Project title	Narcissus: overcoming the problem of 'soil sickness' with particular reference to the Isles of Scilly
Project number:	BOF 50a
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Report:	Annual report, March 2008
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Location of project:	St. Mary's, Isles of Scilly
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Date project commenced:	BOF 50 1 April 2001 BOF 50a 1 April 2006
Date project completed (or expected completion date):	1 September 2009
Key words:	Narcissus, soil sickness, Root lesion nematode, *(Pratylenchus), Nectria (Cylindrocarpon), Tagetes patula*, Telone II (dichloropropene)

The results and conclusions in this report are based on an investigation 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.

Although this is an annual report it is an extension of work carried out between 2001 and 2006 under the reference BOF 50 and should be read in conjunction with the final report of June 2006. This extension was granted in 2006, by which time the plots were two years old, in order to monitor the effects of the treatments over a longer period. Crops of Tazetta Narcissus grown on the Isles of Scilly normally remain in the ground for 4 or 5 years. This is a longer period than that currently used for the production of standard daffodils in the UK.

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

[Name] Andrew Tompsett
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Report authorised by:

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Grower Summary

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- Three years after application, the effect of using a combination of *Tagetes* (a bio-fumigant crop) followed by Telone II (a soil sterilising agent) to control the level of Pratylenchus root lesion nematode and improve vigour in tazetta narcissus crops was less evident than after two years.

Background and expected deliverables

By sampling soil from affected plantings of Tazetta varieties of narcissus, the project sought to establish the extent and causes of 'soil sickness' on the Isles of Scilly. The suspected causes of soil sickness are pathogenic free-living soil nematodes which then enables secondary infection of the bulbs by fungi. Bulbs on affected sites remain intrinsically healthy but become progressively smaller due to root loss and early senescence.

Research from The Netherlands concluded that growing *Tagetes patula,* variety 'Ground Control' on a site in the year prior to planting a bulb crop reduced the incidence of soil-sickness. The growing of a bio-fumigant crop such as *Tagetes* requires land to be set aside for one year prior to planting whereas Telone II (dichloropropene) only requires a minimum period of three weeks between treatment and planting. However, Telone is a highly toxic substance and the possibility of developing resistance to treatment is possible over time with frequent applications.

Projects (BOF 50 and BOF 50a) compared the effect of planting a biofumigant crop (*Tagetes*) alone, with the standard method of injecting Telone (dichloropropene) into the soil alone, with a combined treatment of Tagetes followed by Telone.

Experiments were designed to identify treatments for soil sickness of tazetta narcissus that could result in vigorous crops that can be left in the ground for up to four years.

Summary of project and main conclusions

A survey was carried out in 2001/2 on 20 ‘problem’ sites on farms on the Isles of Scilly. On these fields of varying size (approximately 0.1- 0.4 ha), crops of narcissus grown for flowers and bulbs were showing patches or general areas of depressed growth possibly due to ‘soil sickness’ complex. Soil samples were collected from the affected areas.

- *Pratylenchus* root lesion nematode was detected on 12 of the 20 survey sites.
- The pathogenic fungus *Cylindrocarpon* (Nectria) was isolated on 11 of the 20 survey sites.
- There was no correlation between occurrence of the root lesion nematode and the pathogenic fungus.

Two trials were sited on two of the initial survey sites that were infected by both *Pratylenchus* and *Cylindrocarpon*. Treatments of *Tagetes* and Telone II both alone and in combination were applied on both sites. The four treatments which were replicated six times were:

1. Untreated control
2. *Tagetes*
3. Telone II
4. *Tagetes* followed by Telone II

In 2003, *Tagetes patula* variety ‘Ground Control’ seed was sown at 5kg/ha in drills 30 cm apart in Summer (June) into treatments 2 and 4 only. The subsequent crop residue was then incorporated into the soil in the autumn. The crop residue averaged 40 tonnes fresh weight per hectare at maturity. In early Summer the following year, Telone II (dichloropropene) was injected at 225 litres/ha into treatments 3 and 4 and immediately covered with plastic. In July 2004, bulbs of *Narcissus tazetta* variety ‘Royal Connection’ were planted in all plots. The trial was observed for three years and growth recorded. Free-living soil nematode populations were monitored during this period.

After two growing seasons (BOF 50), the plots combining *Tagetes* followed by Telone II were the most vigorous and free from Pratylenchus nematode in

comparison to plots treated with Tagetes or Telone alone or the control plots. After three growing seasons (BOF 50a), the combined treatment effect of Tagetes and Telone II on Pratylenchus nematode numbers was no longer evident. The effect of the treatment on plant vigour (leaf length and leaf senescence) was still evident on one site out of two (Table 1).

Table 1 Average length of narcissus leaves (cm) in May 2006 and 2007

Treatment	Site 1		Site 2	
	2006	2007	2006	2007
Control	53	58	83	84
Tagetes	64	59	83	86
Telone II	75	70	87	86
Tagetes + Telone	81	75	90	88

Financial benefits

Soil sickness, though frequently patchy in its distribution, can cause severe crop damage. However, its unpredictability is a major management problem since a narcissus flower crop which is normally expected to be productive for at least four years may show areas of reduced growth much sooner.

Lifting the bulbs, treating and re-locating them involves considerable cost in addition to the loss of the most productive years of the plantation (usually years 3, 4 and perhaps 5).

Telone II injection at 225 litres/ha. plus plastic coverage costs £1250/ha. *Tagetes patula* 'Ground Control' sown at 5kg/ha. costs £400/ha to which must be added the cost of herbicides (Goltix + Betanal, possibly two applications needed) required to maintain a weed free stand of *Tagetes* plants.

The costs of soil preparation, injecting or drilling are common to either method. Both require suitable equipment.

The *Tagetes* crop, on incorporation, adds to soil organic matter, (up to 85 tonnes fresh weight (20 tonnes dry matter / ha) is claimed but in these trials it averaged 40 tonnes fresh weight / ha).

Trial results after two years suggested that Telone II out-performs *Tagetes* but that the combined use of *Tagetes* and Telone II is superior to either agent alone. Unfortunately this raises the cost of the combined treatment to about £1640 / ha. However results after 3 years are not so promising.

Since 2001, when these treatments were applied, there has been a marked change in attitude and legislation regarding the use of toxic, non-selective chemicals such as Telone II and its future is now under active review through the EU.

Action points for growers

- As populations of *Pratylenchus* can be unpredictable, soil samples should be collected and sent for identification and density to a diagnostic laboratory before committing to expensive control measures.
- If high populations of *Pratylenchus* are found (eg 300 per 200g soil), growers should consider using a combination of a *Tagetes* 'biofumigant crop', followed by Telone II injection. This appears capable of reducing the effects of 'soil sickness' in a narcissus crop for at least two years.
- The 'double treatment' was more effective than either agent alone. Although costly, it enabled the crop to remain productive for longer. By boosting crop vigour it maintains the yield of flowers over years 2-4 which are normally the most productive years of a plantation.
- Growers should keep a watching brief on the registration status of Telone II.