

The proper synchronisation of planting time is important

The desired flowering period

The time to plant depends on the desired flowering period and the temperature to be maintained during the actual forcing procedure.

For December flowering, planting will have to start early and use batches intended for early forcing. Miniature daffodils such as Tête-à-Tête are often planted in pots starting as early as September and put into refrigerated rooting rooms due to the increased risk of Botrytis.

Long-stemmed cultivars are planted in pots starting in October and then put into trays in the rooting room or perhaps in the plunge bed.

By using rooting rooms for the earliest forcing period, daffodil bulbs can be planted in pots as early as September. If planting outside in a plunge bed, it is better to wait until the temperature drops to around 12°C or lower. Temperatures that are too high increase the risk of diseases and reduce the cold effect. Tazetta daffodils in the Paperwhite Group, however, can be planted at higher soil temperatures (16-18°C). Most daffodils used for pot plant production are planted between September and December.

Providing the right cold period

Daffodils used for pot plant production are usually rooted and stored at lower temperatures than those used for cut flower production. These lower temperatures keep the plants from growing as tall. This is also the reason for recommending a cold period that is on average 2 weeks shorter. Commonly used temperatures maintained during the cold period for potted daffodils begin at 5°C and are later reduced to 2°C. A possible dry pre-cooling for long-stemmed daffodils can be conducted at 5°C. (For miniature daffodils, this is often 9°C.) Long-stemmed daffodils are usually stored at a lower temperature than miniature daffodils in order to keep them shorter. If rooting takes too long, it would be advisable to raise the temperature in the rooting room temporarily from 2 to 5°C. It would even be possible to increase this to as high as 9°C for a while before housing or to put the pots temporarily in the greenhouse maintained at that temperature. If for some reason the daffodils cannot be housed (but should be because of their shoot length), the temperature will have to be reduced instead of increased but not made any colder than 0°C because of the risk of frost damage. Daffodils are often stored in the same rooting room with tulips and this usually works out reasonably well. In this case, the shoot length for potted daffodils at the time of housing should usually be no more than 5 cm.

TYPE OF DAFFODIL	SEPTEMBER	OCTOBER - MARCH
Miniature daffodils	9°C (including any dry pre-cooling)	5°C until approx. 1 February and then drop to 2°C. (If it looks as if the shoots will grow too tall, drop to 0°C as needed but no lower!)
Long-stemmed daffodils	5°C (including any dry pre-cooling)	5°C until approx. 1 January and then drop to 2°C. (If it looks as if the shoots will grow too tall, drop to 0°C as needed but no lower!)

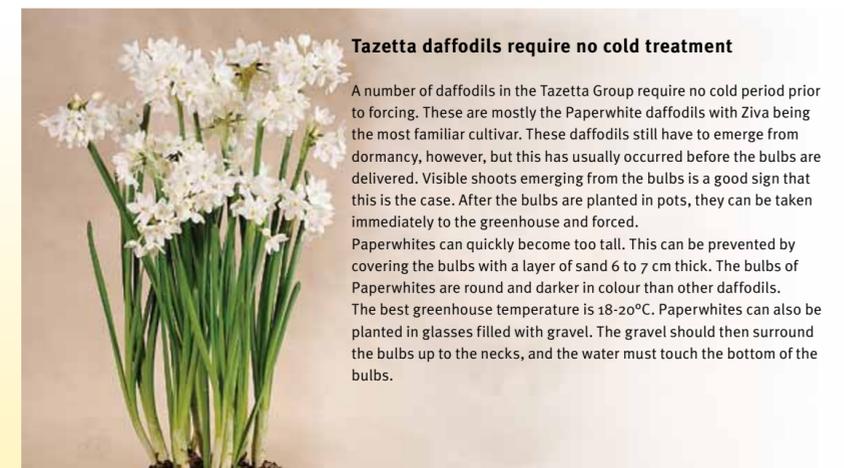


Cultivars and their cold periods

A list of the leading cultivars for pot plant production and their required cold periods: the number of weeks for the various forcing periods.

CULTIVAR	GROUP	BEGIN FORCING BEFORE 17 DEC.	BEGIN FORCING FROM 17 DEC. TO 17 JAN.	BEGIN FORCING FROM 17 JAN. TO 17 FEB.	BEGIN FORCING FROM 17 FEB. TO 17 MARCH
Miniature					
Jetfire	Cyclamineus	14	12	12	12
Tête-à-Tête	Cyclamineus	12	14	14	13
Topolino	Trumpet (yellow)		12	12	11
Long-stemmed					
Abba	Double	10	10	10	10
Bridal Crown	Double	-	14	14	14
Carlton	Large-cupped	14	14	14	14
Ice Follies	Large-cupped	14	14	14	12
Cragford	Tazetta	13	12	12	12
Minnow	Tazetta	-	-	-	16
Paperwhite	Tazetta	0	0	0	0
Ziva	Tazetta	0	0	0	0
Attraction	Trumpet (white/yellow)	16	16	15	15
Gold Medal	Trumpet (yellow)	-	-	14	14
Double Gold Medal	Double (yellow)	-	-	-	14
Primeur	Trumpet (yellow)	-	-	15	15

- = less suitable or totally unsuitable for this forcing period



Tazetta daffodils require no cold treatment

A number of daffodils in the Tazetta Group require no cold period prior to forcing. These are mostly the Paperwhite daffodils with Ziva being the most familiar cultivar. These daffodils still have to emerge from dormancy, however, but this has usually occurred before the bulbs are delivered. Visible shoots emerging from the bulbs is a good sign that this is the case. After the bulbs are planted in pots, they can be taken immediately to the greenhouse and forced. Paperwhites can quickly become too tall. This can be prevented by covering the bulbs with a layer of sand 6 to 7 cm thick. The bulbs of Paperwhites are round and darker in colour than other daffodils. The best greenhouse temperature is 18-20°C. Paperwhites can also be planted in glasses filled with gravel. The gravel should then surround the bulbs up to the necks, and the water must touch the bottom of the bulbs.

Good preparation: the basis for success

A forcing schedule makes it easier to plan

A forcing schedule can be drawn up based on the duration of the cold period required by the bulbs. In this way, it is possible to plan when planting should be done for a certain harvest date. The length of the forcing period depends on the forcing method, the time of year, the cultivar being used, and the forcing temperature. In general, this is what a schedule looks like:

SAMPLE FORCING SCHEDULE	
• greenhouse period until the end of harvest: 2 weeks	
• cold period required by the cultivar: 14 weeks	
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• put daffodils in rooting room or plant them: 16 weeks before the desired flowering period	

Greenhouse equipment and forcing procedures

Daffodils do not need much light, so most greenhouses are suitable for forcing them. Should there not be enough light, however, the plants can become overly tall and limp. As spring approaches, some amount of shading can even help prevent excessively high temperatures that would result in more rapid flowering. Forcing potted daffodils is often done on benches to improve the ergonomics involved in

harvesting. Watering can be done in various ways, including from above the plants. Providing less water will keep the plants shorter. Humidity must be higher (up to around 90%) for daffodils than for tulips, so sealing the greenhouse with plastic sheeting would be beneficial for reducing energy consumption. The best forcing temperature would be 15 to 18°C. The length of the greenhouse period depends on the forcing method, cultivar, shoot length at the time of housing, the time of year in which forcing is done, and the greenhouse climate, and will usually last two to three weeks.

Good quality ensures repeat sales

Before delivery, daffodils in pots must have developed a good root system and be standing upright in their pots. They can be marketed at various stages of maturity: from a green shoot measuring a few centimetres in height to when the first coloured flower buds are visible. Distributors and retail outlets make insert labels available showing how the plants will look in flower; these are very useful, especially for plants being sold in the early stages of maturity. The pots can also be packaged in special sleeves displaying the cultivar name and giving information about how consumers should care for potted daffodils. Product presentation improves when sold at a more mature stage, but the sales period will be shorter.



Immediate planting prevents problems

Problems can be prevented by a careful choice of material, proper scheduling, proper planting conditions and immediate planting. Here are the leading diseases and how to deal with them. Taking precautionary measures considerably reduces the risk of damage due to disease.

CAUSE	SYMPTOMS	PREVENTION/CONTROL
Botrytis species, Stagonospora (smoulder, fungus)	 Dark brown leaf tips. The noses and outer scales of the bulbs display rotten spots often accompanied by small sclerotia.	After receipt of the bulbs, either plant them quickly or remove them from their packaging and store properly under dry conditions. The bulbs of susceptible cultivars (including Tête-à-Tête) should be dipped in a suitable fungicide.
Fusarium (bulb rot, fungus)	 Plants grow crookedly or fail to emerge at all. Tissue inside the bulb, particularly in the lower part, displays greyish brown rot.	Use fresh soil. Plant the bulbs at low temperatures: 9°C or lower. Plant bulbs immediately after delivery.
Pythium	 Roots rot in the pot.	Use potting soil with a texture that is not too fine and that contains not too much humus. Do not overwater during planting. Finely rooting cultivars, particularly the miniature daffodils, are susceptible.
Flower bud blasting	 Flower buds dry out on the stems above the bulb or inside the bulb	Make sure that the greenhouse temperature is not too high during early forcing. Prevent frost damage. Keep the soil from becoming too dry and keep the RH from becoming too low.



PRODUCING DAFFODILS AS POT PLANTS

- PRACTICAL TIPS FOR
- ▶ DECIDING ON THE RIGHT CULTIVAR AND POT SIZE
 - ▶ EFFECTIVELY TREATING BULBS BEFORE STARTING PRODUCTION
 - ▶ USING THE RIGHT GROWING CONDITIONS FOR POT PLANT PRODUCTION
 - ▶ PREVENTING PROBLEMS DURING PRODUCTION





The right starting material and proper scheduling are important

A daffodil bulb is usually made up of a single round bulb to which one or more offsets are attached, the resulting cluster being known as a double-nosed bulb. When large enough, round bulbs will produce a single shoot with a flower. As a rule, the round bulbs included in double-nosed bulbs will always produce flowers whereas offsets will produce flowers depending on their size and when they are brought into flower. Bulb sizes depend very much on the kind of cultivar and can vary in circumference from 10/12 to 18/- centimetres. When used for very early flowering, the bulbs will produce fewer flowers that will be lighter in weight. For good results, it is important to order the bulbs well in advance (preferably more than six months ahead of time) so that the supplier can give them the right temperature treatment for the desired flowering period. Daffodil bulbs used for pot plant production are usually supplied as uncooled bulbs that still need to receive their entire cold treatment. If delivered as bulbs that have been pre-cooled at 9°C for a number of weeks, the length of this pre-cooled period can be deducted from the length of the required cold period. The forcing of daffodils for pot plant production takes place from December through March, but February and March are the most important months for production.

The right temperature treatment

Bulb suppliers synchronise the temperature treatments that the bulbs receive with the desired flowering period. After being lifted in July, all daffodil bulbs have to receive a warm period. Bulbs to be used for earliest forcing have to be lifted earlier than this. For many daffodils, flower initiation has already been completed during the lifting period. After the bulbs have received sufficient warmth, the cold period can be started. Plant them in pots during the autumn and store them in trays in a refrigerated rooting room. It is also possible to plant the bulbs in pots during the autumn and place them in a plunge bed outside so that the bulbs will be subjected to seasonal cold temperatures. The first of these methods is used more commonly for pot plant production. The desired flowering date determines the time at which the cold period is to be started (earlier for early flowering periods, later for late flowering periods). After the cold period has been completed, forcing can begin. Some daffodils in the Tazetta group do not require any cold period but will need to emerge from dormancy. For early forcing, the bulbs will sometimes have received an additional treatment involving a period of dry pre-cooling before being planted. This means that they will already have received part of their cold period before delivery.



Various forcing methods can be used

Forcing in trays using refrigerated rooting rooms

The most commonly used forcing method involves placing the pots in trays and storing them in refrigerated rooting rooms. This method has advantages related to labour and scheduling. The bulbs root in stacks and remain in the rooting room for the duration of the cold period they require. The pots are usually stored in plastic trays or wooden boxes measuring 40 x 60 cm and 50 x 75 cm that have to be deep enough to provide room for the emerging shoots. (The shoots are usually allowed to grow to a height of 5 cm and preferably no taller than 7 cm). The trays have to be 16 to 20 cm tall but using larger pot sizes means that the trays have to be taller. After planting, the soil must be thoroughly dampened but not saturated with water. Tête-à-Tête and Bridal Crown are cultivars that are highly susceptible to Pythium root rot, so these must not be given too much water when planted. In a cell with a high RH, watering before housing is usually unnecessary. Keeping the soil in the pots from drying out can be prevented by wetting the floor of the rooting room occasionally. As daffodils root, their roots can exert so much upward pressure that the bulbs can be lifted out of the soil. The later in the season that they are planted, the greater the risk. This is why it is necessary to cover the bulbs with a layer of sand at least 3 cm thick or to use foam rubber mats that fit exactly between the trays in the stack. The foam

rubber should be thick enough to keep the bulbs firmly in place in their pots. If the roots emerge from the bottom of the pots (this usually occurs after around 6 weeks) the mats can be removed to allow room for the shoots.

Placing pots in a plunge bed to subject them to seasonal cold

Daffodils in pots can also be stored in a plunge bed in order to subject them to seasonal cold. This requires more work, however, and allows fewer opportunities for maintaining the desired temperatures. It also involves more risk of excessively tall plants. Small pots containing potting soil and bulbs are usually placed in boxes or crates before being planted container and all in the plunge bed. A layer of material about 5 cm thick (preferably sand) is used to cover the bulbs to keep them from being pushed upward due to root pressure. Daffodils, particularly the miniature varieties such as Tête-à-tête, are susceptible to frost damage. The bulbs can freeze at a temperature at bulb level of 0°C or lower. To prevent frost damage, covering with 8 to 12 kg of straw per m² or with blister padding is recommended. To keep the shoots from becoming too tall, this frost protection will have to be removed later. It is best to plant the bulbs once soil temperatures have dropped to below 9°C. Planting at temperatures higher than 13°C will reduce the cold effect and lead to a greater risk of diseases such as Fusarium.



The right bulb for the right pot

Treatment after receipt

The bulbs will usually be delivered at the time they can be planted. The cold period can be initiated by planting them at low temperatures. It is not advisable to leave the bulbs in their packaging or to store them in a damp place for very long. If it is simply impossible to plant the bulbs straight-away, they must be stored in a dry place at temperatures of about 17-20°C and provided with ample air circulation. If the bulbs have already been pre-cooled or if cooling can begin straightaway, a good temperature to start with is around 5-7°C. If the bulbs are stored under conditions that are too damp, they will start to root prematurely and can then become infected with Penicillium and Botrytis. Under conditions that are too warm as well as too damp, the bulbs can also be damaged by Fusarium bulb rot. In cases of doubt, consult your supplier.

Plant with care

Fresh potting soil is used almost everywhere to fill the pots. Do not use a potting soil containing too much humus. Instead use a substrate mixed with plenty of black peat and/or sand. This reduces the risk of Botrytis damage, especially among miniature daffodils such as Tête-à-Tête. Although it would also be conceivable to use good-quality

soil from the grower's own nursery bed or soil from the plunge bed, doing so would involve more risk of disease. Besides, this soil is often too heavy. Because the preferred pH for the potting soil is 5.5-7.0, a peat substrate will always require the addition of lime. The soil must have a good permeable structure in which the soil particles are not too fine and sticky. This kind of soil can contain less oxygen and when watered, this increases the risk of Pythium root rot. Cultivars susceptible to Botrytis such as Tête-à-Tête should also be dipped in a special anti-fungal agent before planting. For planting, the pot is filled to the brim with potting soil and the bulb is then pressed lightly into it. The top part of the bulb is positioned just above the rim of the pot. Pressing on the bulbs too firmly will give the roots less room and increase the chance of them growing upward out of the soil. After planting, the pots should be given enough water to make the soil thoroughly moist but not entirely saturated. Thoroughly drenched soil increases the risk of problems resulting from Pythium, especially among susceptible cultivars such as Tête-à-Tête and Bridal Crown. Larger forcing operations often use potting machines to fill the pots.



Planting the right number of bulbs according to pot size

Pot sizes range from small 7-cm square pots for one bulb to very large pots that can accommodate dozens of bulbs. The following table provides information about some of the most commonly used smaller pot sizes with suggested numbers of bulbs and their bulb sizes:

POT SIZE	NO. OF BULB-SPER POT	BULB SIZE	NO. OF POTS IN A 50 X 75 TRAY	NO. OF POTS IN A 40 X 60 TRAY	NO. OF BULBS PER NET M ² IN TRAYS
7 cm square	1	12/14	75	48	190
9 cm round	3	10/12	43	25	300
10.5 cm (4-inch) round	3	12/14	33	20	240
12 cm round	3	14/16 16/-	24	15	180
12 cm round	5	12/14	24	15	300
13 cm round	4	14/16	22	12	210
16 cm (approx. 6-inch) round	5 to 7	16/- to 10/12	-	-	-

The pot can also simply be planted with as many bulbs as can be fitted into it but remember that small-flowering daffodils such as Tête-à-Tête can easily produce many flowers per pot whereas this is much less the case for the large-flowering cultivars.



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