



Faster Flowering of Perennials

International Plug & Cutting Conference, 2002

Pros and cons of finishing strategies for perennial plugs

Technique	Sales windows	Pros	Cons
Standard plugs & liners	<ul style="list-style-type: none"> • Early spring • Spring • Summer • Fall 	<ul style="list-style-type: none"> • Longer availability than cooled plugs & liners • Can schedule for any sales window • Excellent for growers new to perennials • Fit easily into warm growing production system 	<ul style="list-style-type: none"> • Cultivar choice limited if flowering desired • Flowering may be delayed or less full compared to cooled plants
Cooled plugs & liners	<ul style="list-style-type: none"> • Early spring • Spring • Summer 	<ul style="list-style-type: none"> • No need to maintain plants through the winter • Adapted to cool growing conditions • Shorter crop time than fall planting • May finish fuller than standard plugs & liners 	<ul style="list-style-type: none"> • Limited time of availability each year • Vernalization usually not guaranteed • May have premium price
Fall planting	<ul style="list-style-type: none"> • Early spring • Spring • Early summer 	<ul style="list-style-type: none"> • Can use small, economical plugs & liners • Overcomes juvenility in many species • High quality finished plants 	<ul style="list-style-type: none"> • May require overwintering facilities • Long crop time • Somewhat limited sales windows • Losses can occur during overwintering

Caution!

- Don't expect someone else's "cookbook" to automatically work perfectly in your system!
- Don't expect a schedule for one cultivar to always work the same for another cultivar!
- Don't expect a schedule for one sales window to always work the same for another sales window!
- A poor quality blooming perennial will be less saleable than a high quality green perennial

Providing Long Days

Perennials which require long days to flower can be flowered out of season with supplemental lighting

- Under 14 hour or shorter photoperiods, provide artificial long day
- Night break lighting (10 pm – 2 am) is recommended
- Incandescent, fluorescent, HID light is acceptable
- Will get some stretch, especially with incandescent
- To minimize stretch, turn lights off after flower buds appear
- Provide 5-10 footcandles minimum (1.25 watts/ft² for incandescent, 0.3 watts/ft² for HPS)
- Providing night break lighting during times of natural long day photoperiods can accelerate flowering 7-14 days for some perennials

Cooling and vernalization

Many perennials (both seed and vegetative) need to go through a cold period in order to flower, or flower much more quickly after receiving cold treatment.

- Vernalization = cooling a perennial long enough to cause it to bloom when it is warmed up.
- Successful vernalization depends on:
 - Maturity of the plant
 - Length of the cooling period
 - Cooling temperature
- Only when mature plants are cooled for the proper length of time and at the proper temperature is vernalization successful
 - Cooling juvenile plants can lead to sporadic flowering, greatly increased time to flower, or failure to flower
 - In general, older plants are less likely to be juvenile
- Even if not vernalized, cooled plugs typically have a better developed root system and produce fuller growth with better secondary shoot development than standard plugs. This can lead to fuller plants with more breaks, giving better pot fill

Perennials with attractive foliage for sale green

When scheduling these crops, provide 4-6 weeks for finishing in small containers, and 6-8 weeks in large containers, when grown at 60-70 °F. Remember, a well-grown green perennial may sell better than a poorly grown flowering perennial!

- *Ajuga*
- *Alchemilla mollis*
- *Artemisia* spp.
- *Festuca*
- *Heuchera* 'Palace Purple' and other foliage types
- *Hosta*
- *Lobelia* 'Queen Victoria'
- *Lychnis coronaria*
- *Penstemon digitalis* 'Husker's Red'
- *Stachys byzantina*
- *Veronica repens*
- Many variegated varieties, even if they have attractive flowers

Perennials which flower without cooling

By providing the proper photoperiod, these perennials can be flowered for spring, summer, or fall sales. Cooling may be beneficial for some items, decreasing bench time and/or increasing finish quality and uniformity. Schedules based on 128 cell plugs (seed varieties) or 72 cell liners (vegetative varieties) transplanted 1 per pot for quart and smaller containers, 2-3 per pot for gallon, and growing temperatures of 60-68 °F (unless otherwise indicated), under the proper photoperiod. Larger plugs and liners may finish 2-4 weeks faster, smaller plugs and liners 2-4 weeks slower. In gallon containers, some species may require 1-2 additional weeks to flower.

Plant	Photoperiod*	Weeks to flower	Days bud to flower	Height (inches)
<i>Achillea millefolium</i> 'Summer Pastels', 'Colorado', 'Cassis'	LD	8-10	20	12-18
<i>Agastache foeniculum</i> cultivars	LD	6-8	14	24-36
<i>Agastache</i> 'Summer Breeze'	LD	8-9	15	18-30
<i>Anchusa capensis</i> ‡	DN	9-10	20	8-12
<i>Armeria pseudoarmeria</i> 'Joystick' series	LD	10-12	12	18-24
<i>Asclepias tuberosa</i> ††	LD	8-10	20	12-14
<i>Calamintha nepetoides</i>	LD	6-7	18	12-18
<i>Campanula carpatica</i> 'Clips', 'Star', 'Uniform' series	LD	7-9	20	6-8
<i>Campanula carpatica</i> 'Pearl' series	LD	6-8	20	5-6
<i>Campanula cochlearifolia</i> cultivars	LD	6-7	14	6-10
<i>Campanula rotundifolia</i>	LD	5-6	10	12-14
<i>Centaurea montana</i>	LD	7-8	24	12-16
<i>Centranthus ruber</i>	LD	6-8	14	24-36
<i>Coreopsis grandiflora</i> 'Early Sunrise'	LD	10-12	28	18-24
<i>Cynoglossum amabile</i> 'Mystery Rose'	DN	8-10	20	12-16
<i>Delphinium grandiflorum</i> cultivars † ‡	DN	8-10	20	20-24
<i>Dianthus × allwoodii alpinus</i> †	DN	7-8	16	8-12
<i>Dianthus barbatus</i> 'Rondo Mix' †	DN	7-8	20	6-8
<i>Dianthus deltoides</i> 'Arctic Fire', 'Zing Rose' †	DN	7-8	14	4-6
<i>Dianthus gratianopolitanus</i> 'Grandiflorus' †	DN	8-10	20	8-14
<i>Digitalis grandiflora</i> 'Temple Bells', 'Carillion'	DN	7-8	14	12-16
<i>Helenium autumnale</i> 'Helena' series	LD	12-14	12	30-42
<i>Heliothis beliantoides</i> **	LD	8-10	22	30-36
<i>Hibiscus × hybrida</i> cultivars **	LD	9-12	45	24-30
<i>Lavandula angustifolia</i> 'Lady'	LD	8-10	24	12-16
<i>Lavandula stoechas</i> 'Kew Red'	LD	12-14	9-12	20
<i>Leucanthemum (Chrysanthemum) × superbum</i> 'Silver Princess', 'Snow Lady', 'White Knight'	LD	8-10	25	10-14
<i>Linaria purpurea</i> 'Canon J Went'	LD	8-10	14	20-30
<i>Lobelia siphilitica</i>	LD	10-12	20	24-32
<i>Lobelia × speciosa</i> 'Compliment', 'Fan' Series	LD	9-10	24	18-30
<i>Lupinus × hybrida</i> 'Gallery' series ‡	LD	8-9	14	20-24
<i>Nepeta faassenii</i>	LD	10-11	8	12-16
<i>Oenothera missouriensis</i>	LD	9-11	24	10-12
<i>Papaver alpinum, nudicaule</i> cultivars † ‡	DN	6-8	14	12-24
<i>Penstemon campanulatus</i> 'Evelyn'	DN	9-10	18	16-24
<i>Platycodon grandiflorus</i> 'Sentimental Blue' F1 ††	LD	6-8	18	4-6
<i>Platycodon grandiflorus</i> 'Astra' series, 'Mariesii'	LD	9-11	24	16-24
<i>Rudbeckia hirta</i> cultivars	LD	8-9	16	10-24
<i>Rudbeckia triloba</i> **	LD	15-16	36	36-42
<i>Sagina subulata</i>	LD	5-6	8	3-4

* LD indicates long days are required or beneficial for flowering ** Better performance when grown warm, 70-75 °F
† Provide additional 2-3 weeks for flowering under short days †† Pinch at transplant for better pot fill
‡ Prefers cool growing temperatures, not good for summer sales window

Perennials which can be vernalized as plugs or liners

Cooled perennial plugs are ideal for finish growing under cool temperatures for early and late spring sales. Items on this list can also be planted in fall, and will finish at approximately the same schedule (or up to 1-2 weeks earlier) after overwintering. This schedule is based on mature plugs and liners cooled 10 weeks at 38-41 °F and 60-68 °F growing temperatures (unless otherwise indicated), under the proper photoperiod. In gallon containers, 1-2 additional weeks may be required.

Plant	Photoperiod*	Weeks to flower	Days bud to flower	Height (inches)
<i>Aquilegia alpina</i> †	DN	6-8	10	10-14
<i>Aquilegia vulgaris</i> , × <i>hybrida</i> (<i>cultorum</i>) cultivars †	DN	6-7	10-12	10 - 18; 24 - 36
<i>Arabis caucasica</i> cultivars ‡	DN	3-5	7	4-6
<i>Astilbe chinensis</i>	LD	12-15	30	8-16
<i>Astilbe chinensis</i> var. <i>taquetii</i>	LD	12	32	20-32
<i>Aubrieta</i> × <i>hybrida</i> 'Grandiflora', 'Whitewall Gem'	DN	9-10	7	6-8
<i>Bellis perennis</i> cultivars ‡	DN	6-8	12	8-10
<i>Coreopsis auriculata</i> 'Nana'	DN	5-6	14	6-12
<i>Coreopsis grandiflora</i> 'Sunray', 'Baby Sun' †	LD	6-8	20	20-30
<i>Coreopsis rosea</i>	LD	8-9	21	18-24
<i>Coreopsis verticillata</i> 'Moonbeam', 'Zagreb'	LD	8-9	28	12-24
<i>Delphinium</i> × <i>belladonna</i> cultivars	DN	8-9	20	20-28
<i>Delphinium</i> × <i>elatum</i> 'Magic Fountains' series	DN	8-10	20	18-28
<i>Dianthus barbatus</i> 'Double Dwarf', 'Indian Carpet'	DN	8-9	12	6-8; 8-12
<i>Digitalis grandiflora</i> (<i>ambigua</i>)	DN	6-8	16	14-18
<i>Echinacea purpurea</i> cultivars **, ***	LD	10-12	24	36-48
<i>Gaillardia</i> × <i>grandiflora</i> cultivars ***, †	LD	7-9	20	10-18; 24-28
<i>Geum chiloense</i> 'Lady Stratheden', 'Mrs. Bradshaw'	DN	8-10	10	12-16
<i>Heuchera sanguinea</i> cultivars †	LD	7-8	18	14-30
<i>Leucanthemum</i> (<i>Chrysanthemum</i>) × <i>superbum</i> 'Alaska', 'G Marconi' ***	LD	7-8	24	24-36
<i>Myosotis sylvatica</i> 'Victoria' series ‡	DN	5-7	14	6-10
<i>Phlox paniculata</i> 'David', 'Franz Schubert'	LD	9-10	12	22-30
<i>Phlox subulata</i> 'Appleblossom', 'Coral Eyes', 'Fort Hill', 'Scarlet Flame'	DN	3-4	7	4-6
<i>Physostegia virginiana</i> 'Alba'	LD	10-12	26	20-30
<i>Physostegia virginiana</i> 'Rosea'	LD	12-15	30	30-36
<i>Platycodon grandiflorus</i> 'Fuji' Series	LD	10-12	30	24
<i>Polemonium caeruleum</i>	LD	4-6	12	20-26
<i>Primula</i> × <i>polyantha</i> (<i>elatior</i>), × <i>pruboniciana</i> ‡	DN	7-8	15	4-10
<i>Rudbeckia fulgida</i> 'Goldsturm' †, **, ***	LD	12-14	30	18-24
<i>Salvia</i> × <i>sylvestris</i> 'Blue Hill', 'East Friesland', 'Snowhill', 'May Night'	LD	5-6	14	12-20
<i>Saxifraga</i> × <i>arendsii</i> 'Purple Robe'	DN	5-7	7	6-8
<i>Scabiosa columbaria</i> 'Butterfly Blue'	LD	4-5	21	12-20
<i>Veronica spicata</i>	LD	6-8	18	18-24

† These plants have a relatively long juvenility period and large plugs are recommended to ensure flowering.

* LD indicates long days are required or beneficial for flowering

** Better performance when grown warm, 70-75 °F

*** Multiple plugs per pot recommended. Fuller plants and better pot fill when planted in fall and overwintered.

‡ Prefers cool growing temperatures, not good for summer sales window

Perennials for fall planting

These perennials have long juvenility periods or produce better filled pots when plants with a large root mass are vernalized. This schedule is based on pots cooled a minimum of 10 weeks at 38-41 °F, and 60-68 °F finish growing temperatures (unless otherwise indicated), under the proper photoperiod.

Plant	Photoperiod*	Weeks to flower	Days bud to flower	Height (inches)
<i>Achillea millefolium</i> cultivars	LD	9-10	24	20-24
<i>Aquilegia alpina</i>	DN	6-7	10	10-14
<i>Aquilegia flabellata</i> 'Cameo' Series †	DN	4-5	7	4-8
<i>Aquilegia vulgaris</i> , × <i>hybrida</i> (<i>cultorum</i>) cultivars	DN	6-7	10-12	10 - 18; 24 - 36
<i>Aster alpinus</i> cultivars	LD	5-6	14	14-20
<i>Aster tongolensis</i> 'Wartburg Star'	LD	7-8	28	18-24
<i>Astilbe chinensis</i>	LD	12-14	30	8-16
<i>Astilbe chinensis</i> var. <i>taquetii</i> (<i>A. taquetii</i>)	LD	10-12	32	20-32
<i>Aurinia saxatilis</i> 'Compactum'	DN	5-7	10	10-14
<i>Campanula glomerata</i> cultivars	LD	7-8	24	18-24
<i>Campanula persicifolia</i> cultivars	LD	10-12	30	36-42
<i>Coreopsis grandiflora</i> 'Sunray', 'Baby Sun'	LD	6-7	20	20-30
<i>Dianthus caryophyllus</i> 'Grenadin' Series	DN	7-9	26	18 - 24
<i>Digitalis purpurea</i> cultivars	DN	10-11	14	24-36
<i>Doronicum orientale</i> cultivars	DN	7-8	6	18 - 30
<i>Echinacea purpurea</i> cultivars **	LD	10-12	24	36-48
<i>Gaillardia</i> × <i>grandiflora</i> cultivars	LD	7-8	20	10-18; 24-36
<i>Heuchera sanguinea</i> cultivars	LD	7-8	18	14 - 30
<i>Iberis sempervirens</i> 'Snowflake'	DN	6-7	13	8 - 10
<i>Lavandula angustifolia</i> 'Hidcote Blue', 'Munstead Dwarf' (from seed)	LD	6-7	20	12-20
<i>Leucanthemum</i> (<i>Chrysanthemum</i>) × <i>superbum</i> 'Alaska', 'G Marconi'	LD	7-8	24	24 - 36
<i>Lupinus</i> × <i>hybrida</i> 'Minarette', 'Russell' Series	LD	10-12	14	24-36
<i>Lychnis viscaria</i> 'Firebird', 'Splendens'	DN	5-6	9	18-24
<i>Oenothera fruticosa</i> 'Youngii'	LD	9-10	20	24-36
<i>Potentilla megalantha</i>	LD	8	10	4-8
<i>Potentilla nepalensis</i> 'Miss Willmott'	DN	9-10	14	10-14
<i>Rudbeckia fulgida</i> (var. <i>sullivantii</i>) 'Goldsturm' **	LD	12-14	30	18-24
<i>Scabiosa caucasica</i> 'Fama', 'Perfecta Alba'	DN	10-12	24	30-36
<i>Tanacetum</i> (<i>Chrysanthemum</i>) <i>coccineum</i> cultivars	LD	7-8	18	24-36

* LD indicates long days are required or beneficial for flowering

** Better performance when grown warm, 70-75 °F

† Make sure plants are well established before cooling, or low quality plants will result