

Handling Bareroot Perennials

by WILLIAM B. MILLER AND AMY BESTIC

Maximize your bareroot perennial program with these practical research results on digging, storing, washing, shipping and planting



BAREROOT CHECKLIST

Recommended procedures for receiving, handling and planting bareroot perennials:

- Always handle bareroots with care.
- If a shipment arrives frozen, allow it to thaw slowly, preferably in a cooler for a day or more, as needed.
- Avoid temperature extremes, both high and low.
- Avoid direct sun.
- Don't allow bareroots to dry out.
- Only remove as many bareroots from the cooler as needed for rapid planting.
- Plant high. Recent research suggests many species show markedly reduced growth when the crown settles below the soil surface after planting.

Based on attendance and interest at the 2003 Perennial Production Conference in Chicago, it was clear that perennials continue to be a vibrant and expanding part of American floriculture. And despite the growth of perennial plugs, bareroot perennials are still a major component of the perennial industry. They can be produced domestically or imported as washed soil-free roots or crowns.

Bareroot perennials are simply dormant crowns, roots, fans, clumps or tillers of the parent plant. These structures function much like a bulb; that is, they're a source of storage carbohydrate and buds from which the new plant grows.

What does—or doesn't— influence bareroot quality?

WASHING. All imported roots, bulbs and landscape plant material must be free of soil, per USDA-APHIS regulation, to minimize the danger of importing unwanted plant pests, such as nematodes. In practice, this means roots and crowns are washed by a series of moderate- to high-pressure sprays. A given lot of bareroot perennials may be washed once or several times. Along with washing, high temperatures and/or fungicide dips may be applied to control nematodes or disease.

The physical impact of high-pressure water in combination with sand and soil particles has led many to believe that this form of washing can cause physical injury to certain bareroot items. This injury would lead to pathogen entry points, perhaps cause more rapid water loss due to the▶

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High Marks for "High" Planting

Species that showed markedly better growth from "high" planting (dormant buds ¼ to ½ in. above the surface), as opposed to "deep" plantings (dormant buds ½ to 1 in. below the surface):

Aconitum	Geranium	Ligularia
Astilbe	Geum	Lysimachia
Athyrium	Helenium	<i>Salvia nemorosa</i>
Campanula	Hemerocallis	Sidalcea
Echinops	Heuchera	Tradescantia
Epimedium	Hosta	Trollius
<i>Euphorbia amygdaloides</i>	<i>Iris sibirica</i>	Verbascum
Filipendula	Liatris	

injury to the root or crown epidermis (or "skin"), and generally lead to reduced regrowth potential and quality.

In 2001, we initiated a two-year research project with the PPO (formerly the Flowerbulb Research Center) in Lisse, the Netherlands, aimed at sorting out the washing issue. Our colleagues in Holland organized several species of perennials (phlox, helleborus, pulmonaria, anemone, delphinium and epimedium) to be washed zero, two, four or eight times. After washing, roots were packed per normal procedure and shipped to Ithaca, New York, where we planted them into 6-in. pots in Metro Mix 360. After three to four weeks, we evaluated root and plant growth.

The findings are simple: Washing from zero to eight times had no effect whatsoever on the rate of re-rooting, the growth by season's end or the percentage of survival for any plant. This held true for plants exported to Ithaca and for those that remained in Holland and were planted out in fields for growth observation. Since perennials are never washed eight times, we can state with confidence that normal commercial washing regimes aren't injurious to bareroot perennials.

DRYING METHOD. We looked at a range of techniques in use in the Dutch industry, including temperature of post-wash drying (33 or 45F), exposure (thin or thick root layer) and protection (with or without some enclosure by poly film).

The basic result: The post-wash drying treatments typically used in the

industry aren't extreme enough to cause excessive drying of the roots. It's crucial to bear in mind that excessive drying of bareroots is detrimental and must be avoided for proper regrowth and quality.

PACKAGING METHOD. In 2001, we looked at several packaging methods used in the industry. Ranging from "wettest" to "driest," they were: 1) poly film with micro-holes, 2) poly film with larger holes, 3) poly film with double the number of holes as in No. 2, and 4) more holes than No. 3 as well as holes in the cardboard box. Washed divisions were packed by normal procedures, held for some time in Holland, then shipped to Ithaca for regrowth. In both Ithaca and Holland, there were no differences in regrowth between any of these packaging methods.

PEAT MOSS MOISTURE LEVEL. In both 2001 and 2002, bareroots were packed in peat moss with moisture levels ranging from 31 to 64%, held for some time, then shipped to Ithaca for planting and growth evaluation. In 2001, storage was for six weeks at 32F (not frozen); while in 2002, packaged roots were held at 30F for three months before shipping to Ithaca. We did these experiments with pulmonaria, anemone, phlox, helleborus, delphinium and epimedium.

We found that the highest moisture levels usually caused excessive sprout growth and sometimes rooting within the case. This was a problem, as the young, etiolated growth was easily damaged during unpacking and planting. We▶

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speculate these wounds could easily become entry points for pathogens, but in our trials we didn't see this as a particular problem. In other situations, if handling areas aren't clean and disease-free, you might see disease problems. In 2001, with delphinium and phlox, the lowest and highest moisture levels noticeably reduced root growth three weeks after planting. In 2002, there was no difference in phlox root rating, and we had very poor survival of delphinium. In both years, there were no differences in aboveground growth at flowering for the plants that survived.

The main conclusion to be drawn is that there's probably a greater danger from shipping plants too wet than too dry. It's also difficult to bring a natural product such as peat moss to a consistent, non-saturating moisture level, such as 45%. Personal observation indicates that bareroot perennials are occasionally shipped under very wet conditions, and you can expect this to cause rooting and sprouting and possible problems when finishing.

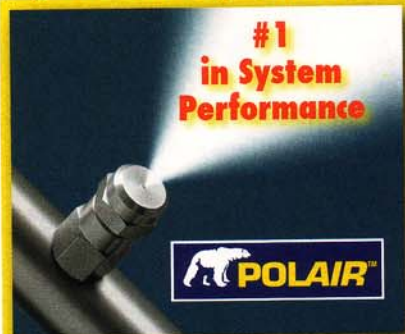
DIGGING TIME. In the second year of trials, we looked at digging time as a factor influencing storage potential and regrowth. Work by Art Cameron in Michigan some years ago indicated that digging time is a critical factor for storability of bareroot perennials. We reexamined this using Dutch-grown delphinium, helenium, phlox and solidago plants that were lifted between Weeks 40 and 51. After lifting, roots were washed, packed, held frozen in Holland until late May, then shipped to Ithaca by ocean vessel to arrive in mid-June. We planted them in 6-in. pots and evaluated their growth.

Delphinium had a strong reaction to digging time, with early and very late lifting being detrimental to both survival and growth. Roots dug in Weeks 40 and 43 had zero and 13% survival. Roots dug in Week 46 (mid-November) had 76% survival, with decreasing survival to 35% when dug during Week 51. Growth data followed this same optimum. The other three species were much less ▶



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Bareroot Pros and Cons

Compared with plugs or liners, bareroot crowns or divisions have several advantages and disadvantages, including:

ADVANTAGES OF BAREROOT: They're available in a wide assortment of cultivars and varieties, both domestically and as imported items, and in a range of sizes and grades. You can store them for a relatively long period, and you can freeze many to alter your planting and flowering dates. Bareroots can also handle cool starting temperatures, grow into a bigger plant in a shorter time and be cost effective.

DISADVANTAGES OF BAREROOT: There are yearly and seasonal differences in bareroot growth, and availability is seasonal. Obvious distinguishing characteristics (such as foliage color or markings) are absent, making cultivar confirmation impossible until growth resumes. Bareroots are very susceptible to drying-out (resulting in loss of quality and vigor). You can easily plant bareroots too deeply, with negative consequences. Growing practices after planting need to be very carefully monitored, and the optimum storage and handling details for each species/cultivar aren't known. Additionally, some genera simply seem to resent the bareroot stage. Some are fundamentally difficult to work with ("Which end of this thing is up?"), and it's hard to tell overall quality ("Is this thing dead or alive?").

affected by lifting time, but phlox growth was reduced by about one-third at the earliest digging time.

In general, you shouldn't dig perennials too early. From a range of research findings, we know that lifting before the full onset of dormancy yields roots that aren't able to handle long-term storage, that might be more sensitive to freezing storage, and/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. We really know very little about the optimum (or earliest) safe lifting times, and there's certainly no method to examine the plant to determine this. Perhaps in the future, tests based on stored carbohydrate or some other simple parameter might be developed for this purpose.

PLANTING DEPTH. This is a critical factor affecting bareroot perennial regrowth. While there are obviously instances of poor-quality bareroots, we're convinced that problems often occur as a result of mishandling or abuse on the part of the finisher. For example, consider something as innocuous as 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's

impossible to determine the depth of the plants before lifting.

We conducted two experiments in 2003 looking at planting depth as a factor in bareroot regrowth. We used a range of bareroot perennials supplied by Eric Olson and Jack de Vroomen of Jac. Th. de Vroomen, Holland.

We used 1-gal. containers filled with MetroMix 360, and we planted crowns so the dormant buds were at or $\frac{1}{4}$ to $\frac{1}{2}$ in. above the media surface (planted "high"), or $\frac{1}{2}$ to 1 in. below the surface (planted "deep"). Half of the plants were subjected to water logging by placing the container on a plastic plate maintained with $\frac{1}{2}$ to $\frac{3}{4}$ in. of water, in a greenhouse with 63F night temperature. We did two experiments, starting in late spring or early summer, and evaluated each after six to eight weeks of growth.

The results were striking. Some plants (such as *Geranium cinereum* Ballerina) showed an almost absolute aversion to deep planting. Nearly 100% of the deeply planted crowns failed to grow. High planting, on the other hand, resulted in nearly 100% survival and good growth. While this is an extreme example, nearly every genus evaluated showed better growth six to eight weeks after planting if planted high. The sidebar on page 40 shows species that responded favorably to "high" planting▶

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with a minimum of 15% better growth (measured by height), to as much as four times better growth, in the case of geum.

Also, note that your experience might indicate that some plants do better with deep planting. We haven't examined all plants, nor do we intend to. It is striking, however, how many plants responded favorably to high planting. Some have suggested these results might be greatly influenced by the planting mix. We used MetroMix 360, a lightweight mix common in floriculture. While many perennials are grown in different mixes, we believe that mix, *per se*, wouldn't play a major role in influencing response to deep planting.

The clear conclusion is that you should pay very close attention to your planting practices and evaluate what happens to your material from the moment it's planted. Sloppy planting on a planting machine and a bumpy trailer ride to the bed could cause bareroots to migrate deeper in the pot, with marked consequences for growth. This is an example where even the highest quality product could deliver poor performance and fail due to the grower's negligence.

Bareroot success depends on the exporter delivering a high-quality product and the grower handling, planting, and caring for it correctly. ■

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