



Agriculture & Horticulture
DEVELOPMENT BOARD



Grower Summary

BOF 072a

Narcissus: improved control of foliar diseases and the effect of fungicide sprays on flower production

Final 2013

Disclaimer

AHDB, operating through its HDC division seeks to ensure that the information contained within this document is accurate at the time of printing. No warranty is given in respect thereof and, to the maximum extent permitted by law the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document.

No part of this publication may be reproduced in any material form (including by photocopy or storage in any medium by electronic means) or any copy or adaptation stored, published or distributed (by physical, electronic or other means) without the prior permission in writing of the Agriculture and Horticulture Development Board, other than by reproduction in an unmodified form for the sole purpose of use as an information resource when the Agriculture and Horticulture Development Board or HDC is clearly acknowledged as the source, or in accordance with the provisions of the Copyright, Designs and Patents Act 1988. All rights reserved.

AHDB (logo) is a registered trademark of the Agriculture and Horticulture Development Board. HDC is a registered trademark of the Agriculture and Horticulture Development Board, for use by its HDC division. All other trademarks, logos and brand names contained in this publication are the trademarks of their respective holders. No rights are granted without the prior written permission of the relevant owners.

The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

HDC is a division of the Agriculture and Horticulture Development Board.

Project Number: BOF 072a

Project Title: Narcissus: improved control of foliar diseases and the effect of fungicide sprays on flower production

Project Leader: Dr Tim O'Neill

Contractor: ADAS UK Ltd

Industry Representative: Mr Mark Clark, Grampian Growers Ltd
Mr Dick Evenden, H L Hutchinson Ltd

Report: Final Report 2013

Publication Date: 25 September 2013

Previous report/(s): None

Start Date: 01 January 2013

End Date: 31 December 2013

Project Cost: £11,490

Headline

The fungicides Signum, Tracker and Vivid applied post-flowering to narcissus delayed senescence in the year of application and increased flower yield by up to 44% the following year.

Background and expected deliverables

Foliar diseases remain a major threat to narcissus production, with the potential to reduce both flower and bulb yield. In 2012 white mould (*Ramularia vallisumbrosae*) was widespread and occasionally severe in all the main narcissus producing areas in the UK. In some crops it caused premature senescence despite the use of several fungicide sprays. BOF 72 identified several new fungicides that are very effective against white mould and markedly delayed leaf senescence. Information gained on the efficacy of new products against smoulder (*Botrytis narcissicola*) was limited due to low disease levels. The aims of this project were to further improve control of foliar diseases and to determine the effect of some fungicide sprays on flower yield. Specific objectives were:

1. To determine if foliar fungicides applied one year affect occurrence of smoulder primaries the following year;
2. To determine if foliar fungicides that delay senescence one year affect flower numbers produced the following year;
3. To determine if *R. vallisumbrosae*, *Botrytis* species or other fungi are associated with leaves showing rapid dieback but no obvious white mould or smoulder symptoms;
4. To carry out a desk top exercise to devise some example fungicide programmes for control of foliar diseases.

Summary of the project and main conclusions

Objective 1 – Effect of foliar fungicides applied one year on smoulder primaries the following year

A replicated field experiment on cv. Early Flame in Cornwall, established and treated with different fungicides in 2012, was left unsprayed with fungicides in 2013. Although a low level of smoulder (up to 2% leaf area affected) was recorded in the crop in 2012, no smoulder primaries occurred in 2013, indicating conditions were not suitable for infection of shoots by *B. narcissicola* during emergence. As such, authors cannot draw any definitive conclusion as to whether fungicides applied in year one influence the occurrence of smoulder primaries the follow year.

Levels of white mould in 2013 were affected by fungicides applied the previous year. On 27 February 2013, shortly after the end of flower picking, white mould severity was significantly reduced by eight fungicides compared with the untreated (2.5% leaf area affected). Nativo 75WG (tebuconazole + trifloxystrobin), Tracker (boscalid + epoxiconazole) and Vivid (pyraclostrobin) were most effective, reducing white mould to 0.3% leaf area affected. These fungicides all significantly reduced white mould in 2012 from 9% leaf area affected to 1.5% or less. This result suggests that good control of white mould one year reduces the risk of severe disease in the crop early in the following year.

Objective 2 – Effect of foliar fungicides that delay senescence on flower numbers the following year

In the same crop of cv. Early Flame, six fungicide treatments that delayed foliage senescence in 2012 were examined for their effect on flower numbers in 2013. Green leaf area on 11 May 2012 ranged from 65% (Karamate Dry Flo Neotec) to 97% (Tracker) on fungicide treated crop, compared with just 36% on untreated crop. The mean number of flower bunches picked in February 2013 was significantly increased by Signum (boscalid + pyraclostrobin), Tracker and Vivid, by 44, 27 and 22% respectively compared with crop left untreated in 2012 (Figure 1). Green leaf area in 2012 was significantly associated with numbers of flower bunches picked in 2013, accounting for 55.3% of the variation in flower yield.

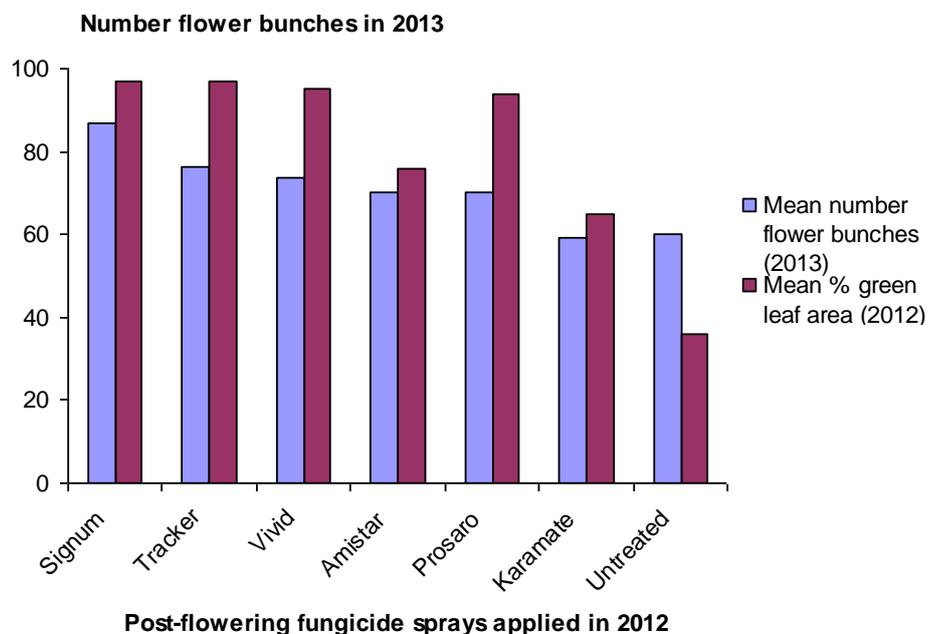


Figure 1. Effect of post-flowering fungicide sprays (x3) applied in 2012 on narcissus green leaf area (11 May 2012) and flower number the following year (February 2013)



a)

b)



c)



d)

Figure 2: Narcissus experiment in Cornwall, 2013, a) View of trial site; b) white mould symptoms before flower picking; c) comparison of plot showing differences in white mould severity; d) White mould lesion with sclerotia of *R. vallisumbrosae* just visible.

Objective 3 – Association of R. vallisumbrosae, B. narcissicola and other fungi with narcissus crops showing rapid dieback and no obvious foliar disease

There were few reports of rapid crop dieback in 2013. Samples were collected from a crop showing patches of foliage dieback in Lincolnshire in June 2013. On laboratory examination, the necrotic leaves were found to contain one or several pale brown oval lesions; *B. narcissicola* was consistently isolated from these lesions. Further samples would need to be

examined to determine whether *Botrytis* is consistently associated with these symptom types and can be implicated as a causal agent.

Objective 4 – Example fungicide programmes

Details of fungicides permitted for use on narcissus and with useful activity against white mould and/or smoulder are summarised in Table 1. The relative activity of these products against white mould and smoulder as determined in trials undertaken in BOF 072 and BOF 072a is given in Table 2. Based on this information, example fungicide spray programmes for control of narcissus foliar diseases were devised (Table 3). The programmes are all designed to comply with label restrictions, reduce the risk of selecting resistant strains of *R. vallisumbrosae* and *B. narcissicola*, provide effective control of white mould and smoulder and delay leaf senescence. Other effective programmes using different products could be devised. The timing of fungicide sprays in a programme should be made according to interval since last treatment, disease pressure (determined by crop monitoring) and opportunities to spray. Where early lifting is required, it would be prudent not to apply a late spray of a fungicide that greatly delays leaf dieback.

Potential fungicide options for control of leaf scorch (*Stagonospora curtisii*) were examined by reference to field trials on control of glume blotch on wheat (*Stagonospora nodorum*). Good control of *S. nodorum* was given by Amistar, Twist (trifloxystrobin) and Vivid. Vivid at half dose gave control equivalent to or better than a full dose of most other fungicides tested. Triazole/strobilurin fungicide products showed a small improvement over triazoles alone. Based on these results it is suggested that fungicides likely to provide good control of narcissus scorch include Amistar, Signum, Tracker and Vivid; Bravo 500 (chlorothalonil) used as a protectant also provides some control. A fungicide programme designed to control white mould, smoulder and scorch was devised (Table 3).

Table 1: Details of fungicides permitted for use on narcissus (August 2013) and with activity against smoulder and white mould

Product	Active ingredients (fungicide group)	Maximum rate of use (kg or L/ha)	Approval status (August 2013)	Max. no sprays	Harvest interval (days)
Amistar	Azoxystrobin (11)	1.0	SOLA 0443/09	Not stated ^a	Not stated
Bravo 500	chlorothalonil (M5)	2.0	SOLA 1130/11	1	Not stated
Brutus	epoxiconazole (3) + metconazole (3)	3.0	LTAEU	3	Not stated
Escolta	cyproconazole (3) + trifloxystrobin (11)	0.35	LTAEU	2	35
Folicur	tebuconazole (3)	1.0	LTAEU ^b	2	28
Karamate Dry Flo Neotec	mancozeb (M3)	2.0	Label	4	Not stated
Nativo 75WG	tebuconazole (3) + trifloxystrobin (11)	0.4	LTAEU	2	21
Priori Xtra	azoxystrobin (3) + cyproconazole (11)	1.0	LTAEU	2	30
Prosaro	prothioconazole (3) + tebuconazole (3)	1.2	LTAEU	2	56
Scala	pyrimethanil	2.0	SOLA 1315/11	3	3
Shirlan	fluazinam (29)	0.4	LTAEU	10	0
Signum	boscalid (7) + pyraclostrobin (11)	1.35	EAMU 2141/12	2	Not stated
Switch	cyprodinil (9) + fludioxonil (12)	1.0	Label	3	Not stated
Tracker	boscalid (7) + epoxiconazole (3)	1.5	LTAEU	2	Not stated
Vivid	pyraclostrobin (11)	1.0	SOLA 2884/08	2	Not stated

^aMaximum total dose of 4 L/ha. ^bExtrapolation under the Long Term Arrangements for Extension of Use (LTAEU) from SOLA 1516/04 which permits Folicur on narcissus grown for galanthamine production.

Where a product is used under a SOLA, EAMU or the LTAEU, growers should read and observe all the restrictions; treatment is at a grower's own risk.

Table 2. Relative efficacy of some fungicides against narcissus white mould (*Ramularia vallisumbrosae*) and smoulder (*Botrytis* spp.) based on trials results in BOF 072, BOF 072a and elsewhere

Product	Relative efficacy against white mould		Relative efficacy against <i>Botrytis</i> spp.	
	BOF 72	BOF 072a	BOF 72	Other trials
Amistar	***	***	*****	*
Brutus	*****	*	****	NT
Escolta	****	****	***	***
Folicur	*****	*	*****	***
Karamate	***	****	**	NT
Nativo 75WG	****	*****	****	NT
Priori Xtra	***	NT	NT	NT
Prosaro	***	****	*****	NT
Rovral WG	NT	NT	NT	***
Scala	****	*	****	***
Shirlan	*****	NT	NT	***
Signum	*****	****	*****	***
Switch	****	*	*****	****
Tracker	*****	*****	*****	NT
Vivid	*****	*****	****	NT

* 0-20%. ** 21-40%; *** 41-60%; **** 61-80%; ***** 81-100% control. NT – not tested.

BOF 072 – calculated from the mean results of 2-5 trials for white mould, 2 for smoulder.

BOF 072a – effect of fungicides one season on white mould at flowering the following season.

Other trials – relative efficacy of those fungicides used against *Botrytis* spp. in other crops.

Table 3. Example fungicide spray programmes for narcissus leaf diseases

Pre-flowering sprays			Post-flowering sprays				
1	2	3	4	5	6	7	
<u>First-year down, no flowers cropped</u>							
A.	-	Karamate	Signum	Karamate	Tracker	-	-
B.	Karamate	Signum	Folicur	Signum	Folicur	Tracker	-
<u>Second-year down, flowers cropped</u>							
C.	-	Signum	Folicur	Signum	Tracker	-	-
D.	Karamate	Signum	Folicur	Vivid	Tracker	Vivid	-
<u>High <i>Stagonospora</i> risk (eg Tazetta varieties/Isles of Scilly), flowers cropped</u>							
E.	-	Signum	Bravo 500	Vivid	Tracker	Vivid	-
F.	Bravo	Signum	Folicur	Vivid	Tracker	Vivid	Tracker

Example 'guideline' programmes A-D are designed for management of white mould and smoulder; programmes E-F for these diseases and leaf scorch. There are numerous other programmes that could be devised using these and/or other fungicides. Varietal susceptibility, disease occurrence in a crop and forecast weather should also be used to inform product choice and spray timing.

The interval between sprays will be determined by interval since last treatment, disease pressure (determined by crop monitoring) and opportunities to spray. Where early lifting is required, it would be prudent not to apply a late spray of a fungicide that delays leaf dieback.

Financial benefits for growers

Annual losses of narcissus bulb and flower production due to foliar diseases vary greatly between crops and years. The effect of foliar diseases on bulb yield is probably underestimated as foliar die-back due to disease is not easily distinguished from that of early senescence due to other causes (e.g. moisture deficit). Assuming that foliar diseases on average reduce marketable bulb yield by 10%, and flower production by 5%, and with an estimated farmgate value of £11 million and £15 million for narcissus bulb and flower production respectively in 2011, it is estimated that losses each year are in excess of £1.85 million.

Action points for growers

- For narcissus crops where flowers will be harvested the following year, consider applying one or more sprays of Signum, Tracker or Vivid in the current year to delay leaf senescence and increase future flower yield.

- It is likely that other fungicides which give good control of foliar diseases and delay leaf dieback will also increase flower yield.
- Where a crop will be left down for another year, apply fungicide sprays after flowering to prevent late-season build up of white mould. Amistar, Escolta, Karamate Dry Flo Neotec, Nativo 75WG, Prosaro, Signum, Tracker and Vivid applied post flowering in 2012 all reduced the occurrence of white mould in early 2013.
- Examination of the literature on a related disease indicates that Amistar, Signum, Tracker and Vivid are likely to provide some control of leaf scorch (*Stagonospora curtisii*)
- In addition to cost, consider the following aspects when selecting fungicide products for use in a programme to control foliar diseases: efficacy against white mould, smoulder and leaf scorch; maximum number of permitted sprays; harvest interval; rotation of products from different fungicide groups to reduce the risk of resistance development.
- Example spray programmes for different situations are given in Table 3.
- Monitor occurrence of foliar diseases in crops to inform spray decisions (product choice and spray timing).
- An application was made to CRD for an off-label approval (EAMU) for use of Tracker, post-flowering, on outdoor narcissus.