Production

Container Production of Herbaceous Perennials — Overwintering Production Method

This is the eighth and final article in a series on the container production of herbaceous perennials. This series has been a report on research by James Locklear and Gerald Coorts, which began in the December, 1981 BPI News and has continued through this issue.

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When To Sow Seed

The production of perennials that will be overwintered begins in the summer. Propagation by seed will probably be the major method used, but the grower may also propagate some plants by cuttings or division, or may buy in plants normally done this way. In an operation that offers a wide selection of perennials which they grow themselves, propagation will probably be going on all year. Most of the work involving seed-propagated plants will begin in the summer, however.

In the discussion of seed propagation in the January, 1982, BPI News, it was mentioned that a number of factors can determine when seed will be sown. The length of the growing season will probably have the strongest influence of any factor, however. The goal is to produce a plant that is adequately developed by winter to be receptive to the cold temperatures that promote flowering in many perennials. The grower would need to sow seeds early enough in the summer to allow time for the necessary growth and development to occur before winter arrives.

Unfortunately, there is no precise information on just when a given species must be sown in order to insure flowering. A sowing in July ought to give good results for most species in most areas, however. Some experimenting under local conditions would need to be done to pinpoint the best time.

One consideration in determining when to sow seed is the cost of the crop. A crop started June 1 is going to require 1 month's more irrigation, fertilization, etc., than one started July 1, and subsequently will cost more to produce. It may also be necessary to set the sowing time so that plants do not grow too large. Some perennial species grow rather quickly and can become too large for the chosen container size if started too early. One publication suggests that many perennials can be sown as late as the later part of August. These plants would be transplanted to 3-inch containers, overwintered, and sold the following spring in the same pot, or repotted to a larger size.

Growing-On

Once a decision is reached and seed is sown, the next step in production is growing-on. If sowings are made later in the summer and the plants are to be marketed in smaller size containers, such as 3- or 4-inch pots, then seedlings could probably be transplanted directly to the final size pot. If larger plants are to be offered, in 1 or 2 quart polytainers, for instance, then seedlings will probably have to be grown-on in smaller units before transplanting to the final container. Seedlings started in early July could be transplanted into 2¼-3-inch pots, grown-on, and then repotted late summer or early fall into the final container. One grower transplants from the seed flat to a 48-cell pack and then to the final container.

Containers

There are a variety of containers available that would be suitable for this type of production. One important requirement is that such containers be durable since they will be exposed to outdoor conditions, most importantly low winter temperatures. The final container size chosen will be governed largely by what the grower feels will sell best and can be handled most easily. Other factors are the root structure of the plants to be sold and the period of time that the plants will be held before selling. Some plants with large root systems may require larger containers than are used for the majority of the species offered. This can be true particularly for field-grown plants that are bought in bare-root and potted up. Also, if plants are to be sold in bloom, a larger container may be required in order to give the plants a secure base and prevent tipping-over.

In general, the wider the variety of perennials offered, the greater the number of different container sizes that may be needed. One very large perennial nursery in England uses a total of 14 different types of pots, although a 9 cm (approx. 3½-inch) pot is used for most plants. The same nursery uses about 3 million pots annually (in 1979), and does its potting by machine as well as by hand.

Potting Medium

The potting medium is, of course, a very important factor in container production. Any medium used should be porous and allow for good aeration, while at the same time retaining moisture well. It should be of moderate pH (ph6-6.5), low in soluble salts, and have good nutrient exchange capacity. In addition, a medium used in larger containers should have enough "bulk" to support such containers.

There are probably a wide range of media that would be suitable for this type of perennial production, and the choice of a medium might be a matter of personal preference or availability of materials more than anything else. Reports of potting media used include a proprietary peat-lite mix (Sunshine Mix #1) and various other mixes prepared by growers themselves. One grower uses a mix of sand, peat, and perlite. A mix of 1 part topsoil, 2 parts peat, and 1 part perlite is also suitable. There may be some growers using a composted bark mix with perennials, but there are no reports of this.

Depending on the number of different perennials offered, one container mix will probably be suitable for most species. However, if plants with more exacting soil requirements are also produced, then the grower may have to specially prepare some media to meet these requirements. Alpine plants, for example, require perfect drainage, making it necessary to include a considerable amount of sand in the medium.

Fertilizing

Fertilization of perennials produced by this method is somewhat complicated by the overwintering process. During the early part of the growing season fertilization practices similar to those used with annuals could be employed. A weekly feeding with Peters 15-16-17 is used by one perennial grower during this time. Once growth begins to slow in the late summer and fall, fertilization practices would need to change. This is particularly important as it relates to the acclimation of plants to insure maximum cold-hardiness. The frequency of fertilization would need to be reduced during this time of slowing growth. The weekly feedings of the summer could eventually be reduced to monthly during the winter.

The incorporation of a slow-release fertilizer into the container mix prior to potting will also serve to feed plants during the winter months, and will provide nutrients for perennials being overwintered in structures which will not be opened until early spring. Although top growth will essentially cease in the winter, root growth may continue during periods of warmer temperatures. A slow-release fertilizer should provide for the nutritional needs of the growing root system during the winter. Once top growth is renewed in the spring, a more frequent fertilization program would need to be begun again.

Winter Protection

After propagation and growing-on, the final step before spring sales would be to expose these perennials to low winter temperatures. In container production, however, certain steps must be taken to insure the survival of container-grown plants over winter. Under similar conditions, the medium temperatures in a container can be lower and fluctuate more rapidly than soil temperatures around a plant in the field. The result is that injury or death due to low temperatures can occur much more readily for container-grown plants than field-grown plants.

A considerable amount of information has been published in the last few years on the winter protection of container-grown woody plants. It centers around the need to understand the factors involved in cold-hardiness and the causes of winter injury. A similar approach will be used here to discuss the winter protection of herbaceous perennials.

Winter injury of container-grown plants is basically the result of winter desiccation, direct freezing injury, or both. Winter desiccation results when water in the container medium is frozen, but air temperatures are warm enough to cause water loss from aerial plant parts through transpiration. Since water in the medium is frozen, the plant cannot take up water to replace what it has lost through transpiration, and desiccation can result.

This type of winter injury would be a greater problem with woody plants than herbaceous perennials. The tops of many herbaceous perennials either die back completely in the winter, or the plant overwinters in a low-profile rosette. In either case, water loss would not be as great as it could be if more aerial plant parts were exposed. Herbaceous perennials which retain their foliage during winter, such as **Phlox subulata**, could conceivably suffer from this type of winter injury, however.

Direct freezing injury would be a more likely cause of winter damage to container-grown perennials. Plants may be susceptable to this type of injury due to limited hardiness or failure to synchronize the process of acclimation and deacclimation with the environment.

Plant species differ in their cold-hardiness, that is, their capacity to survive an unfavorably low freezing temperature. If a plant is to survive low winter temperatures in a container, then temperatures must be kept above the minimum which that plant can survive. Studies with woody plants have shown that roots may be much less resistant to cold than the rest of the plant, and that container temperatures must be kept above the minimum which the roots can endure if a plant is to survive winter storage. Roots of the most cold-sensitive woody plants can be killed by temperatures of less than 20°F. Similar studies and information are not available for herbaceous perennials, but data for woody plants could serve as a guideline for perennials. With both woody and herbaceous plants, winter survival is dependent on being protected from killing or injurious temperatures.

Overwintering Systems

In practice, this is accomplished by one of a number of methods. The simplest is to place containers tightly together. Packing them closely affords some insulation from the cold, particularly for containers to the inside. The sides of exposed containers on the edge could be mulched to provide additional insulation, but it can require considerable labor to place and remove the mulch, and it may also attract rodents.

Cold frames may also be used for overwintering perennials. These may be above ground or sunken into the ground (which would provide more protection). After plants are placed into frames, they can be covered by glass sash or some other sort of covering. For added protection, the sides of the frames, and even the top, could be mulched with some material such as leaves. As mentioned, placing and removing such a mulch could be expensive in terms of labor. Microfoam, a flexible, styrofoam-like material which comes in thin sheets, has high insulating capabilities and could be used in place of a mulch to line the cold frames. Some perennial growers using cold frames line the insides with microfoam and also lay a sheet of this material over the top of the frame.

Microfoam has also been found useful for perennial growers in the structureless overwintering of perennials. In this system, the containers are set out on beds and covered with one or two rolls of microfoam, directly on top of the pots. The beds are of a width such that the microfoam comes down over the sides of the outer-most containers and touches the ground. This is then covered with a roll of plastic and the plastic and microfoam are anchored down.

A final way that container-grown perennials can be overwintered is in polyethylene-covered overwintering structures. These may be covered with a single layer of poly or may be double-layer, air inflated. Two layers of poly separated by an air space would provide more insulation against cold than a single layer. Supplemental minimum heat could also be used if the overwintering structure itself does not provide enough protection.

The choice of an overwintering system would, of course, depend largely on the minimum temperatures that can be expected to occur during winter in a given area. A simple cold frame system may be enough where winter temperatures are not too severe, but in very cold areas a polyhouse with minimum heat might be necessary. Frames or the structureless microfoam system would provide better protection in an area that experiences a considerable amount of snowfall, due to the added insulating effect of the snow. In Georgia, one perennial grower uses unheated polyhouses for overwintering. Another near Cleveland, Ohio uses the structureless microfoam system, and a nursery in Kansas City, Missouri uses both mulched cold frames and a polyhouse with minimum heat.

Other factors that would enter into the choice of an overwintering system are cost and convenience. A cold frame system would probably be less expensive to construct than a polyhouse. In addition, any amount of extra handling that plants receive, such as moving in and out of an overwintering structure, adds to their cost of production. Therefore, an overwintering system should be chosen and designed to require as little extra handling of the plants and as little initial expense as possible.

The management of an overwintering system is as important to the winter survival of container-grown plants as is the choice of the system itself. Protecting plants from killing or injurious temperatures is just a part of the job. As mentioned earlier, freezing injury is not only caused by limited cold-hardiness, but can also be due to the failure to synchronize the processes of acclimation and deacclimation with the environment.

Acclimating Plants

Before any plant can survive freezing winter temperatures, it must be properly acclimated. Acclimation, also referred to as hardening, is the process whereby plant tissues acquire an increasing resistance to cold. It is a physiological process which, like flowering, is under the influence of light and temperature. In fact, there are strong similarities between the control mechanisms for both cold acclimation and flowering in temperate zone plants.

The two stimuli for cold acclimation are the decreasing daylength and onset of cooler temperatures that occur in the late summer and fall. Acclimation appears to occur in stages, with decreasing daylength triggering the first stage of growth cessation and the initial increase in cold-hardiness. Colder temperatures and finally frost bring about maximum cold-hardiness.

It is interesting that the time at which plants begin to undergo acclimation may be important in winter survival. In a study of three **Dianthus** clones, it was found that the time of initiation of acclimation correlated well with the winter-hardiness of the clones. The hardiest clone underwent acclimation 2-3 weeks before the most tender clone.

In herbaceous plant species capable of undergoing acclimation, above-ground tissues may be able to survive temperatures well below 0°F if properly acclimated. If not fully acclimated, however, these same tissues might be killed by temperatures at or just below freezing. It is therefore important that container-grown plants be fully acclimated before they are placed in overwintering structures.

Complete acclimation can be insured by waiting as long as possible before covering plants for winter. A rule of thumb for woody plants in containers is to cover just prior to the time that the root zone starts to freeze. This time varies greatly, depending on the local climate. The previously mentioned grower using the structureless microfoam system covers his plants in November after a few hard frosts; the grower in Georgia moves his plants into unheated polyhouses at the end of October.

Acclimation can also be influenced by cultural practices. The cessation of growth at the end of the growing season marks the beginning of the acclimation process. Any excessive irrigation or fertilization during this time could prolong the growing season and interfere with acclimation. Both cultural practices should be gradually reduced through the fall prior to covering. However, plants should not go into winter storage weakened by under-fertilization, and they should be thoroughly moistened at the time of covering.

Just as plants in temperate regions undergo acclimation prior to winter, they also undergo deacclimation at the end of winter. Of concern to the grower is the problem of excessively high temperatures in an over-wintering structure which could lead to premature deacclimation and a loss in cold-hardiness. Should a prolonged period of cold temperatures occur after this premature deacclimation, plant losses could be high. This is especially a problem in polyethylene-covered structures where heat can build up rapidly on sunny days. Proper ventilation during unseasonably warm periods in winter can help prevent this problem.

Uncovering Plants

The final consideration in overwintering is when to uncover or bring plants out of winter storage. Since there can be a problem with deacclimation, plants should be uncovered early enough to prevent a loss in hardiness that could result in injury to the plants should temperatures drop suddenly. In most cases, perennials could probably be uncovered in February or March, depending on local conditions.

Properly acclimated perennials are surprisingly hardy, and should be able to stand most cold weather after being taken out of winter storage. The brief record below based on personal observation at Rosehill Gardens in Kansas City, Missouri bears this out. A wide assortment of perennials grown in 2 quart polytainers had been brought out from a minimum heat polyhouse and placed uncovered in cold frames in the sales area at the end of February, 1979. No damage occurred despite below-freezing temperatures on the following dates.

March 7 - 25°F
March 8 - 20°F
March 11 - 16°F
March 23 - low 20's; 1'' of snow
March 24 - low 20's
April 3 - 30°F

It should be pointed out that greenhouse-grown perennials will not exhibit this type of hardiness, and will need protection on frosty nights. In addition, plants which have been brought in and potted up may not survive cold temperatures until they have established a good root system. In the above example, newly potted bare-root plants of Garden Phlox, Hostas, and Bleeding Hearts were subject to the same temperatures from mid-March and received no damage. However, cold frames holding these plants were covered with plastic on nights when the temperature was expected to go below freezing.

Summary

As mentioned at the beginning of this series of articles, a grower would need to consider a number of factors when choosing a method of perennial production. Hopefully, one of the most important of these will be the quality of the plants produced. If interest in herbaceous perennials is going to continue to rise, and if these plants are to become an important part of the industry once again, then the consumer is going to have to be presented with the best quality possible. The future of perennials in the industry is going to depend largely on how growers choose to produce and market them.

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