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Delphinium as a cut flower crop grown in Spanish tunnels

Grower summary

- Delphiniums are a major international cut flower crop, but are only grown on a very small scale in the UK. There appears to be potential to increase UK production if product consistency and post-harvest quality can be improved.
- In Europe and North America, delphiniums are grown under glass, in tunnels and outdoors in the field. Production in tunnels could be exploited in the UK.
- Many series and cultivars are available, and breeding is actively ongoing, so careful assessment of varieties is necessary.
- While the 'typical' ('Elatum') delphinium types grow up to 2m tall with dense flower stems, 'Belladonna' types have attractive, open inflorescences and some shorter types may be useful in bouquets, as fillers and as specialty cut flowers.
- In National Cut Flower Centre (CFC) trials, the use of a range of cultivars and transplanting dates enabled the production season to be extended to four or five months. The earliest date for planting in Spanish tunnels (about week 15) was governed by the plants' vulnerability to adverse weather, but this crop could follow an early crop grown under cold glass. Transplanting into tunnels could be continued until around week 27.
- Tunnel-raised stems were longer and heavier than those grown outdoors in the CFC trials. Stem weights fell with later planting and in later flushes. In trials, cultivars of the 'Scent' series were more consistent in producing stems of good length and weight than either the 'Aurora' or 'Guardian' series.



Figure 1. The colour range of 'Elatum' type delphiniums

- There were occasional gaps in supply, indicating that scheduling needs to be refined further. This could be achieved by incorporating both first year and overwintered plantings, using additional series or cultivars, pinching part of the crop, or applying cold treatments to the seeds or seedlings.
- Wide plant spacings are often recommended, but in the CFC trials a range of 'Elatum' types performed well, spaced at 36 plants/m².
- Only modest rates of base fertiliser dressing and ongoing liquid feeds are needed. The roots of delphiniums are sensitive to high salt levels.
- Under glass, growth should be kept as 'hard' as possible. Delphiniums grow best in temperate conditions with cool nights, and require high light levels.
- Delphiniums have a cold requirement for flower initiation, but it is facultative (beneficial, not essential). Without cold, delphiniums still flower in their first year, but a cold treatment enhances yield and quality.
- Long days are not essential but will, if light intensity is sufficient, hasten flowering.
- Excessive soil wetness and drought should both be avoided. Avoid overhead irrigation after picking flowers.
- Powdery mildew can be a serious problem in wet, cloudy weather, and in earlier CFC trials led to reduced flower production. A preventative fungicide spray programme is essential.
- For field-grown crops in their first year, yields of five to six stems per plant are reported for 'Elatum' types and up to 12 for 'Belladonna' types. Crops under protection have two or three flushes per year.
- 'Elatum' types should be picked when one-third to half of the flower stem is open, but 'Belladonna' types should be picked at a more advanced stage, when 75–90% of florets are open.
- In CFC trials, the cultivars tested had similar vase lives. Using a post-harvest conditioner suitable for ethylene-sensitive flowers (such as 'Chrysal AVB') doubled the average vase life from six days (in plain water) to 12 days. The post-harvest conditioner should be applied in a four to six hour 'pulse' at ambient temperatures, followed by standing the flower stems in water to which a conditioner suitable for use during transport and retail display has been added. Store the stems upright if practicable.

Introduction

Delphinium hybrids have been an important cut flower crop in Europe and North America for many years. Large quantities are imported into the UK from the Dutch auctions, but only a very small area (less than 10ha) of delphiniums is currently grown commercially in the UK. Of all the cut flowers trialled by the CFC, delphiniums revealed the most ambiguous attitudes amongst growers and retailers over whether they have the potential for greater sales here. On the one hand, they are popular with florists and consumers as typical 'English country garden' flowers, while on the other, growers and supermarkets may regard them as vulnerable to the vagaries of UK weather, difficult in terms of achieving continuity, marginal for meeting specifications, delicate to handle and having too short a vase life. Trials conducted over several years by the CFC have tended towards the more positive view.

The cut flower cultivars grown today are hybrids of *Delphinium elatum*, *D. grandiflorum* and *D. x belladonna*. They are stately, tall plants with attractive flowers borne in long, dense flower stems or racemes. Flowers are a wide range of shades of blue, pink or white, rarely creamy white, often with a contrasting eye (called a 'bee'), sometimes bicoloured, and single to fully double. They are perennials, with many grown as annuals or biennials in commerce. Occasionally they are marketed as dried flowers. Types around 0.5m in height are sometimes described as 'multi-purpose' (for use as bedding, in containers or as cut flowers) or as having a place as a specialty flower or filler. Species of delphiniums include annuals and biennials as well as perennials, and suitable species may be grown as specialty cut flowers for niche markets. Delphiniums are fully hardy.

Delphiniums and larkspurs are commonly confused, to the extent that they are sometimes thought of as synonymous. Larkspurs – tall, slender-stemmed annuals formerly called *D. consolida* – are now placed in the genus *Consolida* as *Consolida ajacis* (syn. *C. ambigua*). This information sheet deals only with delphiniums.

All parts of the delphinium can cause severe discomfort if ingested. Contact with delphinium foliage may cause skin irritation.

Cultural requirements and production methods

CFC trials could not cover all aspects of delphinium production, so the information in this section has been compiled from textbooks, research findings, web-based information and the catalogues and websites of seed and young plant suppliers, augmented where possible by the results of the CFC trials described later in this Information Sheet. The following information is an attempt to provide a consensus of the key aspects of commercial delphinium growing and is provided for guidance only.

Cultivars

Delphiniums have been the subject of much hybridisation, resulting in large numbers of both series and cultivars. Information gathered from different sources on attributes, such as plant height, sometimes appears inconsistent, so it's important to consider various claims when deciding which delphiniums to grow.

Important factors for consideration include: suitability as a cut flower; potential for growing under glass, in tunnels or in the field; first year flowering potential; quality of second flush; tolerance of short days, heat and cold (including winter hardiness); tolerance to powdery mildew; consistency of flowering; flower stem strength and vase life.

Most delphinium cut flower cultivars fall into one of three groups and in addition some species may be used as cut flowers. The series and cultivars mentioned below are by no means a complete list. Some recent cultivars may be subject to Plant Breeder's Rights.

- 'Elatum' types are the classic garden delphiniums, clump-forming perennials with fleshy crowns producing tall, densely packed flower stems of large, sometimes double, florets. Sometimes they are grouped into three height categories, small (up to 1.5m), medium (up to 1.7m) and tall (2m). The series grown include 'Aurora', 'Centurion', 'Clear Springs', 'Crown', 'Guardian', 'Highlander', 'MAGIC

Fountain', 'Mistral', 'New Century hybrids', 'Prism', 'Raider', 'Scent' and 'Summer', which usually include shades of blue, white and pink. Less usual colours include creamy white/yellow (such as 'Sungbeam') and salmon-pink ('Princess Caroline' selections such as 'Red Caroline').



Figure 2. Typical 'Elatum' type flower stems in commercial production

- 'Pacific Hybrids' are sometimes regarded as a separate group, but are essentially 'Elatum' types about 1.7m tall, usually grown as annuals or biennials and having semi-double florets. 'Pacific Hybrids' have been subject to much hybridisation and selection and may appear under various series names, such as 'Giant Pacific Court', 'Pacific Giant', 'Pacific Premium' or 'Round Table'; they include numerous blue, white and pink shades and are recognisable by their Camelot-themed cultivar names ('Black Knight', 'Guinevere', 'King Arthur' and so on). Originally hand-pollinated and line bred, they are now usually cross-pollinated and are consequently less uniform.



Figure 3. 'Belladonna' type delphiniums in trial at the CFC

- 'Belladonna' types are upright, 1–1.2m tall, branching perennials with wiry stems bearing more open spikes of smaller, often single florets with spurs. 'Belladonna' delphiniums include 'Bellamosum' (blue), 'Blue Donna', 'Blue Donna Imperial', 'Blue Shadow', 'Cliveden Beauty' (blue), 'Oriental Blue', 'West End Blue'; 'Casablanca' (white), 'Connecticut Yankees' (blue/white), 'Delft Blue' (blue/white) and 'Stelchen Strain' (blue/white). Series such as 'Arrow', 'Dasante', 'New Millennium' and 'Plagu' predominate in blue cultivars with some whites and pinks.
- Delphinium species grown as specialties include the blue *Delphinium barbeyi*, *D. elatum*, *D. exaltum* and *D. yunnanense*, the yellow *D. semibarbatum* (syn. *D. zalii*), the red/yellow *D. naudicaule* and the *D. cardinale* cultivars 'Scarlet Butterfly', 'Yellow Butterfly' and 'Beverley Hills' series (reds, yellows and pinks).

Scheduling

As a guide, the period from seed sowing into plug trays to transplanting is around six to seven weeks with sowing to flower picking in 18 to 23 weeks. In CFC trials, transplanting took place as early as week 15 and as late as week 27, and the overall picking period – using a range of cultivars, tunnel and field production, and first and second year crops – was from week 26 through to week 43, though with some breaks in continuity. Based on commercial experience, it is possible to pick delphiniums a few weeks earlier than week 26 when growing them in a cold glasshouse or a permanent polythene tunnel, perhaps in weeks 20–22, which would allow for three flushes in a good year.

Propagation

Seeds should be stored at about 5°C. They should be sown into plug trays containing a well-drained growing medium with a pH of about 6.0 and a medium nutrient level, as delphiniums are sensitive to high salt levels; the seed should be covered lightly. Germination occurs in seven to eight days at 20–21°C, but a couple of extra days should be allowed as germination is not uniform. Light is beneficial for germination, but not essential, though the recommendations for some types state that germination is better in the dark. High relative humidity (95% plus) is important. Giving seeds an initial period of 2–4°C for one to two weeks prior to sowing, makes germination less erratic. For 'Belladonna' types, higher germination temperatures may be recommended, say 18–21°C day and 24–27°C night, moving the seedlings on when the cotyledons are open.

For 'less precise' growing, seeds may be sown directly into soil under glass or in tunnels between mid-March and mid-May. The direct seeding rate is 1g/m² and the soil should be kept uniformly moist until emergence is complete; it may not be necessary to thin plants in the row.

Bought-in plug plants however are usually preferred as starting material. Plugs should be grown on at 18–21°C day and 15°C night and moved to cooler temperatures (18°C day, 15°C night) a week before transplanting.

Micropropagated plants are available for some of the newer cultivars, but they add substantially to costs. In some cases, cuttings and bare-root divisions are also available. For cuttings, terminal cuttings 8–10cm in length should be taken from new shoots arising at the base of the crown (the base

of the cutting must be solid, not hollow) and rooted under mist in sand/peat for three to four weeks before potting-on. Some of the more expensive micropropagated and cutting-raised cultivars are protected by Plant Breeder's Rights and should not be propagated.

Transplanting

Plugs should be transplanted when they are large enough to handle. Recommendations for spacing vary widely, and include 30x40cm when growing for more than one year and from 23x23cm to 30x30cm for annual production, equivalent to 8, 11 or 19 plants/m². In CFC trials however, a range of 'Elatum' types performed well when spaced at 36 plants/m². Growers should check with their plant suppliers for specific advice on their cultivars and the required spacing and growing conditions.

Growing conditions

A modest rate of fertiliser base dressing can be applied to the soil during site preparation, but this may be unnecessary under glass if the previous crop was well fertilised.

Delphiniums can be grown under glass, in tunnels or outdoors. Under glass, growth should be kept as 'hard' as possible via appropriate structure ventilation. Plants grow best in temperate days (temperatures above 21°C reduce yield and flower size, above 24°C cause spindly growth, and higher temperatures can cause premature flowering) with cool nights (13–15°C is optimal) and under high light levels. Glasshouse cooling has been used to achieve high quality crops in the summer, and high intensity lighting to achieve crops in the winter. There is a cold requirement for flower initiation, but it is facultative (beneficial but not essential); without cold they still flower in their first year. However, a cold treatment, say six weeks at 2–4°C, enhances yield and quality; this enhances the flower production of overwintered plants and stimulates basal branching. For less precise growing, a temperature range of 5–20°C is tolerable. Long days are not essential but will, if light intensity is sufficient, hasten flowering and improve quality, including longer stems, especially in 'Belladonna' types. A day-length extension or a four hour night-break can be used. In winter, high light levels are more beneficial than long days.



Figure 4. Well grown beds of 'Guardian' series with wire supports

Growing under cool glass or in fixed polythene tunnels brings picking forward by 30–40 days compared with outdoor production, with three flushes a year.

Nutrition and irrigation

One week after transplanting, a liquid fertiliser feed of 100–150ppm nitrogen should be applied weekly as part of a complete balanced fertiliser regime. Avoid high ammonium and nitrogen levels as the plants' roots are sensitive to high salt levels. Incorporation of a controlled-release fertiliser (at 60–80g/m²) may be better.

Excessive soil wetness and drought should both be avoided. After picking, avoid overhead irrigation, as it can result in rotting of the hollow ends of the cut stems.

Plant manipulation and support

At least one level of support wires are needed for 'Elatum' types and for late picked crops.

Pinching can extend the picking period, delay flowering and (under long days) enhance yields. After early summer flowering, cutting the plants back will result in a second flush.

Pest and diseases control

Sciarid flies can be a problem during propagation. Aphids, caterpillars (including delphinium moth caterpillar), leaf miners, thrips, slugs and snails cause problems under protection and in the field.

Both insecticide and fungicide treatments are likely to be needed. *Pythium* root rot can be a problem at germination. Powdery mildew (*Erysiphe aquilegiae* var. *ranunculi*) can be serious during wet, cloudy weather. *Phoma xanthina* is common and leads to regular brown or black leaf spots, while black spot (*Pseudomonas delphinii*) causes large black spots on stems and leaves. Crown rot (*Sclerotinium rolfsii* var. *delphinii*) causes a wilt and plants fall over (brown or yellow sclerotia may be visible on the roots). Viruses (such as cucumber mosaic virus) lead to misshapen shoots, stunted growth and necrotic yellow leaf spots and require control of the vector, generally aphids and/or thrips.



Figure 5. Bacterial leaf spot (*Pseudomonas delphinii*) causing black spots on leaves

Picking, specifications and packing

For field-grown crops in their first year, yields of five to six stems/plant are reported for 'Elatum' types and up to 12 stems/plant for 'Belladonnas'. Under glass, four stems/plant/flush can be expected for 'Elatums' and six to eight for 'Belladonnas'. Under glass there can be two or three flushes a year, the third flush being brought to an end when autumn light levels fall.

'Elatum' types should be picked when one-third to half of the flower stem is open; picking at a later stage can lead to flower shattering. For 'Belladonna' types a more advanced stage is picked, when 75–90% of florets have opened.



Figure 6. Delphinium flower stems awaiting preparation and sleeving

Post-harvest care

At best, vase life in plain water is adequate, around five to eight days. Delphinium flowers are very sensitive to ethylene, which causes flower drop and shortens vase life.



Figure 7. Flower drop on 'Belladonna' type delphiniums in shelf life

After picking, stems should be placed promptly in water with a post-harvest conditioner suitable for ethylene-sensitive flowers (such as 'Chrysal AVB') for at least four hours at ambient temperatures (not in a cold store). After this 'pulse' the stems should be moved to water with a conditioner suitable for use during transport and retail display (such as 'Chrysal Clear Professional 2 T-bag'). Alternatively, re-cut stems after picking and place in water with a post-harvest conditioner suitable for ethylene-sensitive flowers (such as 'Chrysal AVB'); this will allow stems to be stored for one to two days at 3–5°C. Silver-based conditioners such as 'Chrysal AVB' are for grower use and should be neutralised and disposed of by the grower according to the instructions supplied, prior to sending on the treated stems in a different product.

As the flower stems show a geotropic response, they should be stored upright if practicable.

Summary of National Cut Flower Centre trials

Overview of the work at CFC

Trials were sited on 1m wide outdoor beds or beds in 'Haygrove' or 'Pro-Tech' polythene tunnels on a medium silt soil at Kirton, Lincolnshire (up to 2008) and on a heavier silt at Holbeach St Johns, Lincolnshire (from 2009 onwards). Between years the soil was sterilised with steam or Basamid (dazomet). Fertiliser applications were according to soil analysis, and although it is not possible to give a base fertiliser recommendation for every cut flower crop, the aim was to bring base levels to those required for column stocks (soil indices of two for nitrogen, six for phosphorus, four for potassium and four for magnesium). Delphiniums were obtained as plug plants from various suppliers and were transplanted at 36/m² through black polythene film. After establishment, irrigation water was generally applied through lay-flat tubing and plants received a liquid feed weekly. One layer of support net was provided. Preventative and curative crop protection products were applied as appropriate.

During the examination of post-harvest quality, simulated grower, transport, depot and retail phases were undertaken first (taking about five days in total), followed by the actual vase life test under simulated consumer conditions; the vase life figures quoted are the number of days the flowers last in the vase itself, not for the whole period from picking.

First delphinium continuity trial

In 2007, to investigate continuity of supply, plug plants of a range of 15 cultivars were transplanted (at 36/m²) into outdoor and tunnel plots on three dates (weeks 21, 23 and 27). The cultivars represented the mainstream 'Aurora' (five cultivars), 'Guardian' (three cultivars) and 'Scent' series (five cultivars) and there were two 'Belladonna' type cultivars ('Blue Donna Imperial' and 'Blue Shadow'). The trial was assessed over two years.

Despite using a wide range of treatment combinations and being able to pick flowers between weeks 27 and 36 in the first year, there were breaks in continuity in weeks 29, 33 and 34. In the second year, the picking season ran from week 19 through to 40 with three flushes, but again there were gaps in continuity (weeks 25–29 and 35–38). In the second year, having both tunnel and outdoor plots conferred no advantage because equivalent plots flowered at the same time in both environments.

Tunnel-raised stems were generally longer and were consistently heavier than those of outdoor crops. Stem weights also fell with later planting and in later flushes. Stems below 55cm in length were considered unmarketable, and those above 75cm were regarded as a premium grade. For the early planting, the average lengths and weights in the first year were 104cm and 108g for tunnels, but only 65cm and 49g for outdoor crops. In the second year, all tunnel-grown stems and many outdoor-grown stems exceeded the 75cm length specification. Cultivars of the 'Scent' series were the most consistent in producing stems of good length and weight.

Productivity and continuity were further impaired by the effects of powdery mildew in both years of the trial. A further problem was that 'Aurora' cultivars from the later plantings, whether outdoor or tunnel grown, produced short, poor quality stems.

Second delphinium continuity trial

From the first trial it was clear more work was needed to improve scheduling, and a second trial was set up in 2008 using tunnel-grown crops only. Plug plants of the 'Aurora' series (three cultivars), 'Centurion' series (one cultivar) and 'Guardian' series (three cultivars) were transplanted (at 36/m²) in weeks 15, 17, 19 and 21. These plantings produced two flushes with a cropping period from week 26 through to week 43, but there were gaps in supply in weeks 32, 33, 38 and 42.

Flower stem length, an important feature of delphiniums, averaged 62cm. 'Aurora', 'Guardian Blue' and 'Guardian Early Blue' produced high yields of premium stems from the two earlier plantings, with at least 45 stems/m² over the various flushes. Productivity fell in the later plantings. Yields were lower for 'Aurora Blue', 'Aurora Light Blue' and 'Centurion Gentian'. With one exception ('Guardian Early Blue' planted week 19) most or all of the stems from the first flush, and about 50% from the second flush, reached premium grade. The later plantings of 'Guardian Blue' gave poor yields.

Achieving continuity with delphiniums

Although the two trials advanced the quest for continuity of supply stretching over a 16 week period, they did not eliminate all gaps in production. Continuity could be improved were it practical to plant earlier, but growing in Spanish tunnels means that planting cannot begin before week 15. Low tunnels, less vulnerable to the weather, might be more suited for an earlier crop, but would be uneconomic for delphinium growing because they could be planted only in the centre line of the structure. Modern straight sided tunnels, however, especially multi-spans, would be suitable and are known to be used for delphiniums. Since delphiniums are suitable for growing under cold glass, continuity could almost certainly be extended by planting the first crop under glass.

A review of the scientific literature by Dr Allen Langton suggested several ways in which the flowering season of delphinium might be extended. The simplest, and possibly the most effective way to extend the season would be through combining first year and overwintered plantings, with additional cultivar selection and pinching part of the crop (which delays flowering but increases quality). Since delphiniums have a quantitative response to vernalisation that advances flowering and improves stem length, cold treatments could be applied to seedlings, or possibly even to seed.

Powdery mildew control

In the continuity trials, powdery mildew affected several plantings, both outdoors and in tunnels, at moderate to severe levels, especially in 2007.

Powdery mildew did not affect specific cultivars, but rather developed more randomly across the plots within the trial. During this and other trials, a number of protectant and curative fungicides had to be applied, some of which are still currently permitted for use on both protected and outdoor ornamentals including boscalid + pyraclostrobin (as Signum via Extension of Authorisation for Minor Use - EAMU 2141/12), cyflufenamid (as Takumi SC via EAMU 1294/13) and myclobutanil (as Systhane 20 EW). Other active ingredients are also available for the control of powdery mildew.

In 2008, a regular preventive programme was used which reduced powdery mildew levels to some extent, although they were still significant. For the tunnel-grown crops during 2014, powdery mildew control was more effective.



Figure 8. Powdery mildew on delphinium caused by the pathogen *Erysiphe aquilegiae* var. *ranunculi*

Vase life testing

Samples of stems from the continuity trial were picked at an appropriate stage (one-third to half of the flower stem open and the remainder in bud) for standard vase life testing. They were placed in flower buckets containing either plain water or water with an added post-harvest conditioner for ethylene-sensitive flowers ('Chrysal AVB') for a six hour pulse at ambient temperature, then moved to fresh water with an added conditioner for cut flowers during transport and retail display ('Chrysal Clear Professional 2 T-bag') and held for one day at 5°C then four days at 20°C. Finally, the stems were re-cut and placed in vases of water containing a standard flower food sachet, placed under lights at 20°C, and assessed daily.



Figure 9. 'Guardian' series during vase life testing at CFC

The cultivars tested all had a similar vase life, but using the post-harvest conditioner rather than plain water doubled average vase life from six to 12 days as well as increasing the flower quality score and water uptake. Despite the generally similar performance of cultivars, 'Aurora Light Blue' had poorer foliage quality and 'Aurora' had poor water clarity, demonstrating the need for careful variety selection.

Demonstration of new 'Belladonna' types

With their more open flower stems and more delicate appearance, 'Belladonna' types make a marked contrast to the standard, tall 'Elatum' types. There may be scope for exploiting their differences, if superior 'Belladonna' types were available to provide more consistent stems over a longer time period and therefore higher returns per unit area. In 2008, plug plants of eight coded micropropagated, smaller-flowered 'Belladonna' types were made available to the CFC for a demonstration trial. Plugs were transplanted (36/m²) into plots in a tunnel in week 21. One group cropped earlier, produced two flushes, and had the greater stem lengths and weights, averaging 86cm and 99g for the first flush and 122cm and 71g for the second. The other group were poor, yielding shorter, lighter stems in the first flush and failing to produce acceptable stems in the second. This suggested there would be scope for the further development of more vigorous 'Belladonna' types.

New 'Elatum' types

In 2012, the availability of new cultivars from Hilverda/HilverdaKooij suggested a fresh demonstration would be worthwhile. Micropropagated plug plants of cultivars 'Sky Waltz', 'Tango Dark Blue', 'Trick', 'Trick Pink' and 'Trick Yellow' were transplanted (at 16/m²) into tunnel and outdoor plots in week 25. However, the weather that summer proved unsuitable for producing quality stems, a fact confirmed by other growers.

More plugs of 'Sea Waltz', 'Sky Waltz' and 'Tango Dark Blue', were obtained in 2014. They were transplanted (at 9/m²) into tunnel plots in week 22. The plants were productive and on their way to a third flush when they were damaged by the gales of late October 2014.

Conclusions from the CFC trials work

- By using a range of cultivars and transplanting dates, the picking of 'Elatum' types could be extended over about a four to five month period.
- For example, a late crop transplanted in weeks 21, 23 and 27 outdoors and in a tunnel, enabled picking from week 27 through to week 36 in the first year and from week 19 through to week 40 in the second year. An early crop transplanted in weeks 15, 17, 19 and 21 to tunnels only, gave a cropping period from week 26 through to week 43 in the first year.
- Tunnel-raised stems were longer and heavier than those from outdoor crops, and the outdoor crop added little to seasonal extension. Stem weights fell with later planting and in later flushes. Of the three series grown, cultivars of the 'Scent' series were more consistent in producing stems of good length and weight than either 'Aurora' or 'Guardian'.

- In these trials there were occasional gaps in supply, indicating that some scheduling refinements are needed. These could include combining first year and overwintered plantings, using additional cultivars, pinching part of the crop and applying cold treatments to the seeds or seedlings.
- A preventive fungicide programme should be applied to control powdery mildew.
- All the cultivars tested had a similar vase life, but using a post-harvest conditioner suitable for ethylene-sensitive flowers doubled the average vase life from six days (in plain water) to 12 days and increased flower quality and water uptake.
- Despite the large numbers of series and cultivars of 'Elatum' type delphiniums currently available, there still seems to be scope for improvements in resilience to adverse weather and resistance to powdery mildew and for the development of new flower forms. There may also be scope for greater commercialisation of the 'Belladonna' type, but more evaluation would be needed first.

Further information on the National Cut Flower Centre project and trials work

Further details can be found in the following project reports, available from either the AHDB Horticulture website horticulture.ahdb.org.uk or the CFC website thecutflowercentre.co.uk

- Annual reports on AHDB Horticulture Project PO/BOF 002a (2013–2015): The National Cut Flower Trials Programme for 2013–2017.
- Annual and final reports on AHDB Horticulture Project PO/BOF 002 (2010–2012): The National Cut Flower Trials Programme for 2010–2012.
- Final report on AHDB Horticulture Project PC/BOF 268a (2009): Establishing a trials centre for the cut flower sector.
- Annual and final reports on AHDB Horticulture Project PC/BOF 268 (2008): Establishing a trials centre for the cut flower sector.

The industry-led National Cut Flower Centre was set up at Kirton Research Centre, Kirton, Lincolnshire in 2007 with AHDB Horticulture and Lincolnshire Fenlands LEADER+ support. In 2009, with AHDB Horticulture funding, the CFC moved to a dedicated site at Rookery Farm, Holbeach St Johns, Lincolnshire, where the current funded programme will continue until the end of 2017. The basic remit of the CFC is the stimulation of UK polythene tunnel and field-grown cut flower production through providing know-how from practical trials carried out under UK conditions.

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