

**Project title:** **Narcissus: Screening new varieties for basal rot susceptibility**

Project number: BOF 57

Project Leader: Andrew Tompsett

Report: Annual report, Autumn 2007  
Previous reports: Annual report, Autumn 2006

Key workers: Martin Goodey, Manager, Trenoweth Horticulture Centre.

Location: Trenoweth Horticulture Centre, St. Mary's, Isles of Scilly, TR21 ONS

Co-ordinator: Robert Body, CABGA, Nanpusker Farm, Hayle, Cornwall (01736 753438) and David Bond, Heath Farm, Blofield Heath, Norwich (01603 270 294)

Project commenced: June 2005

Expected Completion date: Autumn 2009

Key words: daffodils, varieties, cultivars, basal rot, *Fusarium oxysporum f. sp. narcissi*

#### **Waiver, disclaimer and copyright**

Whilst reports issued under the auspices of the HDC are prepared from the best available information, neither the authors nor the HDC can accept any responsibility for accuracy or liability for loss, damage or injury from the application of any concept or procedure discussed.

The contents of his publication are strictly private to HDC members. No part of this publication may be copied or reproduced in any form or by any means without prior written permission of the Horticultural Development Council.

The results and conclusions in this report are based on a series of experiments conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.

## CONTENTS

	Page
<b>Grower Summary</b>	
Headline	3
Background and expected deliverables	3
Summary of the project and main conclusions	3
Financial benefits	4
Action points for growers	4
<b>Science section</b>	
Introduction	5
Materials and Methods	5
Results	7
Discussion	10
Technology Transfer	11

# **GROWER SUMMARY**

## **Headline**

109 bulb stocks were screened for susceptibility to basal rot and the percentage of bulbs which subsequently rotted after one or two years has been determined. This will guide growers in assessing the future of stocks alongside their other desirable traits.

## **Background and expected deliverables**

During 2005/06 and 2006/07 forty eight daffodil bulb stocks, including many still unnamed, were subjected to a basal rot susceptibility test at Trenoweth Horticultural Centre, St. Mary's, Isles of Scilly. The simple screening test for basal rot, established by Rosewarne between 1980 and 1989, involves planting a healthy test bulb beside a basal rot infested bulb cv. 'Golden Harvest'. One-year-down plots were recorded in 2006 and in 2007. In 2007 a set of two-year-down plots was also harvested and recorded.

In 2006 a further batch of 61 varieties was subjected to the same test and the one-year-down plots of these were recorded in 2007.

Plots have been replanted with inoculators in 2007 so that the tests will continue on both sets of bulbs under both one and two-year-down growing regimes.

## **Summary of the project and main conclusions**

The severe disease pressure applied in this test (equivalent to planting a stock with 50% rotten bulbs) revealed levels of susceptibility ranging from 0% - 80%. Losses from the two-year-down test are similar to those occurring in the one-year-down tests.

The full details are listed in the tables of results in the main report but the key points are summarised here:

Stocks showing 30% or more of basal rot (i.e. a level indicating high susceptibility) in one or more of the tests were: -

- CABGA 43, CABGA 52, CABGA 55, CABGA 49, Golden Ducat, Loch Owskeich, Red Devon, CABGA 24, Brabazon, Dutch Master, Knight of St. John, Standard Value and Camelot.

Stocks showing between 15% and 30% of basal rot (ie a level indicating moderate susceptibility) in one or more of the tests were: -

- Marjorie Hine, CABGA 21, Irish Minstrel, Gold Crown, Tibet, Kingscourt, CABGA 39, Cornish Pride, CABGA 38, CABGA 8, GCRI No 344 and Nanpusker.

## **Financial benefits**

As the work progresses growers will be able to see how the total of 109 new varieties perform when exposed to *Fusarium* (basal rot) infection. The industry will, subject, of course, to the assessment of other factors, be able eliminate the susceptible varieties. Growers will benefit financially by being able to apply priority treatment and propagation to the best stocks (i.e. the most basal rot resistant) which are indicated in this work.

## **Action points for growers**

The information will accumulate over several years and no single year's data should be taken as definitive. However, growers holding these stocks will now be able to assess the suitability of the various stocks for future priority treatment or as candidates for destruction. Those stocks showing susceptibility will need to be observed closely on growers' farms for signs of basal rot problems developing and fungicide treatment applied particularly if varieties show merit in other respects.

## SCIENCE SECTION

### Introduction

Basal rot (*Fusarium oxysporum* f. sp. *narcissi*) is the most serious bulb-borne fungal disease of narcissus worldwide. The fungus causes root rot, premature leaf senescence and after lifting, bulbs feel soft and may become completely rotted. Basal rot has been damaging daffodil crops for at least 100 years and remains one of the most intransigent problems with virtually all growers suffering losses and uncertainty every year. The disease causes major problems in the bulb trade, especially exports, and its presence in consignments reflects badly on the industry. For many years the two major varieties 'Golden Harvest' and 'Carlton', together with many others, have recorded varying, but significant, Basal rot losses and have had to be routinely treated with fungicides. The replacement of these varieties with resistant stocks is long overdue.

Daffodil breeding at Rosewarne Experimental Horticulture Station and the Glasshouse Crops Research Institute created a large pool of new varieties that have not been screened for basal rot susceptibility as part of an assessment programme. Resistant parents such as 'St. Keverne' were regularly used in this breeding work. The parent lines used in these programmes offer good possibilities of resistance but clones selected in the latter years of the programme need to be tested avoid future problems.

The aim of the project is to give growers data on the susceptibility of these new clones to basal rot. The project employs a test which has previously been successfully applied to a range of Rosewarne raised clones, and existing commercial cultivars. (Ref. Tompsett, Acta Horticulturae 177, 1986). To date, no reliable laboratory screening technique has been developed. The field test consists of planting healthy bulbs of each stock next to inoculator bulbs (*Fusarium* - rotted 'Golden Harvest' bulbs) and assesses the test varieties for Basal rot losses over one or two years.

### Materials and Methods

#### Trial design and bulb stocks

Healthy test bulbs of each stock were planted next to rotted 'Golden Harvest' bulbs in which the presence of *Fusarium* has been confirmed.

48 different stocks of narcissus were tested for basal rot susceptibility in 2005/6 and 2006/7 and a further 61 in 2006/7. The bulbs were supplied by growers, who provided 50 bulbs per stock. These had not been treated with a fungicide dip in the past two years.

Each selection was exposed to a high level of *Fusarium* inoculum over one and two growing seasons.

#### Production of infected bulbs (Inoculators)

'Golden Harvest' bulbs were artificially infected with *Fusarium oxysporum* f. sp. *narcissi* by cutting the base plate of a bulb, immersing it in an infected dip and then storing the bulbs at 25°C for up to 4 weeks to allow symptoms to develop. Only those inoculators showing clear symptoms of basal rot infection, that is, softness and whitish *Fusarium* sporulation around the base plate were used as inoculators.

## **Planting and layout of the trial**

Each autumn bulbs of each stock were planted by hand, in nets, in a double row, 100 mm apart each way, in furrows as normal. An inoculator bulb was then placed next to each test bulb. Tubular netting was used to contain the test bulbs. This ensures that none are lost, that each can be accounted for in the test and that no portion of the inoculator, should it survive, is mistakenly included in the result. Separation of the test bulbs in the tubular netting makes it possible to record losses accurately.

For each variety, two blocks of ten bulbs were planted adjacent to each other. Therefore for each variety:

- The one-year test comprised 2 replicates x 10 bulbs per plot
- The two-year test comprised 2 replicates x 10 bulbs per plot

Thus, over a 4-year period each stock will be subjected to 4 x one-year tests and 2 x two-year tests. This will provide 12 sets of data over 4 years. There will be 10 spare bulbs per stock kept to replenish the plots if required.

In all respects the cultivation of the trials followed standard bulb production management.

## **Assessment of the trial**

In June 2006, after one growing season, the bulbs from each of the 48 one-year-down varieties trial were lifted, and in 2007 the two-year-down plots plus the one-year-down plots of the 61 varieties. These were stored at 25°C for 2 weeks and then at ambient temperature before recording. A visual assessment for the presence of basal rot was then made.

Assessment of infection was made by:

Not infected = bulb has survived and perhaps increased in weight or number, or

Infected = bulb rotted or a gap, often with bulb residue, in the net.

The bulbs that are not infected with basal rot are replanted in plots of 10 bulbs as before. Where stocks have insufficient survivors, the spares (originally 10) are used to make good the numbers. If this is insufficient to make good the losses, the stock will be eliminated from the trial.

## **Analysis of results**

The results were recorded as the number of rotted bulbs and the weight of firm bulbs remaining. The weight of firm bulbs remaining compared with the planted weight was recorded. Bulb weight increase (or survival) is usually inversely related to disease attack.

In this interim report the results provide guidance for future policy in developing the stocks and a statistical analysis of the results will be presented in the final report.

## Results (Part 1)

The 48 varieties initially planted in 2005 (presented in order of basal rot susceptibility as recorded in the 2005/06 trial)

Daffodil bulb stock	% Basal rot			Final weight of healthy bulbs as a % of planted weight #		
	1Yr 2006	1Yr 2007	2 Yr. 2007	1 Yr. 2006	1 Yr 2007	2 Yr 2007
Rosemoor Gold	0	2	1	208	213	177
CABGA 65/45/2	0	3	0	182	160	193
<b>ST. KEVERNE</b>	0	0	0	161	158	137
Talwyn	0	6	0	159	125	145
St. Peter	0	0	0	148	88	127
CABGA 37	0	0	0	147	95	129
Cornish Pride (CABGA 19)	0	19	17	147	131	108
Kerensa	0	0	0	122	167	113
Cornish Chuckles	0	6	3	122	83	86
Chinita	0	0	0	114	99	106
Beauvallon	0	14	0	88	48	73
Tamara	2	14	2	116	76	112
CABGA 8	3	8	15	175	105	137
CABGA 22	3	7	7	140	118	118
Veryan	3	7	2	136	86	102
Golden Anniversary	3	6	14	136	131	94
CABGA 50	3	3	0	111	65	66
CABGA 39	3	17	5	106	93	153
Lancaster	4	0	0	120	106	103
Trelawney Gold	4	6	7	110	95	96
Jersey Roundabout	4	0	7	95	80	89
Jedna	5	3	0	204	34	247
Kingscourt	6	26	6	121	78	72
Tibet	6	19	4	104	53	79
CABGA 48	7	14	7	124	55	83
Gold Crest	8	12	5	120	67	131
Jersey Torch	8	0	0	94	71	78
Emblyn	9	3	0	173	115	78
Dellan	9	10	3	117	94	91
CABGA 47	10	0	6	94	63	105
CABGA 38	13	0	24	153	178	163
CABGA 20	14	10	6	86	105	167
Gold Crown	15	8	0	147	62	113
Irish Minstrel	16	20	7	100	61	79
CABGA 21	18	6	0	92	57	98
<b>STANDARD VALUE</b>	19	36	36	90	57	33
Knight of St. John	22	37	17	153	89	55
Marjorie Hine	27	2	0	153	90	120
<b>DUTCH MASTER</b>	34	15	20	127	89	86
Brabazon	34	11	8	125	56	55
CABGA 24	34	7	18	78	65	55
<b>RED DEVON</b>	35	14	3	96	119	138
Loch Owskeich	43	13	5	61	70	79
<b>GOLDEN DUCAT</b>	44	27	20	88	72	63
CABGA 49	50	20	9	71	57	81
CABGA 55	50	30	19	42	37	48
CABGA 52	66	44	-	50	46	-
CABGA 43	82	50	-	19	15	-

Varieties in bold represent those commonly grown in the UK.

- = no data

# (200% = double planted weight recovered, 100% = planted weight recovered, 50% = half of the planted weight recovered)

Two stocks (CABGA 40 and CABGA 41) were received for planting in September 2005, however they were discarded prior to planting due to very high levels of basal rot in the material received.

## Results (Part 2 – a one-year-down trial)

Daffodil bulb stock	% basal rot 2007	Final weight of healthy bulbs in 2007 as a % of planted weight
Abba	0	128
Estramadura	0	124
Brackenhurst	0	132
Cornish vanguard	0	73
Double Actaea	0	91
Poetaz Seedling	0	108
Actaea Seedling	0	130
Ganilly	0	163
Articol	0	135
Lady Sainsbury	0	77
Foxhnter	0	142
Camilla	0	131
36D	0	164
51C	0	137
323	0	130
30D	0	133
106	0	136
24Q	0	127
124	0	121
47B	0	138
2E	0	149
66C	0	119
2J	0	144
38H	0	145
35D	0	157
134	0	149
68H	0	125
121	0	143
104	0	144
650	0	129
68K	0	140
Smiling Maestro	2	102
344	2	148
401	2	134
385	2	153
10P	2	138
Pink Charm	3	113
Cornish Pride	3	45
Rose of May	3	82
19F	3	138
442	3	111
23G	3	126

Continued overleaf

Continued from previous page



Daffodil bulb stock	% basal rot 2007	Final weight of healthy bulbs in 2007 as a % of planted weight
Flambards	4	98
High Life	5	59
Furbellow	5	100
194	5	115
29K	6	105
70H	6	122
Tripartite	7	77
Eden Gold	7	62
Treglisson	8	87
Mellen	8	76
77	9	101
232	9	107
Seagreen	11	91
635	11	107
470	12	104
530	13	95
344	16	94
Nanpusker	29	48
Camelot	45	70

## Discussion

The project is due to run until 2009 by which time there will be 4 sets of 1-year-down data and 2 sets of 2-year-down data. The above are therefore interim results which will be confirmed in further tests over different seasons.

Between 1980 and 1989 the project leader applied the same screening test to a wide range of varieties and un-named seedlings raised at Rosewarne. This new data can, in some cases, be placed alongside the former records as a means of adding confidence to the figures.

A selection of these comparative data does show that there is reasonable consistency in the results.

Variety (CABGA No)	% basal rot infection			
	Mean 1980-1989	2006 /07 results		
		1	2	3
GOLDEN DUCAT	59	44	27	20
DUTCH MASTER	31	34	15	12
RED DEVON	19	35	14	3
Talwyn	18	0	6	0
Golden Anniversary (1)	16	3	6	14
Cornish Pride (19)	13	0	19	17
Emblyn	12	9	3	0
Patrick Hackett (8)	11	3	8	15
Dellan	8	9	10	3
Tamara	5	2	14	2
Jedna	4	5	3	0
ST. KEVERNE	0	0	0	0
Kerensa	0	0	0	0
Rosemoor Gold (46)	0	0	2	1
Cornish Chuckles (80)	0	0	6	3

The tests conducted in 1980-89 sought to avoid the release and distribution of new seedlings which would prove susceptible to disease in commerce. The threshold was set at that of Dutch Master a variety that is moderately prone to disease in commercial practice. In the tests over 9 seasons it averaged 31%. Compared with Golden Harvest and Carlton at 83 and 85 % respectively.

Throughout all the past tests and so far in this current work the variety 'St. Keverne' has shown a high level of resistance. Past research showed that, unlike many other varieties it responds to fungal attack by producing barriers tissue within the base plate.

In these trials healthy bulb yield is presented as the weight of visually sound bulbs produced as a % of the planted weight. Thus a figure of 100% means that there was no weight increase.

It will be seen that compared with normal bulb yields the weight figures in these trials are rather low. It is noticeable that many of these bulbs have 'corky' and 'scabby' tissue on the base plate suggesting that the presence of the basal rot fungus, in addition to causing basal rot (and sometimes neck rot) appears also to be associated with root and base plate damage.

A further factor accounting for bulb losses and some inconsistency in results has been the occurrence of of Narcissus fly especially in the two-year-down bulbs. Steps are being taken to reduce the incidence of Narcissus fly attack in future by applying HWT, chlorpyrifos and burning over. It is worth pointing out that the tests conducted in 1980/89 were routinely treated with aldrin to control this pest.

## Technology Transfer

A report was published in HDC News in October 2006 and the annual report for 2006 has been filed.

An outline of the work was presented at the Bulb Growers' Seminar at Rosewarne on the 16 November 2006.

These transfer means will be repeated in 2007/8.