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ALABAMA A&M AND AUBURN UNIVERSITIES

Home Bulb Forcing

Introduction

Forcing bulbs at home brings the bright colors and the fragrances of spring indoors for the holiday season or for late winter and spring enjoyment. Forced bulbs in decorative containers also make great gifts and they are easy to get started. Start from scratch and assemble your own forcing kit requiring only bulbs, potting mix, containers, and decorative doodads, such as moss, ivy, and ribbons. Expensive containers are not essential; some of the best may be flea market finds.

Most people like to receive bulbs as gifts at the planting stage so they can watch the bulbs grow and flower. Amaryllis and paper-white narcissuses can easily be brought into flower in time for the winter holidays if you start about 6 weeks in advance. For those who want their flowers to open right away, give the bulbs as gifts just before they start to open. Spring bulbs such as crocuses, daffodils, hyacinths, and tulips can also be given for spring holidays, such as Saint Valentine's Day, Mother's Day, or as spring wedding gifts, but these bulbs do require more planning.

Forcing is causing bulbs to flower in other than naturally occurring conditions. Basically, there are only two types of bulbs for forcing indoors: those that need a cold period and those that don't. Typically, crocuses, daffodils, hyacinths, and tulips are the most popular, but other spring flowering bulbs such as bulbous irises, English bluebells, glory-of-the-snows, grape hyacinths, and snowdrops may also be forced using similar procedures. These bulbs require a cold period and are typically forced into flower for late winter and early spring, January through April. Paper-white narcissus and amaryllis bulbs offer more flexible forcing, because, unlike the bulbs previously mentioned, they do not require a cold period to flower.

Amaryllis, Kenneth M. Gale, Bugwood.org

History

Despite their natural origins, bulbs are generally associated with the Netherlands because of the rich history Holland has in the production of flowers. Although the Dutch are the largest exporter of flowers and bulbs in the world, the story of the origin of bulbs begins elsewhere. Amaryllis (*Hippeastrum* spp.) are native to tropical areas of South America, daffodils (*Narcissus* spp.) to Spain and Portugal, paper-white narcissuses (*Narcissus tazetta*) to the Mediterranean, tulips (*Tulipa* spp.) to Central Asia, and the list goes on to include many more species and places.

In the 1600s, fresh flowers made their way into the homes of the prosperous across Europe and were perceived as luxury items. For those without the means to display fresh flowers for any occasion, artificial flowers became popular. Finally, indoor bulb cultivation began so that people of modest incomes could have flowers at any time of the year using a few simple forcing guidelines.

What Is a Bulb?

Botanists and gardeners define bulbs differently. A botanist's definition of a true bulb specifies a structure consisting of a stem surrounded by fleshy, modified leaves and further divides the term into two categories: tunicate

or nontunicate. Tunicate bulbs are covered by a dry, papery membrane that helps protect the bulb from bruising or drying out. Daffodils, onions, crocuses, and tulips are common examples of tunicate bulbs. Nontunicate bulbs do not have this paper-like covering and are exemplified by summer-flowering, true lilies.

When gardeners use the word bulb, they generally refer to plants that grow from underground structures such as corms (e.g., crocuses and gladioli), rhizomes (e.g., canna lilies and irises), true bulbs (e.g., tulips and daffodils), tubers (e.g., caladiums and gloriosa lilies), or tuberous roots (e.g., dahlias and sweetpotatoes). However, all bulbs share a characteristic separating them from other flowering plants—a self-contained, underground, food storage tissue able to nourish the plant during harsh environmental conditions, such as the cold of winter or the heat and drought of summer. These storage tissues accumulate food stores, such as sugars and starches, from the leaves in the period of time after flowering in preparation for the next growing season. Therefore, the bulb will be ill-prepared for dormancy if the novice bulb gardener (either indoors or outdoors) cuts the leaves off soon after the bulb has finished flowering.

Purchasing Bulbs

Bulbs available in garden centers and mass market stores typically arrive in the fall, September through November. Talk with the store's customer service representatives early in the fall to find out when their shipments will arrive so you can get the best selection. Popular bulbs for outdoor planting, such as 'King Alfred' daffodils, often disappear from the store shelves soon after the bulb shipment arrives. Many mail-order sources, such as catalogs and the Internet, offer a wider selection of bulbs and indicate which ones are suitable for forcing.

When shopping for bulbs in a local garden center, imagine selecting onions in the grocery store. Begin with healthy, undamaged bulbs that are firm to the touch, are free of mold or dark, bruised spots, and are the correct size for that type of bulb. Pass over bulbs with blemishes, that feel soft, or are an unusual shape or size. Bulbs contain the food for upcoming flowering, so purchase only high quality bulbs. Of course, you do not have the opportunity to judge bulb quality when ordering by mail. However, suppliers who specialize in bulbs and carry a large selection may more reliably offer quality bulbs. Some bulbs are also sold in grades based on bulb diameter. In general, larger bulbs yield larger plants with more flowers.

Keep in mind when shopping for bulbs to grow indoors that some require a cold period and others do not. Some companies may also label bulbs as prechilled or precooled, meaning they have already received a cold period and will grow and bloom in about 2 to 3 weeks. If you purchase precooled bulbs and cannot plant them right away, protect the bulbs from temperatures greater than 70 degrees F. High temperature effectively erases the bulb's memory of prior cooling, which causes poor flowering.

Once purchased, store bulbs in mesh or paper bags (not plastic) or in any container that allows good air circulation and place them in a cool, dry place until you are ready to plant. A dry, cool basement or garage is ideal; bulbs can even be stored in the refrigerator. In a refrigerator, you don't have to worry about bulbs drying out because the relative humidity inside is usually high enough. Check them periodically for molding. Also do not store them with any fruit. Ripening fruit gives off ethylene gas, causing the bulbs to produce distorted growth and no flowers. Tulips are particularly susceptible. Do not expose unplanted bulbs to freezing temperatures either in a freezer or outdoors.

Scheduling

Bulbs commonly forced in the home are in Table 1. Once you decide on what bulbs to grow, develop a target flower date on which you would like for them to flower. To start, add the time required for a cold period (if any) to the time required for growth to flower. Then count back from the target flower date to determine when to plant the bulbs. It is easier to hold bulbs back than to speed them up, so when you know the date you want them to flower, calculate accordingly the best planting time frame. For winter and early spring flowering dates (late December through April), spring-flowering bulbs that require a cold period are planted from mid-September through mid-November. For example, plant bulbs in early- to mid-October for Saint Valentine's Day flowers. The following timetable for spring flowering bulbs will help you plan a forcing schedule to have bulbs in flower at a given time.

- To flower in January, plant in September or very early October.
- To flower in February, plant early to mid-October.
- To flower later, plant in late October or early November.

Planting

Containers for forcing bulbs may be metal, glass, ceramic, plastic, or terra cotta (clay). The only requirements are that they have one or more drainage holes and are twice as deep as the bulbs to be planted are tall. Generally, 2 inches of potting mix below the bulb base

works well. Special bulb containers can be purchased that are shallower than traditional pots (ask your garden center clerk for assistance if you are not sure what to buy). Plan on using about four to six large bulbs of tulips, daffodils, or hyacinths in a 6-inch container, but only one amaryllis bulb in a 6-inch container. Hyacinths are attractive when one bulb is planted per 4-inch container or in groups of three (6-inch container), five (8-inch container), or more in larger containers. More bulbs will be needed of smaller bulbs. As a starting point, use 15 crocuses or four to six daffodils. Generally, bulbs can be planted close together, even touching, and make their best show in crowded arrangements.

NOTE OF CAUTION: Hyacinth bulbs contain oxalic acid that can cause skin irritation. Before planting, thoroughly rinse the bulbs with water to reduce the potential for skin irritation and wear gloves for protection.

The potting mix for bulbs should be a sterile, soilless, well-drained mix that can be purchased at garden centers or mass market stores in plastic bags. Look for a light-weight mix often labeled professional potting mix. Fill the container about half full with potting mix, set the bulbs so their tips are at or just above the container rim, and fill in around the bulbs with potting mix, firming the mix lightly as you go to about ¼ inch below the container rim. Pushing bulbs into the potting mix may compact the soil below the bulbs or damage the bulb base and inhibit rooting. Do not add fertilizer at planting time.

Plant flat-sided bulbs, such as tulips, with the flat side facing the inside of the container. This allows the first leaves to emerge facing outward to form an attractive border around the margin of the pot. For a striking mixed container, place a second set of smaller bulbs of a different type in between the first layer of large bulbs by loosely spacing the first layer. Put the second layer in place, then sift in more potting mix, firming the mix as you go. For example, crocuses or grape hyacinths can be planted among tulips or daffodils.

Water the container thoroughly after planting. Apply water from overhead or partially submerge the containers in a pan of water until the potting mix surface is wet. Write the name of the bulb cultivar on a plastic label and, if the bulbs require a cold period, the date the bulbs were placed into the cold period and the date they should be removed from the cold period. The plastic label helps you determine how much time you have left before removing the containers from the refrigerator to grow them. For cold requiring bulbs, keep in mind the potting mix must be kept moist during the cold period and you must not store bulbs with fruit.

Hyacinths can be grown in water with the base of the bulb just above the water. This is done using hourglass-shaped vases known as hyacinth glasses. Their design allows the bulb to sit just above the water without the water touching the base of the bulb. Because hyacinths require a cold period, place them in a refrigerator for roots to form and the bulb to sprout. Don't forget to maintain the vase water level.

Cold Period

Spring-flowering bulbs purchased in the fall already have miniature leaves and flowers formed within the bulbs, but nature has designed the bulbs not to grow and develop flowers until they receive cold temperatures for at least some minimum time period depending on the bulb type. If curious, you can cut a bulb open through the middle from tip to base with a sharp knife and see these undeveloped structures. After planting, the potted bulbs should be exposed to temperatures between 35 and 45 degrees F for at least the number of weeks specified in Table 1. When a range of weeks is provided, it means that different cultivars of a bulb type have different requirements. However, bulbs can remain in the cold period for a few weeks longer than specified with no ill effects.

Finding the right place to provide a cold period for your bulbs is the real challenge. Suitable locations for providing a natural cold period could be an unheated basement, storage area, garage, or cold frame. If you live where outdoor winter temperatures rarely get below 25 degrees F, just keep the containers of bulbs moist and store them right in the garden beneath a layer of straw mulch. However, protect the bulbs from freezing and keep the potting mix moist during the cold period. Using a natural cold period is fine for forcing bulbs into flower in the spring, but the southeastern United States does not have cold temperatures early enough for forcing bulbs into flower during the Thanksgiving and Christmas holiday period. A refrigerator may be used for this or any target flowering period during the year. Some people may object to having dirty containers of bulbs in the same refrigerator with food or serious bulb gardeners may not have enough room for their ambitions; purchase a used refrigerator just for bulb forcing purposes. Obtain as many shelves as possible to accommodate as many containers as you desire.

If the bulbs must receive a cold period in a refrigerator containing food, especially fruit, place the containers in zippered plastic bags to protect them from ethylene gas and to help keep the refrigerator clean. At least once a month, open the plastic bags for and hour or two to allow fresh air exchange and to check watering needs. Reseal the bags and

place them back in the refrigerator. After the period specified in Table 1, roots should be visible through the drainage holes and short, yellow shoots should have emerged from the bulbs. Bring the containers out into a medium-light, cool room at 55 to 60 degrees F for 4 or 5 days, then move them into a bright window with normal room temperatures. Keep the bulbs well watered and they will flower in about 2 to 3 weeks. Once the flowers open, the bulbs can be moved to a cool location at night to extend the flowering period. For a succession of flowers through the winter, bulbs can be planted and removed from the cold period every 2 weeks with planning.

Forcing

The actual forcing begins at the stage when you remove the bulbs from the cold period environment into warmth and light, triggering the growth of leaves and flowers. Sunshine and temperature are the most important factors in promoting successful flowering. After the cold period required by a particular bulb, transfer the pots to a place indoors with indirect sunlight and temperatures of about 60 degrees F for 1 to 2 weeks. When the shoots are 4 to 6 inches tall, move the containers to a bright, sunny window to stimulate flowering. A temperature of about 68 degrees F and direct sunlight will produce the best results. When the flower buds develop color and are about to open, return the plants to indirect sunlight to make the flowers last longer. Keep the soil moist at all times. If flowers begin to develop more quickly than you desire, move the containers out of direct sunlight and into a cooler location. They can even be placed in a refrigerator in the unopen bud stage for up to a week to stop flowers from opening.

Amaryllis

Amaryllis are easy bulbs to grow. The flowers are large, long lasting, come in many color choices, and are marketed as winter holiday bulbs. They are often seen decorating tables in retail shops and garden centers during the winter holiday season. Flower colors are red, white, pink, orange, salmon, or bicolored (mostly whites with pink or red flushes). Most bulbs on the market are greater than 8 inches in circumference and produce two to six flowers per flower stalk; the average is four. Very large bulbs may produce two flower stalks. The flowers are 4 to 8 inches in diameter and may have a delicate fragrance. Plant heights range from 18 to 36 inches depending on the cultivar, the country in which the bulb was grown, and home forcing conditions. Plant amaryllis bulbs in early November for Christmas flowering.

When planting amaryllis bulbs, do not crowd them in the container. Plant with no less than an 1 inch of space around the bulb and with one-third of the bulb above the container rim. Because the flower stalks are so tall and the flowers so large, plant them in a container with a wide enough base to provide stability. Water the container thoroughly and place it in a warm spot (70 to 75 degrees F) out of the sunlight. Don't overwater. Initially, watering once per week is usually adequate. Avoid watering over the bulb tip. When the first sprouts appear in about 2 weeks, water them more often and place them in as bright a window as possible, but avoid direct sunlight. After the bulb begins to grow, fertilization is essential. Use either a complete N-P-K liquid fertilizer two to four times per month or a slow-release fertilizer that lasts several months. Follow the fertilizer package recommendations. In a window, the tall flower stalks will naturally grow towards the light; so it is a good idea to rotate the container every couple of days to keep the stems straight. Amaryllis can be grown outdoors in USDA Plant Hardiness Zones 8 to 10. Therefore, if they will not be reflowered indoors, plant the bulbs in the garden after the danger of frost has passed.

Unlike most other bulbs, amaryllis bulbs will flower again and again with proper care. Amaryllis bulbs that have retained their original bulb size or have increased in size can be reflowered. After flowers fade, cut off the flower stalk close to the base of the shoot and keep the potting mix moist. The key to reflowering is to place the bulb at a temperature of 55 degrees F for 8 to 10 weeks and stop fertilizing. Withhold water and place the bulb in a cool storage area (no light) or, preferably, place the bulb in a 55 degree F growing location (with light) for this length of time. It is not necessary for the plant to go dormant. Once the bulb has received 8 to 10 weeks of 55 degrees F, resume watering and force the bulbs at 70 to 75 degrees F as before.

If the amaryllis bulbs have been grown for 2 or more years, most cultivars will produce offsets or daughter bulbs at the base of the mother bulb. Offsets can be established on their own in one of two ways. First, the mother bulb can be transplanted to a larger pot with the offsets left attached. By doing this, a large number of flowering bulbs will ultimately be growing in a single pot. This creates quite a show. Alternatively, the offsets can be carefully removed from the mother bulb and each of them planted in individual pots. This should be done after the bulb has been stored cool and dry for 8 to 10 weeks. Remember that small offsets need to grow to a larger size to be able to flower, which can take a year or two.

Daffodils, Hyacinths, and Tulips

The key to flowering daffodils, hyacinths, and tulips is to select the proper forcing cultivars for the desired flowering period. This is necessary because not all cultivars of these bulb types are suitable for all flowering periods. Cultivars best suited for flowering daffodils, hyacinths, and tulips for the various months of the year are found in Tables 2, 3, and 4, respectively.

Planting all three bulb types can take place any time from mid-September through December, depending on the desired date of flowering. As a general rule, plant early for early flowering dates and plant late for late flowering dates. For flowering in late December, the planting must be planted in mid-September; for February flowering, the bulbs should be planted in mid-October; and for March and April, plant in mid-November. Remember, the minimum length of the total cold period is 13 weeks and 15 weeks is preferred for daffodils. The minimum length of the total cold period is 10 to 13 weeks for hyacinths. Longer times result in taller plants and shorter times result in smaller plants that may not flower. Cold period times for tulips vary by cultivar; therefore, exact cold period times must be obtained from the bulb supplier.

The first containers may be placed in the home after the minimum cold period. For a continuous supply of flowers, bring out a few containers at weekly intervals. In the house, place the containers in an area with a temperature of approximately 63 degrees F and, for best results, place them in direct sunlight. Once the flowers begin to open, they will last longer if the containers are placed out of direct sunlight. Because the bulbs contain enough stored food reserves, it is not necessary to fertilize them.

Paper-white Narcissuses

Paper-white narcissuses are tender bulbs that can be forced into flower at any time in the home without a cold period. They can be planted in any width pot depending on the number of bulbs to be forced. However, use a pot that is 3 to 4 inches deep, and plant the bulbs with the tips even or slightly below the rim of the container. After planting, water the potting mix thoroughly and keep it moist. Paper-white narcissuses can be forced using 3- to 4-inch deep decorative containers that have no drainage holes and are filled with gravel, colored glass beads, or marbles. Place the bulbs on a layer of gravel and carefully fill in enough gravel to hold the bulbs but not cover them. A crowded grouping provides the most attractive display. Add just enough water to bring it up to the base of the bulbs and maintain it at this level. Do not immerse the bulbs in water, only the basal (root) plate should be in water.

Initially, place the containers in an area at 60 to 65 degrees F. Then move them to normal room temperatures when flowers begin to open. Paper-white narcissuses will flower under any light conditions but, for best results, initially place them in a window with a bright southern exposure, then move them to lower light to help prolong flowering. Paper-white narcissuses can be grown outdoors in USDA Plant Hardiness Zones 8 to 10. Therefore, if they will not be reflowered indoors, plant the bulbs in the garden after the danger of frost has passed.

Other Easy Bulbs

- Large-flowering Dutch crocuses require 12 to 14 weeks of cold followed by 2 to 3 weeks of forcing. The bulbs look best when planted close together in a shallow container. They can also be potted in gravel and water for a different effect.
- Autumn crocuses are excellent for forcing in the fall because they do not require a cold period and will flower about 2 weeks after potting. In fact, it is difficult to keep them from growing even when unpotted.
- Grape hyacinths require 14 to 15 weeks of cold followed by 2 to 3 weeks of forcing. Purchase and pot plenty of bulbs. They're small, inexpensive, and look best when planted close together.
- Dutch bulbous irises are easy to force, but need excellent drainage and the bulbs do not keep long before potting. They require 12 to 14 weeks of cold followed by 2 to 3 weeks of forcing.

After the Blooms Fade

Spring flowering bulbs such as crocuses, hyacinths, and tulips are usually discarded after flowering because they are difficult to reflower when planted outdoors and attempts to force them again are usually unsuccessful. Daffodils are an exception as long as you are willing to accept that they will not reflower in the same year as they were forced. They will resume normal flowering in subsequent years when planted outdoors.

Table 1. Bulbs Commonly Forced Indoors

Bulb name	Cooling requirement (weeks)	Weeks to flower after cooling
Amaryllis *(Hippeastrum spp.)*	none	6 to 8
Autumn crocus *(Colchicum autumnale)*	none	2 to 3
Glory-of-the-snow *(Chionodoxa luciliae)*	15	2 to 3
Dutch crocus *(Crocus spp.)*	12 to 14	2 to 3
Snow crocus *(Crocus chrysanthus)*	15	2 to 3
Snowdrop *(Galanthus nivalis)*	15	2
Winter aconite *(Eranthis hyemalis)*	15	2
Checkered lily *(Fritillaria meleagris)*	15	3
Dutch hyacinth *(Hyacinthus orientalis)*	10 to 13	2 to 3
Bulbous iris *(Iris reticulata)*	15	2 to 3
Grape hyacinth *(Muscari armeniacum)*	14 to 15	2 to 3
White grape hyacinth *(Muscari botryoides alba)*	14 to 15	2 to 3
Daffodil *(Narcissus spp.)*	13 to 15	3 to 4
Paper-white narcissus *(Narcissus tazetta)*	none	5 to 6
Siberian squill *(Scilla siberica)*	15	2 to 3
English bluebell *(Scilla tubergeniana)*	12 to 15	2 to 3
Tulip *(Tulipa spp.)*	14 to 20	2 to 3

Table 2. Daffodil Cultivars for Home Forcing

Cultivars for January and February flowering			
Yellow	Bicolor	White	Double
'Carlton'	'Barrett Browning'	'Cassata'	'Bridal Crown'
'Dutch Master'	'Fortune'	'Mt. Hood'	'Repleat'
'February Gold'	'Jack Snipe'	'Ice Follies'	
'Peeping Tom'	'Juanito'	'Printal'	
'Tête a Tête'	'Las Vegas'		
'Unsurpassable'			
Cultivars for March and April flowering			
Yellow	Bicolor	White	Double
'Dutch Master'	'Accent'	'Cassata'	'Bridal Crown'
'Osiris'	'Barrett Browning'	'Mt. Hood'	'Repleat'
'Prizewinner'	'Bridal Crown'	'Ice Follies'	
'Unsurpassable'	'Flower Record'	'Printal'	
	'Fortune'		
	'Las Vegas'		
	'Magnet'		
	'Jack Snipe'		
	'Salome'		
	'Jules Verne'		

Table 3. Hyacinth Cultivars for Home Forcing

Flower color	Cultivar	January	February	March	April
Blue	'Atlantic'*	X	X	X	
	'Blue Jacket'*		X	X	X
	'Blue Star'*		X	X	X
	'Delft Blue'	X	X	X	
	'Ostara'*	X	X	X	
Pink	'Anna Marie'*	X	X	X	
	'Lady Derby'		X	X	X
	'Marconi'*			X	X
	'Pink Pearl'*	X	X	X	X
	'Pink Surprise'*		X	X	X
Light pink	'Champagne'		X	X	X
Red rose	'Amsterdam'*	X	X	X	X
	'Jan Bos'	X	X		
Violet	'Amethyst'*			X	X
	'Anna Liza'		X	X	
White	'Carnegie'*		X	X	X
	'L'Innocence'	X	X		
	'Polar Giant'*		X	X	X
	'White Pearl'*		X	X	X
Yellow	'Yellow Queen'		X	X	X

* Suitable in 4-inch pots

Table 4. Tulip Cultivars for Home Forcing

Cultivars for January and February flowering			
Cultivar	Color	Cultivar	Color
'Abba'	red	'Merry Christmas'	red
'Abra'	dark red	'Monsella'	yellow with red
'All Seasons'	cherry red	'Monte Carlo'	lemon yellow
'Arie Hoek'	red	'Montreux'	yellow blush pink
'Bastogne'	red	'Negrita'	deep purple
'Blenda'	carmine red	'Orange Cassini'	orange
'Carola'	dark pink	'Orange Monarch'	orange
'Cassini'	dark red	'Peach Blossom'	carmine pink
'Christmas Dream'	rosy red	'Purple Prince'	purple
'Flair'	red	'Recreado'	magenta
'Hollandia'	vermilion	'Red Paradise'	vermilion
'Kareol'	dark yellow	'Rosario'	rose
'Kees Nelis'	red edged yellow	'Stockholm'	scarlet yellow
'Leen van der Mark'	red edged white	'Viking'	red
'Leo Visser'	red edged white	'White Dream'	ivory white
'Libretto'	rose	'Yellow Present'	creamy yellow
Cultivars for March and April flowering			
Cultivar	Color	Cultivar	Color
'Angelique'	blush pink	'Peach Blossom'	pink
'Annie Schilder'	rosy orange	'Pinocchio'	scarlet edged white
'Arabian Mystery'	purple edged white	'Plaisir'	red edged yellow
'Arma'	red	'Princess Victoria'	red edged white
'Barcelona'	red edged carmine	'Princess Irene'	orange with purple
'Couleur Cardinal'	violet red	'Red Present'	dark red
'Debutante'	red edged white	'Red Riding Hood'	red edged yellow
'Esther'	fuchsia pink	'Rococo'	red edged fire red
'Friso'	red	'Sevilla'	red
'Globe'	dark pink	'Topwhite'	white
'Madison Garden'	carmine edged pink	'Upstar'	white edged purple
'Oscar'	red	'Van Eijk'	Salmon
'Page Polka'	red striped white	'Wirosa'	pink edged white
'Passionale'	purple	'Yellow Flight'	yellow

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ANR-1325

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Web Only, **New Nov 2007**, ANR-1325