultivar, Uproar, based on industry advice. The Management Group will take full advantage of American research when planning the trial.

General conclusions

As this trial will be conducted over a minimum of two years, it is difficult to draw too many firm conclusions in year one. However, it is still possible to draw the following conclusions from the trial so far.

- UK growers are currently very well placed to take advantage of the desire by the UK multiples to reduce their carbon footprint by selling more UK-grown produce, including flowers. The interest shown in this trial by some of our major UK retailers has been very encouraging and has in fact been directly responsible for pinks and German asters being available for sale in 2008.
- In the unusually wet weather of 2007 none of the outdoor trial plots produced flowers that would have been of a suitable quality for sale to UK multiples. Therefore, in order to be able to fulfil the above requirements it may be necessary to grow crops under Spanish tunnels to ensure the appropriate quality. However this will obviously have implications for the economics of the crop and will therefore require careful costing.
- In order to maximise the usefulness of the 2008 trials, most species will be planted under Spanish tunnels as an insurance against a repeat of the 2007 weather conditions.
- As well as the new crops already being requested in 2008, other 2007 trial crops have shown great potential with perhaps the most significant being delphinium, providing they can be scheduled over a longer season. To this end the 2007 work on delphinium has been used as the foundation on which to build a much larger commercial-scale trial in 2008 which will address the key issue of continuity.

Technology transfer

Articles relating to the trial have been included in *HDC News*, *Horticulture Week*, *The Garden* (the journal of the RHS), *The Times* and *Country Homes and Interiors* during 2007. It was also featured on Radio 4's *Farming Today* programme and filming was undertaken for a *Gardener's World* cut-flower special but unfortunately the footage was not used. Press releases have been issued both locally and nationally in conjunction with the Government News Network (GNN). A well attended Open Day took place on 5 September 2007.

Acknowledgments

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Information about vase life treatments used in the trials (kindly supplied by Chrysal

Internatiional

RVB

Description

Universal clear post-harvest hydrating treatment. Free of Aluminium Sulphate, so even a lengthy treatment with Chrysal RVB Clear does not cause leaf damage.

General

Chrysal clear RVB is a clear universal hydrating treatment to be used by growers or importers to prolong vase life. It balances the pH of all water types. Chrysal clear RVB stimulates the water uptake, thus preventing bent-neck, and improves the flower development and leaf quality. Chrysal RVB clear is a liquid that can be dosed automatically.

In addition to improving the quality of the blooms, Chrysal RVB also saves the user time and money by reducing the time spent cleaning buckets and containers.

Effects

- Stimulates water uptake thus preventing 'bent neck', a common problem with roses.
- Lowers the pH of the water.
- Maintains the quality of flowers.
- Pre-treatment product for roses, Chrysanthemum and summer flowers.
- Prolongs vase life.
- Does not leave any sediment in the bucket and does not leave any lime scale in the dosing system.
- Dissolves clearly and odourless in water.

Packaging & Dosing

Available in 5, 10, 25, 100 and 200 litre drums. For an optimal treatment dose 2ml per litre of water.

CVB

Description

Improved Gerbera treatment in tablet form for Gerbera, Germini and other cut flowers. This product is not yet for sale.

General

Chrysal CVBN is a conditioner for cut flowers to be used by growers, bouquet makers or florists. It is an easy-to-use stable tablet that dissolves quickly and produces clear and odourless water. Chrysal CVBN is not harmful to flowers and maintains a good quality of leaves and flowers. Another important effect is that Chrysal CVBN neutralises the damaging effect of daffodil slime in mixed bouquets. Available in a user friendly dispenser (400 tablets) and refill packaging (800 tablets). Suitable for all water types. Use preferably tap water. Can be dosed automatically and manually.

Effects

- Reduces waste
- Maintains a good quality of leaves and flowers
- Neutralises the harmful Narcissus slime in mixed bouquets with daffodils
- More effective than other chlorine products
- Less risk of damage
- Dissolves quickly and clear in water

Packaging & Dosing

Available in an easy to dose dispenser containing 400 pills and refill pots with 800 pills. For an optimal treatment use:

1 tablet for 1 litre of water for gerbera and mixed bouquets with daffodils

1 tablet per 3 litres of water for all other flowers

AVB

Description

Post-harvest conditioner for ethylene sensitive summer flowers.

General

Chrysal AVB is a post-harvest conditioner for ethylene sensitive summer flowers. Dependent on the flower type the positive effect may manifest itself by an improved vase life, a diminished dropping of blooms, leaves and buds and an improved bud opening.

The active ingredient in Chrysal AVB is silver for which Chrysal developed a neutralization method based on the use of Chrysal Tecitine and Chrysal Flocculine. This way most silver can be recovered prior to the disposal of any waste solution.

Several trials have shown that Chrysal AVB is far superior to products based on Amino-oxy-acetic acid (AOA) or Methylcyclopropene (MCP) in protecting cut flowers against ethylene damage and extending their vase life. When used according to its label the product is environmentally sound.

Effects

- Protects against ethylene damage
- Prevents premature shrinking and dropping of buds, leaves and blooms.
- Can be used in combination with SVB
- Contains a tracer for dosing control

Packaging & Dosing

Available in 1L bottle and 5L drum. For an optimal treatment dose 2ml per litre of water. Comes with neutralizing products to neutralise the silver in the residual solution

Professional 2 T-Bag

Description

New and improved conditioner for use during transport for all cut flowers to improve vase life.

General

Chrysal clear professional 2 T-bag is a conditioning product available in a permeable sachet in T-bag form. It is a product that can be used in a cold and/or ambient environment. Chrysal clear professional 2 T-bag contains just enough nutrients for the natural development of the flowers, without stimulating a full development in this part of the chain. It stimulates water uptake and keeps flowers and foliage in an optimum condition. It dissolves clear and odourless in water and offers visual control of the dosing.

Effects

- Keeps flowers and foliage in optimum condition
- Improved opening of flowers and better colour retention
- Stimulates water uptake
- Improves the vase life
- Dissolves clear and odourless in water
- Visual dosing control

Packaging & Dosing

Available in boxes of 800 single T-bags and 2,500 string T-bags. For an optimal treatment use 1 t-bag per 2 litres of water.

Application

Use the t-bag dispenser for automatic application and realise a cost saving.

