With some plants (*Geranium cinereum* 'Ballerina'), there was a nearly absolute aversion to deep planting. Nearly 100% of the plants failed to grow if planted "deep". High planting, on the other hand, resulted in nearly 100% growth of this plant. While this is an extreme example, nearly every plant evaluated showed better growth 6-8 weeks after planting if planted "high" (Figures 2-6, Table 9). This was true even if the bottom of the pots were water-logged. Table 9 shows species that responded favorably to "high" planting with a minimum of 15% better growth (measured by height), to as much as 4 times better growth due to high planting (*Geum*). We have not examined all plants but it is striking how many genera plants responded favorably to "high" planting.

The conclusion is that perennial finishers should pay close attention to their planting practices, and what happens to the material before it gets set on the ground or bench. Sloppy planting on a planting machine and a bumpy trailer ride to the bed could cause roots to find themselves too deep, with marked consequences for growth. This is an example where even the highest quality product can fail due to the negligence of the grower. The bottom line is that success depends on the exporter delivering a high quality product, and the grower handling, planting, and caring for it correctly.

Figure 6. Growth of Salvia nemorosa 'Amethyst' as affected by planting depth and soil water status. L to R: Planted high, normal water; planted high, water-logged; planted deep, normal water; planted deep, water-logged.

Guidelines for Growing Hybrid lilies in Pots

In addition to the first research newsletter about Growth Regulation for Potted Hybrid Lilies another article is published on the internet site www.flowerbulb.nl/RP/index.htm and also on the internet site of Cornell University. This article deals with Guidelines for Growing Hybrid Lilies in Pots and contains additional information on general growing problems.

The Cornell Greenhouse Horticulture Website www.greenhouse.cornell.edu

A new website for greenhouse growers has been created by the Greenhouse Horticulture Program members at Cornell University.

- Some of the information you can find on this website includes:
- Horticultural print references and how to order them
- Online resources and links for all aspects of greenhouse growing
- Online fact sheets for insect pests and diseases
- Diagnostic lab information – including links to problem-solving diagnostic and analytical laboratories
- Issues of *Cornell Focus on Floriculture*, a quarterly newsletter recently introduced through the County Associations. *In the current issue, Bill Miller has an article on greenhouse forcing of potted hybrid lilies, including nutrition, growth regulation, and physiological problems*
- Cornell Guidelines – integrated approaches to pest management and growth regulation, including pesticides and growth regulators registered for use in New York
- Links to upcoming educational programs and events
- Links to other informative websites at Cornell (e.g. SmartMarketing, and IPM websites) and much more…

Info Research Program

More information on the research program and the newsletters, can be found on the website of the Royal DWAFN : www.flowerbulb.nl/RP/index.htm .

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RESEARCH NEWSLETTER

This Flower Bulb Research Program Newsletter is published by the Royal Dutch Wholesalers Association for Flowerbulbs and Nurserystock in cooperation with Dr. Bill Miller of Cornell University.

Handling Bareroot Perennials

Over the last 2 decades, perennials have become increasing popular as they became a prime component in mainstream landscaping and shed their stigma as highly specialized plants that only serious gardeners could understand or appreciate. Their varied sizes, shapes, textures, colors, and the complexity of perennial garden design have all contributed to their popularity.

The long, cool summer days in the Netherlands are ideal for producing many perennials as bare roots, and the agronomic characteristics of the soils and the understanding of digging, handling, and storing dormant products are well-understood in Holland. Bareroot perennials have become a major (in several cases, *the* major) major economic component for many Dutch export companies. Table 1 shows the market trends for the total sector, as well as the top 10 products for the past several years.

Table 1. Export of bareroot perennials to North America, million pieces.

	1999	2000	2001	2002	+/-
Hosta	12.2	12.5	13.6	14.9	9%
Liatris	14.8	10.0	9.1	12.6	38%
Hemerocallis	5.3	5.9	8.2	7.5	-8%
Astilbe	3.0	3.1	3.0	3.1	2%
Convallaria	2.8	2.8	3.1	2.7	-13%
Paeonia	2.0	1.8	1.9	2.1	9%
Dicentra	1.5	2.0	2.3	2.0	-11%
Phlox	1.0	1.0	0.9	1.2	35%
Iris	0.16	0.6	0.08	0.5	460%
Aconitum	0.3	0.4	0.4	0.4	-17%
Others……………	...	…	…	…	…
TOTAL	49.8	48.6	49.7	53.6	8%

North American Perspective

In North America, producers of finished perennials have a number of options when buying-in starter material, including bareroot (domestically produced or imported), seed propagated plugs, or vegetative liners, each available in a range of grades and sizes. Compared to plugs or liners, bareroot crowns or divisions have several advantages and disadvantages, among the following:

Advantages of bareroot:

- Availability of a wide assortment of the major cultivars and varieties
- Available both domestically (North America) or as im ported (Dutch) items
- Availability in a range of sizes or grades
- Can make a bigger plant in a shorter time, compared to many liners
- Are easily stored dormant, thus many delivery sche- dules are possible
- The grower is certain the cold requirement has been met (since a dormant, cold-stored crown is being pur chased)
- Many species can tolerate lower temperatures after plant ing than many greenhouse-produced plugs or liners
  Can be very cost-effective

Disadvantages of bareroot:

- There are yearly and seasonal differences in bareroot growth
- Obvious distinguishing characteristics (e.g. foliage color or markings) are absent, thus impossible to determine if true-to-type
- Some are fundamentally difficult to work with ("which end of this thing is up?")
- Roots and crowns are very susceptible to drying-out (quality, vigor loss)
- Time frame of availability is somewhat limited (e.g. not year-round)
- Growing practices after planting need to be very care fully monitored
- Optimum/detailed storage and handling procedures per species/cultivar are not known
- Some plants resent bareroot handling
  With imports, washing to remove soil (to comply with USDA-APHIS import regulations) is thought to injure the roots (but, see below!)

Import of bareroot perennials and the washing process

Traditionally, Holland has been the major source of bareroot perennials for use in the North American market. While this will undoubtedly hold true in the future, other countries (e.g., Mexico) are increasing production, and will provide a wider range of product, and somewhat different shipment windows.

A distinguishing characteristic of imported roots, bulbs, and landscape plant material, is that is must be free of soil, per USDA-APHIS regulation. This is to minimize the danger of importing unwanted plant pests (e.g. nematodes) into the United States. In practice, this means roots and crowns are washed by a series of moderate to high-pressure sprays. In Holland, there are a number of different machines to do this, and this activity can be conducted internally by individual export companies, or it can be contracted to one of the major "washing companies". In any case, a given lot of bareroot perennials may be washed from one to several times to fully dislodge and remove adhering soil or sand. Along with washing, high temperature and/or fungicide dips may be applied to control nematodes or disease.

The physical impact of fairly high pressure water in combination with sand and soil particles has led many to believe that "washing" can cause physical injury to certain bare root items. This injury would lead to pathogen entry points, perhaps cause more rapid water loss due to the injury to the root or crown epidermis (or "skin"), and generally lead to reduced regrowth potential and quality.

Our research on factors affecting regrowth of bareroot perennials.

The problem of regrowth of perennials after export to the US was identified by a survey of Group 1 Exporters in the late 1990's. In response to this, a specific project was written, and was approved by March 2000. This project (PT-10.655) had the goals of investigating the "regrowth problem" and to foster research linkages with the then-LBO (now PPO, Lisse) and the North American Flowerbulb Research Program at Cornell University. Henk Gude and Arie Vanderlaans of the PPO coordinated activities in Holland, and Cornell handled the US activities.

The basic issues to address and species to use in the work were developed through a series of consultations with a number of perennial growers and exporters.

Does washing injure perennials?

In 2001 several perennials (*Phlox*, *Helleborous*, *Pulmonaria*, *Anemone*, *Delphinium, and Epimedium*) were washed 0, 2, 4, or 8 times at Helmus (the major perennial washing company in Holland). After washing, roots were packed per normal procedure, and shipped by air to Ithaca in mid-April 2001, where they were planted into 15 cm pots with a typical greenhouse planting mix (Metro Mix 260). Plants were grown in a 17C night temperature greenhouse, with day temperatures varying from 20-26C. The experiment was repeated in 2002, with plants stored at –1C until shipping to Ithaca (ocean vessel at 2C), and arrival in Ithaca in mid-June, 2002. Root growth was evaluated by a scale that allowed a non-destructive root rating (Table 2). In both years, a second set of plants was retained in Holland and planted in fields at the PPO field research site in Lisse.

Table 2. Rating system used to evaluate rooting after 3 weeks of growth.

Rating	Description
0	No new roots visible at all on the rootball
1	2-3 new roots visible on the rootball, <1 cm long
2	4-6 new roots visible on the rootball, 2-5 cm long
3	Many new roots >5 cm long, not yet circling the bottom of the pot
4	Plant is fully rooted, with new roots circling the bottom of the pot once
5	New roots circling bottom of the pot more than 2 times

The findings are very simple: there was no effect of washing from 0 to 8 times on the rate of rooting, growth by season's end, or percentage survival for any plant in any year (Tables 3 and 4). This held true for plants exported to Ithaca, or for those that remained in Holland and were planted-out for field growth observation. The tables clearly show differences in rooting speed between the plants (for example, phlox and pulmonaria were well-rooted before hellebore and anemone even began to root).

Table 3. Effect of number of washings on root growth rating taken on 15 May 2001. Dormant roots were planted at Cornell University, Ithaca, NY on 25 April in 15 cm pots with Metro Mix 360. There were 40 plants per treatment.

Species	Number of washings	Root growth rating
Anemone 'Honorine Jobert'	2x	0.175
	4x	0.308
	8x	0.2
Delphinium elatum	2x	0.9
	4x	0.974
	8x	0.775
Helleborus orientalis	2x	0.025
	4x	0.025
	8x	0.025
Phlox paniculata 'Windsor'	2x	2.56
	4x	2.65
	8x	2.31
Pulmonaria saccharata 'Mrs. Moon'	2x	3.5
	4x	3.72
	8x	3.7

In the first year, there was large variability in grade of the plants. This did not seem to affect rooting, but leads to increased crop variability for the finisher. The second year experiment pointed out one of the issues with bareroot product, the difficulty of telling whether the roots are alive or dead. In this case, *Omphalodes* crowns were dead on arrival in Ithaca.

Since in no one's experience are perennials ever washed 8 times, we can state with confidence that washing *per se* is not an injurious process for bareroot perennials and has no effect on survival, regrowth, and rooting.

Table 10. Bareroot species showing markedly better growth with "high" planting (with crown and buds at or 1 cm above the soil surface), as opposed to planting with dormant buds 2-3 cm below the surface.

Aconitum	*Astilbe*	*Athyrium*
Campanula	*Echinops*	*Epimedium*
Euphorbia amygdale	*Filipendula*	*Geranium*
Geum	*Helenium*	*Hemerocallis*
Heuchera	*Hosta*	*Iris sibirica*
Liatris	*Ligularia*	*Lysimachia*
Salvia nemorosa	*Sidalcea*	*Tradescantia*
Trollius	*Verbascum*	*Veronica*

Figure 2. Growth of Filipendula purpurea 'Elegans' as affected by planting depth and soil water status. L to R: Planted high, normal water; planted high, water-logged; planted deep, normal water; planted deep, water-logged.

Figure 3. Growth of Geranium oxonianum 'Sherwood' as affected by planting depth and soil water status. L to R: Planted high, normal water; planted high, water-logged; planted deep, normal water; planted deep, water-logged.

Figure 4. Growth of Geum rivale 'Album' as affected by planting depth and soil water status. L to R: Planted high, normal water; planted high, water-logged; planted deep, normal water; planted deep, water-logged.

Figure 5. Growth of Hosta 'Abiqua Moonbeam' as affected by planting depth and soil water status. L to R: Planted high, normal water; planted high, water-logged; planted deep, normal water; planted deep, water-logged.

Table 9. Effect of planting depth on growth of several bare root perennials. The "High" treatment refers to plants where the crown and buds were placed at or slightly above the soil line, "Deep" refers to bare roots where the crown and buds were about 1-1/2" (4 cm) below the soil surface. Experiment started in late April. Plants grown in 15 cm pots, with MetroMix 360 in a 17-20C greenhouse. Data were taken about 6 weeks after planting. 10 pots per treatment.

Plant Planting treatment	Height (cm)	Root rating	Perrcent survival
Aconitum henryi 'Spark's Variety'			
Deep	9.6	2.5	60%
High	15.6	3.3	85%
Echinops bannaticus 'Blue Pearl'			
Deep	15.2	2.5	95%
High	15.7	2.7	100%
Filipendula purpurea 'Elegans'			
Deep	27.4	2.7	100%
High	37.5	4.0	100%
Geranium oxonianum 'Sherwood'			
Deep	7.0	2.4	80%
High	11.5	3.8	100%
Geum rivale 'Album'			
Deep	0.0	0.0	10%
High	6.2	2.9	85%
Hosta 'Abiqua Moonbeam'			
Deep	7.3	2.9	95%
High	13.9	4.1	95%
Hosta 'Blue Wedgwood'			
Deep	2.7	2.0	100%
High	9.6	3.9	100%
Hosta 'True Blue'			
Deep	7.4	3.5	100%
High	10.2	2.4	100%
Liatris spicata 'Alba'			
Deep	20.2	2.3	100%
High	31.6	4.1	100%
Salvia nemorosa 'Amethyst'			
Deep	10.7	1.9	100%
High	30.8	4.3	100%
Sidalcea oregana 'Brilliant'			
Deep	15.5	2.8	85%
High	18.6	3.6	95%
Tradescantia 'Sylvana'			
Deep	14.0	2.6	100%
High	17.9	3.7	100%
Verbascum 'Cotswold Queen'			
Deep	11.3	3.2	55%
High	14.6	3.3	85%
Veronica longifolia 'Lilac Fantasy'			
Deep	7.8	2.2	85%
High	11.7	3.0	95%

Figure 1. Examples of moisture level on sprouting in Delphinium upon arrival in Ithaca (mid-April, 2001). Top: packed in peat with 38% water; middle, 50%; bottom, 60%. Very similar results would be seen with Pulmonaria, Phlox, Helleborous, and Anemone.

Table 4. Effect of the number of washes (in Holland) on root regrowth and plant survival after 3 weeks of growth at Cornell University. Plants were planted June 26-27, 2002. Root and survival data collected July 16/17. Data are averages of two independent evaluations of root growth and plant survival. There were 40 plants per treatment.

Species	Number of washes	Root rating	Percent survival	Fresh weight (g)	Final height (cm)
Epimedium	2	0	98%	5.6	10.0
	8	0	89%	4.3	10.6
Phlox	2	1.2	92%	25.2	38.3
	8	1.1	99%	23.6	39.7
Omphalodes	2	dead	0%	---	---
	8	dead	0%	---	---

This is an important finding for the industry, and allows us to reject the idea that the washing process is a culprit in cases where there are regrowth problems after export. Thus, regrowth or problems with uneven growth in imported bareroot perennials should not be blamed on "washing". Of course, we have not tested every kind of perennial, but the ones we looked at had been reported to be problematic for many exporters. The conclusion is that in cases where there are growth problems, *the health, grade, and quality of the product as well as the attention and care given by the receiver must be considered.*

Other Cornell-Holland perennial regrowth research. As part of the project above, we examined 4 other factors that might influence quality and regrowth of bareroot perennials imported into the U.S. These included: 1) drying and handling methods after washing, 2) packaging method, 3) moisture level of the peat-moss material, 4) time of digging.

Drying method. In this work, we looked at a range of techniques in use by exporters, including temperature of post-wash drying (0.5C or 10C), exposure (thin or thick layer of roots), or protection (with or without some enclosure by poly film).

The basic results were that there was very little difference between the treatments in rooting speed for a range of plants, including *Phlox* 'Windsor', *Pulmonaria* 'Mrs. Moon', *Delphinium elatum*, *Helleborous orientalis*, *Epimedium*, and *Anemone* 'Honorine Jobert' (Table 5). In the first year, the harshest treatment (2 days drying at 10C in a thin layer) caused a slight reduction in initial root growth in *Phlox* and *Pulmonaria*, but these differences did not affect season-long performance.

From this, we can conclude that the basic techniques in use by exporters and handlers are adequate for the purpose of drying roots after washing. It is well known that excessive drying causes reduced growth vigor, but this degree of drying was not reached in these experiments.

Table 5. Effect of drying method on root growth rating taken on 16 May 2001. Dormant roots were planted at Cornell University, Ithaca, NY on 26 April 2001 in 15 cm pots with Metro Mix 360.

Species	Drying method	Root growth rating
Anemone 'Honorine Jobert'		
	2 d 0.5 C in film	0.28
	2 d 0.5C, film with holes	0.25
	2 d 10C thick layer	0.28
	2 days 10C thin layer	0.23
Delphinium elatum		
	2 d 0.5 C in film	0.00
	2 d 0.5C, film with holes	0.00
	2 d 10C thick layer	0.05
	2 days 10C thin layer	0.00
Helleborus orientalis		
	2 d 0.5 C in film	1.08
	2 d 0.5C, film with holes	0.90
	2 d 10C thick layer	0.97
	2 days 10C thin layer	1.00
Phlox paniculata 'Windsor'		
	2 d 0.5 C in film	2.60
	2 d 0.5C, film with holes	2.13
	2 d 10C thick layer	2.60
	2 days 10C thin layer	1.60
Pulmonaria saccharata 'Mrs. Moon'		
	2 d 0.5 C in film	4.03
	2 d 0.5C, film with holes	3.88
	2 d 10C thick layer	3.95
	2 days 10C thin layer	3.43

Packaging method. In the first year, we looked at a number of packaging methods. Ranging from "wettest" to "driest" they were: 1) Poly film with microholes, 2) poly film with larger holes, 3) poly film with double the number of holes as in #2, 4) as #3, but with additional holes, and also holes in the cardboard box. Washed divisions (*Phlox*, *Helleborous*, *Delphinium*, *Pulmonaria*, and *Anemone*) were packed by normal procedure, held for some time in Holland, then shipped to Ithaca.

In both Ithaca and Holland, there were no differences in rooting or growth as a result of these treatments (Table 6). We can conclude that a range of packaging methods are acceptable for handling of bareroot perennials, and none could be specifically related to regrowth problems.

Table 6. Effect of packaging method (film and number of holes) on root growth rating taken on 14 May 2001. Dormant roots were planted at Cornell University, Ithaca, NY on 24 April 2001 in 15 cm pots with Metro Mix 360. Experiment 2001-P4.

Species	Packaging method	Root Growth rating
Anemone 'Honorine Jobert'		
	1. Microholes	0.35
	2. Larger holes, poly lily bag	0.225
	3. Lily bag with extra holes	0.425
	4. As #3, with double holes	0.45
Delphinium elatum		
	1. Microholes	0.95
	2. Larger holes, poly lily bag	1.275
	3. Lily bag, extra holes	0.97
	4. As #3, with double holes	0.9
Helleborus orientalis		
	1. Microholes	0
	2. Larger holes, poly lily bag	0
	3. Lily bag, extra holes	0
	4. As #3, with double holes	0
Phlox paniculata 'Windsor'		
	1. Microholes	3.05
	2. Larger holes, poly lily bag	3.075
	3. Lily bag, extra holes	2.9
	4. As #3, with double holes	2.675
Pulmonaria saccharata 'Mrs. Moon'		
	1. Microholes	3.5
	2. Larger holes, poly lily bag	3.85
	3. Lily bag, extra holes	4.1
	4. As #3, with double holes	3.7

Peat moss moisture level. In two different years, roots were packed in peat moss with moisture levels ranging from ca. 31 to 64% (driest to wettest), then shipped to Ithaca (as described above) for planting and growth evaluation. These experiments were done with *Pulmonaria, Anemone, Phlox, Helleborous, Delphinium* and *Epimedium.*

The findings were that the highest moisture levels usually caused excessive sprout growth, and sometimes rooting. This was a problem as the young, etiolated growth was easily damaged, and could easily have provided entry points for pathogens. In the first year, the lowest and highest moisture levels caused noticeably less initial root growth in *Delphinium* and *Phlox* (Table 7), but this trend did not hold true in the second year (Table 8). In either case, there were no differences in above-ground growth at flowering, some months later. Examples of the effects of peat moisture on sprout development upon receipt at Cornell are given in Figure 1.

Table 7. Effect of peatmoss moisture content (based on wet weight percentage) on root growth rating taken on 21 May 2001. Dormant roots were planted at Cornell University, Ithaca, NY on 1 May 2001 in 15 cm pots with Metro Mix 360. Experiment 2001-P3.

Species	Peat moisture content (%)	Root growth rating
Anemone 'Honorine Jobert'	38%	0.3
	42%	0.44
	50%	0.25
	60%	0.24
Delphinium elatum	38%	0.9
	42%	1.98
	50%	1.8
	60%	0.88
Helleborus orientalis	38%	0
	42%	0
	50%	0
	60%	0
Phlox paniculata 'Windsor'	38%	1.8
	42%	2.9
	50%	2.8
	60%	1.8
Pulmonaria saccharata 'Mrs. Moon'	38%	4.23
	42%	4.45
	50%	4.1
	60%	3.63

Excessive sprouting, regardless of the cause, is an aesthetic problem, but also a practical one, as extra care needs to be exercised by the work force to avoid injury. And, in principle, sprouts that are broken provide entry points for pathogens. In our case, we did not see this as a major problem, but we were working with clean soil mix, clean surfaces, and maintained good sanitation. The issue of injuries and entry points for pathogens is likely to be a bigger problem in a "dirtier" growing environment.

The main conclusion to be drawn is that there is probably a greater danger from shipping plants too wet, than too dry. Personal observation of bareroot exporters indicates that bareroot perennials are occasionally shipped under very wet conditions. This could be expected to cause rooting and sprouting, and possible real problems for the finisher.

Lifting time. In the second year of the trials, we looked at lifting time as a factor influencing storage potential and regrowth. Work some years ago in Michigan indicated that digging time is a critical factor for storability of bare root perennials.

Table 8. Effect of peatmoss moisture level used to package and ship bare root perennials on root growth 3 weeks after planting at Cornell University. Plants were planted June 26-27, 2002. Root and survival data collected July 16/17. Data are averages of two independent evaluations of root growth and plant survival. n=40. Experiment 2002-P3.

Species / Peat moisture content (%)	Root rating	Percent live plants	Fresh weight flowering (g)	Height at flowering (cm)
Delphinium				
31%	0.43	1%	---	---
42%	0.1	30%	---	---
53%	0	26%	---	---
64%	0.4	33%	---	---
Epimedium				
31%	0	93%	5.0	9.2
42%	0	96%	4.7	9.1
53%	0	100%	5.4	10.1
64%	0	100%	5.6	8.0
Omphalodes				
31%	0	3%	---	---
42%	0	0%	---	---
53%	0	0%	---	---
64%	0	0%	---	---
Phlox				
31%	1.5	89%	20.3	32.8
42%	1.0	90%	18.9	33.4
53%	1.7	91%	20.4	29.9
64%	2.1	85%	22.7	33.9

We re-examined this using Dutch-grown *Delphinium, Helenium, Phlox,* and *Solidago* plants that were lifted from weeks 40 to 51. After lifting, roots were washed, packed, held frozen in Holland till late May, then shipped to Ithaca to arrive in mid-June. We planted and grew them as described above and evaluated rooting and seasonal growth.

Delphinium had a strong reaction to digging time, with early and very late lifting being detrimental to both survival and growth (Table 8). Roots dug weeks 40 or 43 had 0 or 13% survival. Roots dug in week 46 (mid-November) has 76% survival, with less survival to 35% at week 51. Growth data followed this same optimum.
The other three species were much less affected by lifting time, but *Phlox* growth was reduced by about 1/3 at the two earliest digging times.

In general, perennials should not be dug too early. From a range of research findings, we know that lifting before the full onset of dormancy yields roots that are not able to handle long term storage, that might be more sensitive to freezing storage, or that are more susceptible to disease or rot problems.

The problem is further compounded by the often-mild nature of the Dutch climate in the fall; hard freezes might not occur until late December, if at all.

Table 8. Root rating and survival of perennials dug in Holland between weeks 40-51, processed, and planted in Ithaca, NY June 26-27. Root and survival data collected 15 July 2002. Data are averages of two independent evaluations of root growth and plant survival. n=40. Experiment 2002-P4.

Species / Height at dig week flowering (cm)	Root rating (0-4 scale)	Percent survival	Fresh weight at flowering (g)
Delphinium			
40	dead	0%	0
43	0.0	13%	0
46	1.2	76%	45.3
49	1.1	55%	35.3
51	0.7	35%	19.1
Helenium			
40	2.9	94%	84.1
43	2.4	95%	89.9
46	2.9	100%	82.5
49	3.0	100%	87.6
51	3.1	100%	85.0
Phlox			
40	1.3	100%	44.5
43	2.3	100%	46.7
46	2.9	100%	66.6
49	2.4	100%	68.8
51	2.7	100%	66.7
Solidago			
40	1.8	82%	39.3
43	3.3	100%	41.0
46	3.5	100%	43.0
49	3.6	100%	39.4
51	3.8	100%	47.7

Other factors….Planting depth. The standard advice when planting perennials is to "plant them at the same depth as they were before lifting". With washed, bareroot divisions, it is impossible to determine the depth the plants were before lifting. During this project, we conducted several trials looking at planting depth as a factor in bareroot regrowth. We used a range of bareroot perennials kindly supplied by Eric Olson and Jack de Vroomen of Jac. Th. de Vroomen.

We used 1-gallon containers, MetroMix 360, and planted crowns so the dormant buds were at, or slightly above the media surface (planted "high"), or 2-3 cm below the surface (planted "deep"). Plants were grown in late spring or mid-summer, in a 17-20C greenhouse, and evaluated after 6-8 weeks of growth.