CROP WALKERS' GUIDE

Bulbs & Outdoor Flowers

AHDB HORTICULTURE

Narcissus

Narcissus growers can encounter a range of problems that can impact on both the quality and yield of flowers and bulbs unless they are identified and dealt with. Often, such problems are linked to pests and diseases, but a range of physiological and cultural disorders may also be encountered.

This AHDB Horticulture Crop Walkers' Guide has been created to assist growers and agronomists in the vital task of monitoring crops in the fields and bulbs post-lifting. It is designed for use directly in the field to help with the accurate identification of pests, diseases and disorders of narcissus. Images of the key stages of each pest or pathogen, along with typical plant symptoms produced have been included, together with succinct bullet point comments to assist with identification.

As it is impossible to show all symptoms of every pest, disease or disorder, growers are advised to familiarise themselves with the range of symptoms that can be expressed and be aware of new problems that may occasionally arise. For other bulb and cut flower crops, see the AHDB Horticulture Cut Flower Crop Walkers' Guide.

This guide does not attempt to offer advice on available control measures as these frequently change. Instead, having identified a particular pest, disease or disorder, growers should refer to other AHDB Horticulture publications which contain information on currently available control measures.

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AHDB Horticulture Knowledge Transfer Manager
(Bulbs and Outdoor Flowers)

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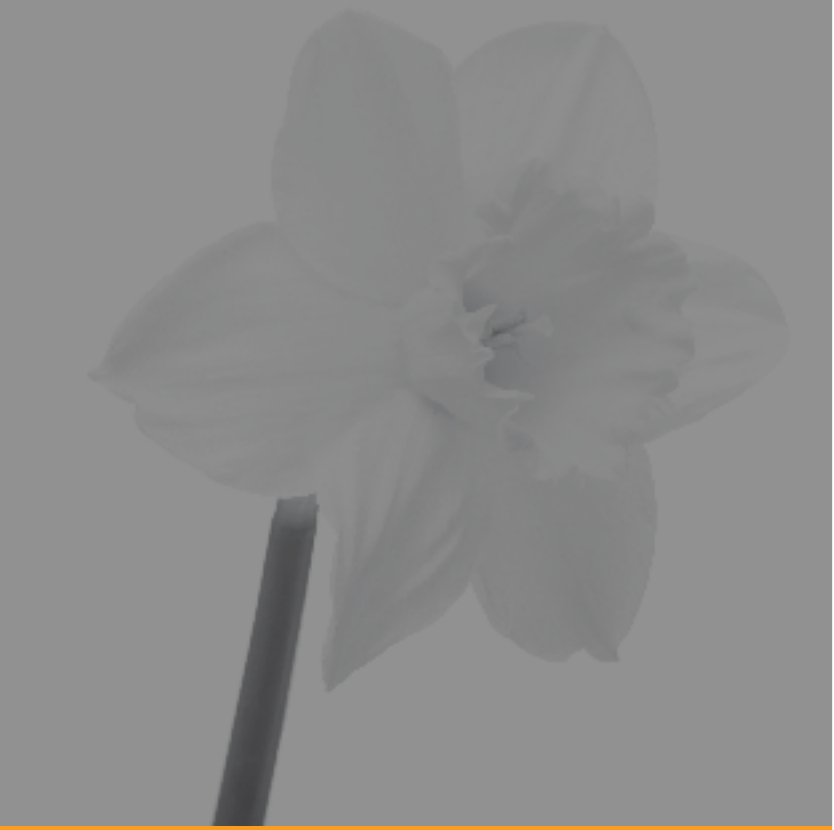


Aphids

Aulacorthum solani, Macrosiphum euphorbiae, Myzus persicae etc.

- Aphids are small (around 2mm in length) and pear-shaped, they are found on the underside of leaves and in the growing points of plants.
- Antennae length and shape and colour of siphunculi (tubes extending from rear of the body) are used for species identification.
- Migrating winged aphids rarely feed on narcissus, though several common species may spread virus through exploratory probing.

Caterpillars

Korscheltellus lupulina, Hepialus humuli and other species

- Adult female ghost swift moths (*H. humuli*) (bottom left image) tend to be small (40–70mm wingspan), brown or yellow and inconspicuous (the male ghost swift moth has white forewings). Caterpillars develop to 40–50mm in length, with a translucent body and a brown head (top left image).
- The common or garden swift moth (*K. lupulina*) (top right image) can be a pest of daffodils.
- Caterpillars of common swift moth, which emerge from eggs dropped in flight, can make large holes in the sides and bases of daffodil bulbs.
- Caterpillars of the ghost swift moth, are also an occasional pest.
- Caterpillars of other moths found feeding on flower buds (bottom right image) probably occur opportunistically.

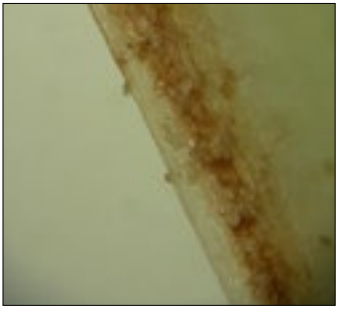
Mites, bulb

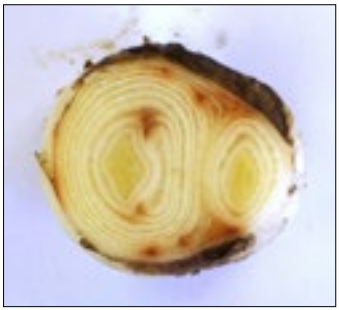
Rhizoglyphus and *Histiostoma* species

- Bulb mites are pale in colour and have two dark spots. They are clearly visible to the naked eye, being much larger (up to 0.9mm in length) than the bulb-scale mite (0.2mm).
- Generally, bulb mites occur in large numbers as secondary pests on damaged bulbs and are often associated with fungi in damaged, musty bulbs. Mites can also penetrate bulbs and become established internally.

Mite, bulb-scale

Steneotarsonemus laticeps





- The bulb-scale mite is light-coloured and only just visible to the naked eye. They usually occur in the top third of the bulb, mainly in the neck region, attacking the new shoots as the weather warms.
- The pest occurs sporadically in the field, however it multiplies rapidly on protected crops.
- Feeding produces leaves that are shinier than normal and with saw-tooth marginal marks (top right image). Dark feeding marks are produced within the bulb and can be seen when the bulb is cut transversely or lengthways.

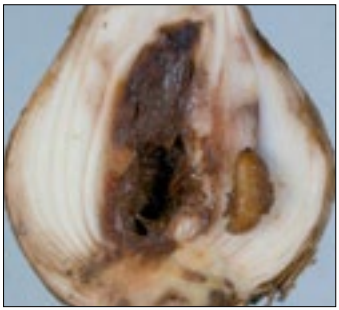
Narcissus flies, small

Eumerus strigatus and *E. tuberculatus*

- Adults are around 6mm in length and less 'bumblebee-like' in appearance than the large narcissus fly. Eggs are around 0.8mm in length and pupae are 6mm long.
- Adults lay eggs only on damaged or weak bulbs.
- Unlike large narcissus fly, larvae occur in groups within the bulb and two or three generations can occur per year. They can pupate in storage; cocoons can be found in bulb stores and on containers.
- Generally a minor pest, but its presence is a good indication of a need to improve bulb husbandry.

Narcissus fly, large

Merodon equestris



- Adults are hoverflies resembling small bumblebees (around 12mm in length). They emerge from the soil during May/June and become active when temperatures are above 20°C.
- Eggs are laid on the foliage close to the soil and the larvae crawl down and enter the bulb in early summer via the base plate (one generation per year).
- Larvae always occur singly within bulbs. It eats away the centre of the bulb leaving a mass of granular debris and can reach 18mm in length by the autumn. The pest pupates in the soil.
- Commercially significant and can cause substantial losses in warm summers in South West England. Also occurs in eastern England.

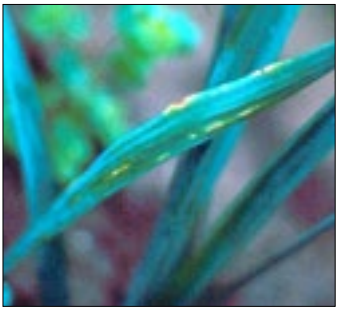
Nematodes, root lesion (and others)

Pratylenchus penetrans, Aphelenchoides subtenuis, etc.

- Root lesion nematodes are microscopic (0.8mm in length) and their feeding damages roots allowing the fungus *Cylindrocarpon destructans* to enter through wounds. Typical symptoms include weak and rotting roots, stunted plants and gaps within crops.
- Narcissus bulb and leaf nematode and associated rots occur rarely on the Isles of Scilly, with similar effects.
- Root lesion nematodes mostly occur on the Isles of Scilly where clean land for bulb production is scarce, exacerbated by multi-year growing.
- Other nematode species are virus vectors. Potato cyst nematode does not attack daffodils, but bulbs for sale must be clean to ensure it is not carried.

Nematodes, stem (and bulb)

Ditylenchus dipsaci

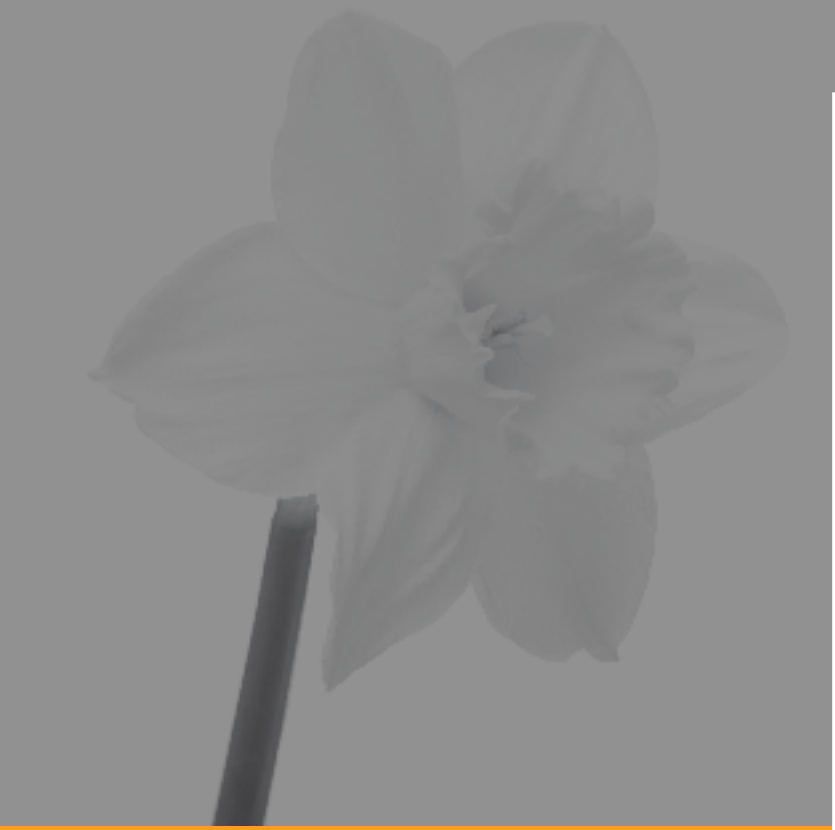


- Nematodes are microscopic translucent worms (previously referred to as eelworms) about 1–2mm in length.
- Bulb infestation leads to patches of poor crop growth in the field. Other symptoms include characteristic yellow 'spikkels' on leaf margins and stem keels.
- Cutting bulbs transversely reveals brown rings (top right image). Off-white blobs of 'wool' may exude from the base plate that can survive for over 10 years (bottom left image).
- EU quarantine pest and universal threat to daffodil growing.

Slugs and snails

Arion hortensis, Deroceras reticulatum, etc. and *Helix* species

- The field and garden slugs are the most common and damaging species. The field slug is light brown in colour and 3–4cm in length (top left image), the garden slug is grey or black and grows up to 4cm.
- A number of snail species can graze widely on stems, leaves, buds and flowers.
- Slugs cause extensive damage to daffodils above and below ground, especially in mild, damp weather and on heavy soils. Coronas of some varieties are prone to attack by slugs. Slugs are now recognised as a significant pest of daffodils.



B

Soft rot

Rhizopus species

- Affects bulbs stored at high humidity and temperature (above 80% RH and 30°C). The disease can occur during warm storage, in non-temperature-controlled transport and during propagation ('chipping').
- Bulbs rot quickly to mushy, grey-white mass covered with coarse mycelium (top left image).
- Not often seen now, but *Rhizopus* soft rot can develop quickly under poor storage conditions.

Basal rot

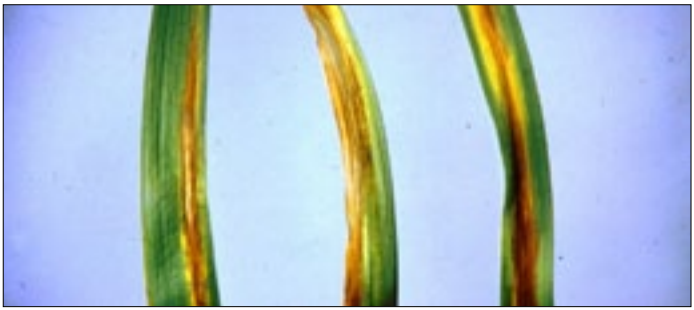
F

Fusarium oxysporum f. sp. *narcissi*

- Bulb foliage may die down prematurely in affected plants (top left image). On lifting, bulbs may feel soft or may already be completely rotted or dried out (bottom left image).
- White or pink fungal growth may be visible externally on the base (top right image). If the bulb is cut lengthways, a moist chocolate-brown rot can be seen spreading upwards from the basal plate (bottom right image).
- Cultivars differ in susceptibility: some popular cultivars are highly susceptible; some resistant ones seem able to lose their resistance. Basal rot can cause major losses in storage. The disease develops rapidly at 20–30°C.

Fire

Sclerotinia polyblastis



- Initially causes water-soaked spots on flowers, spots turning brown with visible sporulation. Spores infect leaves (often near tips) giving small, elliptical, pale-brown spots, later accompanied by yellow streaking up and down leaf (bottom image).
- Dieback can occur in three to six weeks. Sclerotia (around 1.5cm in length) overwinter in soil and debris (but not in bulbs).
- Prevalent under mild, humid conditions such as those in South West England. Affects Tazetta (and to a lesser extent, mainstream) cultivars.

Leaf scorch

F

Stagonospora curtisii

- Emerging leaves develop reddish, yellowish or brownish tips separated from healthy tissue by yellowish zones. Lesions spread down in damp weather forming eyespots.
- Secondary lesions are initially water-soaked spots, turning scabby and coalescing. The pathogen leads to rapid dieback.
- Lesions produce minute pycnidia (0.2mm in diameter). Stems and flowers become spotted with infections during cut-flower storage.
- Widespread on daffodils under suitable conditions. Damaging in South West England. The pathogen persists in bulb and on debris.

F

Neck rot

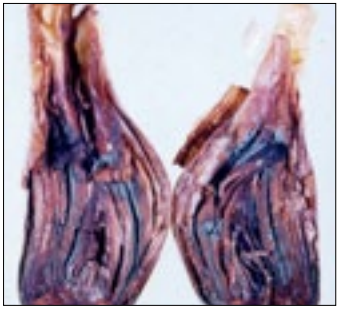
Fusarium oxysporum f. sp. *narcissi, Botrytis narcissicola* and *Penicillium hirsutum*

- The principal pathogen is *Fusarium oxysporum* f. sp. *Narcissi*.
- The rot starts in the bulb neck, being the same colour rot as basal rot, but it progresses downwards through the bulb scales. Eventually, the pathogen invades the basal plate and destroys the new shoot.
- Where *Penicillium* is implicated, it may have ginger colouration (top right image).
- The disease should not be confused with 'physiological neck rot', a natural dieback of leaf bases in the bulb neck that is dry and non-progressive (bottom right image).

Penicillium bulb rot

F

Penicillium species



- Commonly found on damaged areas of bulbs after lifting, for example, where the scales have been torn or offsets removed. Damage is often limited to the outer bulb scale with patches of grey-green mould externally (top left image).
- The bulb may be reduced to a 'puffer' (dried, rotted bulb producing clouds of spores when broken).
- Under poor storage conditions, aggressive strains develop rapidly. Blistery markings appear externally, patches of grey-green mould develop, leading to a complete dark-brown bulb rot.
- Penicillium is a particular problem with dwarf cultivars (like 'Tête-à-Tête') and during propagation ('chipping').

Smoulder

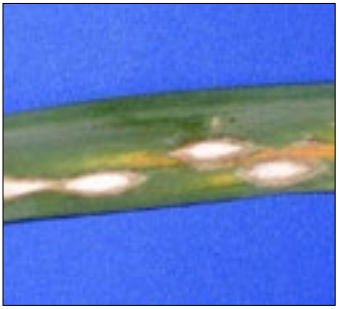
Botrytis narcissicola

- At emergence, infected shoots ('primaries') have crooked, torn, dark leaf tips that are stuck together and (if damp) covered in a grey spore mass.
- Leaves have dark lesions at tips and margins, yellowing zoning can develop around the lesions and leaves become sickle-shaped (top image).
- Spore dispersal produces flower spotting (bottom left image).
- Sclerotia (1.5mm in diameter) can be found on and in the bulb and in the soil (bottom right image).
- Common wherever daffodils are grown. Probably exacts a modest but ongoing yield loss.

White mould

F

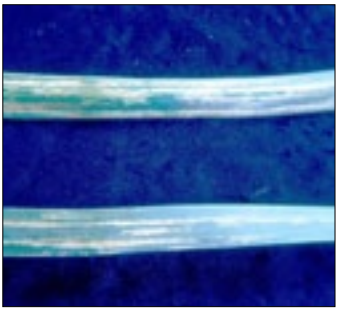
Ramularia vallisumbrosae



- Pale spots or streaks occur on leaves and stems, with a creamy-white spore layer developing under moist conditions. Lesions spread downwards and coalesce, producing rapid dieback and yield reductions.
- Minute sclerotia (0.15mm in diameter), form in leaves and overwinter on debris in soil (not in bulbs).
- Causes severe epidemics in warm, wet springs. Previously associated with mild areas like South West England, but now established in other areas.

Viruses (common leaf symptoms)

Narcissus latent (NLV), *late season yellows* (NLSYV), *yellow stripe* (NYSV) and white streak viruses (NWSV)



- These four viruses are aphid-borne, common and can cause early dieback and yield loss. *Narcissus latent virus* (NLV) is symptomless or causes mild chlorosis (top left image). *Narcissus late season yellows virus* (NLSYV) causes mild chlorotic streaking or mottling later in the season (top right image). *Narcissus yellow stripe virus* (NYSV) (bottom left image) causes yellowish leaf streaks, mottling or leaf distortion early in the season, and flower breaking. Under warmer conditions, narcissus white streak virus (NWSV) causes green to purple streaks, later white, yellowish or grey (bottom right image).
- Viruses are a serious underlying threat. Most daffodil stocks are infested with viruses, often more than one (a combination of viruses may elicit or exacerbate symptoms).

Viruses (other symptoms)

Narcissus mosaic (NMV) and *yellow stripe viruses* (NYSV) and others

- *Narcissus mosaic virus* (NMV) causes flower breaking (A and B; C is normal). NMV also causes mild mosaic or brown, oval, late-season leaf spots.
- *Narcissus yellow stripe virus* (NYSV) also causes flower breaking, while narcissus tip necrosis virus (NTNV) may be symptomless or may cause a late-season leaf-tip necrosis and dieback.
- Narcissus degeneration virus (NDV) gives rise to a chlorosis and a general decline, while cucumber mosaic virus (CMV) may be symptomless or may cause a mosaic.
- Other viruses include: Tobacco rattle virus (TRV), arabis mosaic virus (AMV), tomato black ringspot (TBRSV) and raspberry ringspot virus (RRSV).

Chocolate spot

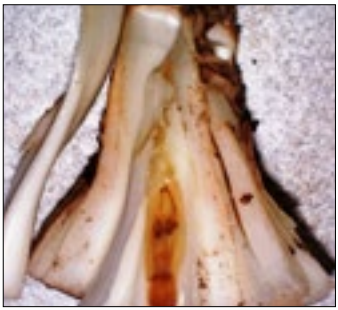
Physiological spotting

- The only symptom of this disorder is spots or small patches the colour of dark chocolate on leaves and stems.
- A long-known physiological disorder, with usually little or no effect on cut flower quality, causing no significant losses.
- Cause unknown, but not known to be attributed to a pathogen or nutritional issue. Sometimes attributed to an effect of rising temperature.

Daffodil rust

Physiological rust

- Symptoms are rust-coloured spots on stems and leaves, from one small lesion to several large clusters of lesions. In worst cases, symptoms also extend to transverse cracking and brittle stems (left image).
- Rust has caused concern since the 1980s. Incidence varies considerably year-to-year and place-to-place.
- Often unnoticeable, in some seasons and cultivars, disfigurement may be serious enough to downgrade stems or make them unmarketable.
- Cause unknown, but not apparently attributed to a pathogen or nutritional issue.



- Death of the flower bud in the spathe is common in *Narcissus poeticus* 'Flore Pleno' (top left image). Attributed to warm growing conditions, poor rooting and adverse water relations.
- A similar disorder is common in double cultivars, especially 'Golden Ducat' (top right image). The spathe dries and dead buds resemble drumsticks.

Flower bud death can also take place at a much earlier stage, visible when bulb is cut lengthwise (bottom left image).

- When forced some cultivars, particularly 'Carlton', occasionally produce flowers with notched margins (bottom right image). The cause is unknown.

Frost damage

Weather related

- Cold damage near to or soon after emergence can result in yellow-tipping – chlorotic bands across distal parts of leaves (top image). In extreme circumstances, it can result in dead leaf tips.
- A late frost near flowering leads to the collapse of exposed stems and leaves, either temporarily or (if severe) permanently (bottom image). Even if less severely affected, flowers may be distorted and fail to open normally.

Hail and other damage

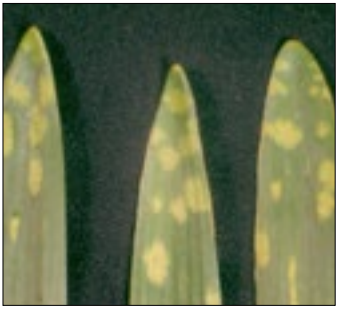
Weather related

- Mild hail results in white flecking of the exposed surfaces of leaves (top left image). Severe hail can result in dead leaf tips (top right image) or even wholesale withering and death of exposed buds, stems and leaves (bottom image).
- Waterlogging can cause poor growth, with yellow bands across the leaves.
- Sun scorch (for example, during windrowing) can damage the bulb scales, which become shrivelled and hard.
- In forced crops, a cool night followed by bright morning sunshine can cause wilting and lodging, though the plants usually recover.

- Apart from possible crop damage through overdosing (for example, at row ends, top left image), several herbicides are known to be damaging to daffodils.
- Diquat can damage the base plate and bulb scales (top right image). Glyphosate can cause 'starry' and otherwise distorted flowers (bottom images), symptoms that could be confused with hot-water treatment (HWT) damage. Sulfonylurea residues can cause similar distortion.
- Clopyralid used to control thistles and volunteer potatoes can also damage daffodils. Some recommended daffodil herbicides (eg chlorpropham, linuron) can cause reduced daffodil growth if used under inappropriate conditions.

Hot-water treatment damage

Mild

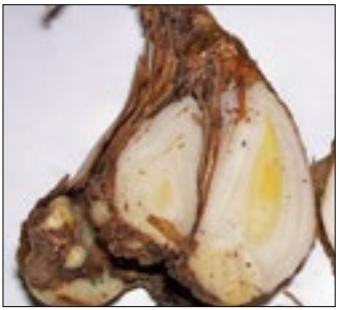


- Hot-water treatment (HWT) treads a knife-edge between too mild a treatment (fails to control nematodes adequately) and too harsh a treatment (kills nematodes but damages bulbs). Even when properly done, HWT will reduce crop growth and damage flowers and leaves to some extent, but normally this is offset by the benefits of nematode control.
- Above are symptoms of mild damage: leaf-tip mottling and roughening, aborted flowers, petal and corona damage and small 'starry' flowers all due to undertaking HWT too early.

- More serious damage is shown above. Damage to the roots and base plate can result from late HWT (top left image).
- Severe leaf damage and death of the stem apex are caused by too harsh a HWT regime (top right image).
- Damage to the stem apex may then result in ‘grassiness’ as many offsets proliferate (bottom left image).

Mechanical damage

Physical



- Damage to bulbs during handling is common. Impacts and dropping can cause bruising several scales deep (top left image), though this does not generally lead to secondary infection unless severely bruised bulbs are stored at high temperature and humidity.
- Rough treatment at lifting and during cleaning can seriously damage the base plate (top right and bottom left images) and consequently the roots.
- Daffodil shoots and leaves suffer various breaks and lesions through weather, predators and picking. Damage consisting of tears in the spathe and buds was formerly thought to result from removal of straw covering materials ('fork damage', bottom right image).

Acknowledgements

AHDB Horticulture would like to thank Gordon Hanks, Independent Consultant for writing, sourcing images and advising on the production of this guide

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Narcissus

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