

Project Title: Narcissus: overcoming the problem of soil sickness with particular reference to the Isles of Scilly

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The results and conclusions in this report are based on an investigation conducted over one year. The conditions under which the experiment was carried out and the results obtained have been reported with detail and 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.

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## **Grower summary**

### **Headline**

This project seeks to establish by survey, some of the causes of soil sickness. Also, since there have been good reports from Holland on the effectiveness of *Tagetes patula* (French marigolds) in controlling certain soil-borne pests and diseases of bulbs, this technique will be compared with the standard soil fumigation treatment Telone, employed by growers.

### **Background**

- The project is located in the Isles of Scilly where intensive Narcissus production has occurred for over 100 years resulting in cases of soil sickness.
- The project could deliver an alternative to frequent routine soil fumigation by the use of *Tagetes* as a bio-fumigant break crop.
- The findings could be immediately applicable on farms.
- If successful, little further work would be required beyond this project.

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

The project initially surveyed 20 sites where crops were sub-standard due to some form of soil problem. Twelve of the sites confirmed the presence of the free-living nematodes widely associated with soil sickness in Narcissus crops, namely the root lesion nematodes *Pratylenchus penetrans* and related species, together with the root rotting fungus *Cylindrocarpon (Nectria) radicum*.

Following on from this work, two affected sites were selected for trials. To assess the effectiveness of *Tagetes* as a bio-fumigant crop compared to Telone, the trial sites were set up with four different treatment plots: untreated control plot; Telone fumigation only; *Tagetes* only; and *Tagetes* + Telone.

In 2003, strips of *Tagetes* were grown on the sites and they were then cross-injected with Telone in spring 2004. Prior to bulb planting in 2004, the nematode populations on the sites were monitored. The preliminary results have now been analysed. It is however, too early in the trials to conclude whether *Tagetes* is an effective bio-fumigant crop. The most valuable data will come from observations on the growth of the crop, as well as monitoring of the numbers of nematode species present over the next two years of the trial.

### **Financial Benefits**

The cost of *Tagetes* seed at 5kg / ha is approximately £400 / ha. There is an additional cost for drilling and herbicides.

The cost of Telone at 225 L / ha plus plastic coverage is approximately £1250 / ha. There is an additional cost for machinery and application.

NB. *Tagetes* is ineffective against the stem nematode (*Ditylenchus*). This pest requires the use of Telone.

### **Action Points for Growers**

The project is in its early stages and there are no action points at present. Observations on the growth of the crop over the next two years, and continued monitoring of nematode populations under the different treatments regimes will define any grower action points.

## Science Section

### Introduction

Trenoweth Horticultural Centre (formerly Trenoweth R&D) is supported by 25 fee paying Narcissus growers on the Isles of Scilly. These growers were invited to notify the centre of problems they were experiencing of patches of so-called soil sickness in their crops.

Soil sickness is a frequent problem in the continuous production of intensively grown crops, and represents a particularly serious problem in Narcissus production in the small islands of Scilly. Past analysis and experience suggest that such problems are usually due to a build up of pathogens in the soil the most commonly supposed to be the root lesion nematode *Pratylenchus* species, in combination with root rotting fungi *Cylindrocarpon (Nectria) radicicola*. However, previous experience suggests that precise diagnosis is difficult.

This project seeks to establish, by survey, some of the causes of soil sickness. Also, since there have been good reports from Holland on the effectiveness of *Tagetes patula* (French marigolds) in controlling certain soil-borne pests and diseases of bulbs, this technique will be compared with the standard soil fumigation treatment, Telone (dichloropropene) employed by growers.

The objective of the work is to seek to replace or reduce the use of the soil sterilant Telone, which is widely used in intensive production. It is a toxic substance and although fully approved, its use should be limited wherever possible and especially in a locality such as the Isles of Scilly.

### Materials and Methods

Following on from previous years' work, two affected sites were selected for trials.

Strips of land each 4.5m wide were sown with *Tagetes patula* 'Ground control', a bio-fumigant crop, in drills 30 cm apart in June 2003. The subsequent crop residue was then rotavated into the soil in the autumn. The crop residue averaged 40 tonnes fresh weight per hectare at maturity.

In spring 2004, strips 4.5 m wide at right angles to those grown with *Tagetes* were injected with the nematicide Telone and covered with plastic. The strips were repeated in each direction to give at least 6 replications per treatment.

The treatments were:

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

Following the set up of the different treatments, the soil was analysed, fertilised and prepared for bulb planting. Soil samples for nematode populations were collected from each treatment at planting time.

The whole area was planted with Narcissus 'Royal Connection' a tazetta Narcissus (Div. 8) variety.

## **Results**

The nematode population survey results from sites 7 (Pine Tree) and 10 (airport) are presented in Figures 1-4 and Figures 5-8 respectively. The 2004 results for each treatment are compared with the data collected in the original survey in 2002, and with data collected prior to soil treatment in July 2003. (A key to the importance of each species can be found in the Glossary at the end of the report.)

### Original survey site 7 (Pine Tree)

The untreated control plots were the only plots to contain free-living nematode species including *Pratylenchus penetrans* and *Pratylenchus neglectus* (Figure 1). These are the species considered most damaging to Narcissus crops. In comparison to 2002 and 2003 surveys, no nematode species were detected in the soil of any of the other treatment plots in the 2004 survey (Figures 2-4).

### Original survey site 10 (Airport).

The plots receiving the *Tagetes* + Telone combination treatment were nematode free (Figure 8), whilst the other treatment plots contained some nematode species (Figures 5-7). Surprisingly, no *Pratylenchus* species were detected on any of the treatment plots, including the untreated control plots on site 10 in the 2004 survey (Figures 5-8). This nematode species had been present on this site in the original survey in 2002.

## **Conclusions**

At present, only preliminary results in the use of *Tagetes patula* as a bio-fumigant crop for controlling nematode populations have been collected. The absence of *Pratylenchus* species on the untreated control plots on site 10 in 2004 makes it difficult to conclude anything from the data at present. However, subsequent analysis of crop performance and further nematode population sampling in the 2005 and 2006 seasons may indicate whether *Tagetes* represents a viable alternative to Telone fumigation.

## **Technology Transfer**

A grower demonstration trial could be organised so the growers can see the results of the different treatments in progress.

## **References**

Translation from Dutch: *Tagetes* as a soil steriliser for nematodes. From Bulb Research Centre, Lisse and other centres in Holland, May 1997.

Figure 1. Untreated control (site 7 Pine Tree)

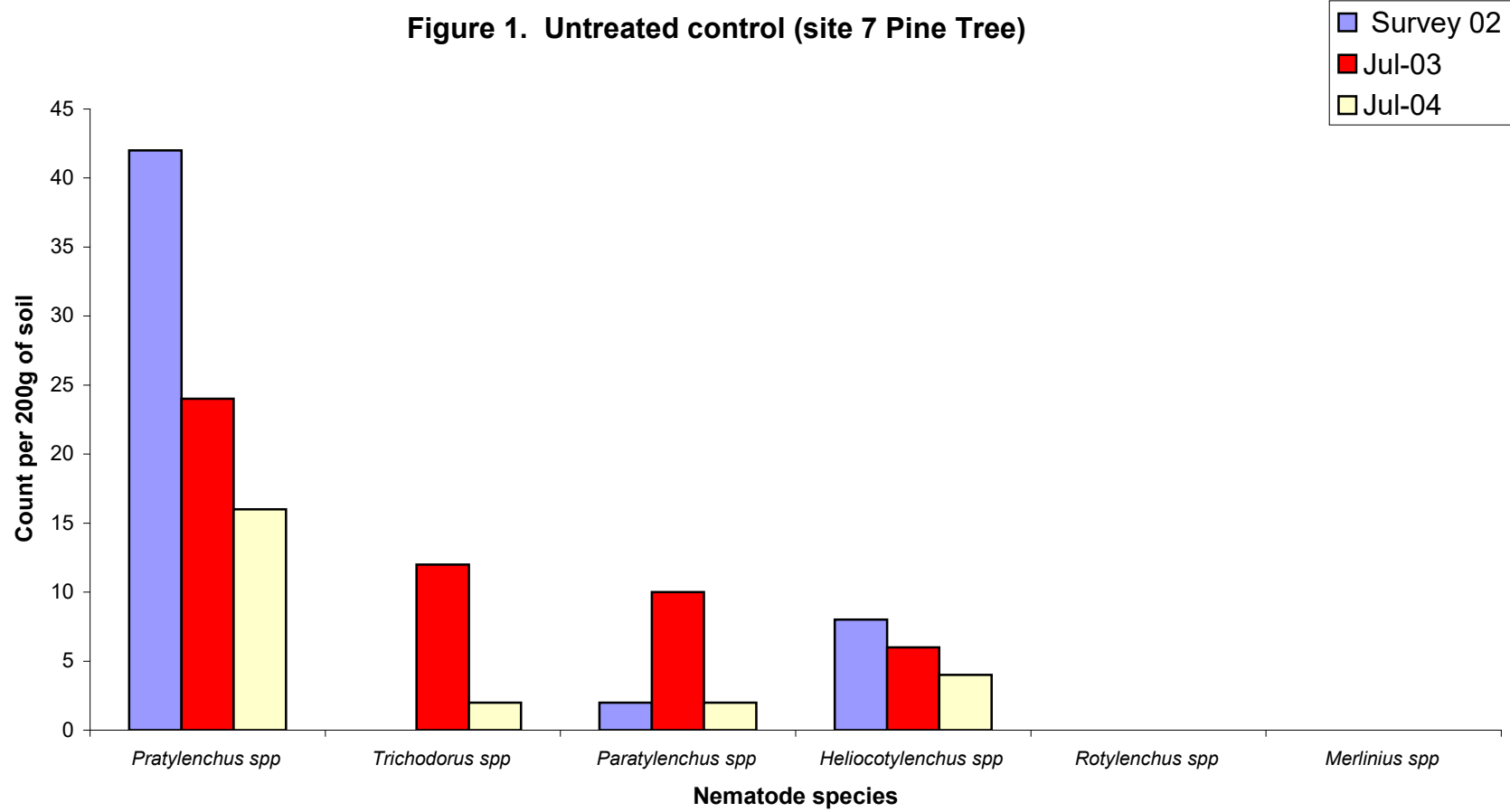




Figure 2. Telone treatment only (site 7 Pine Tree)

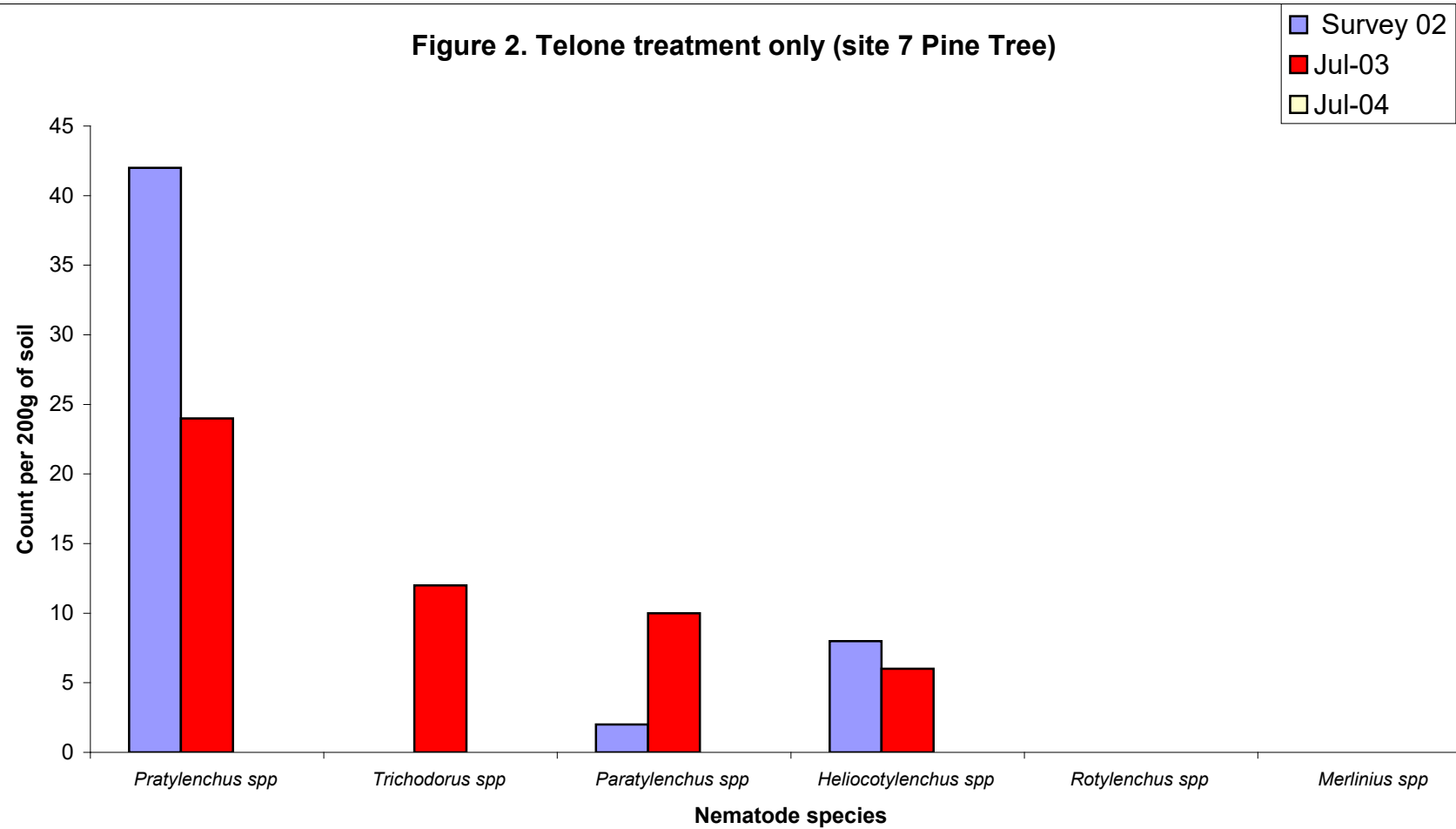


Figure 3. *Tagetes* treatment only (site 7 Pine Tree)

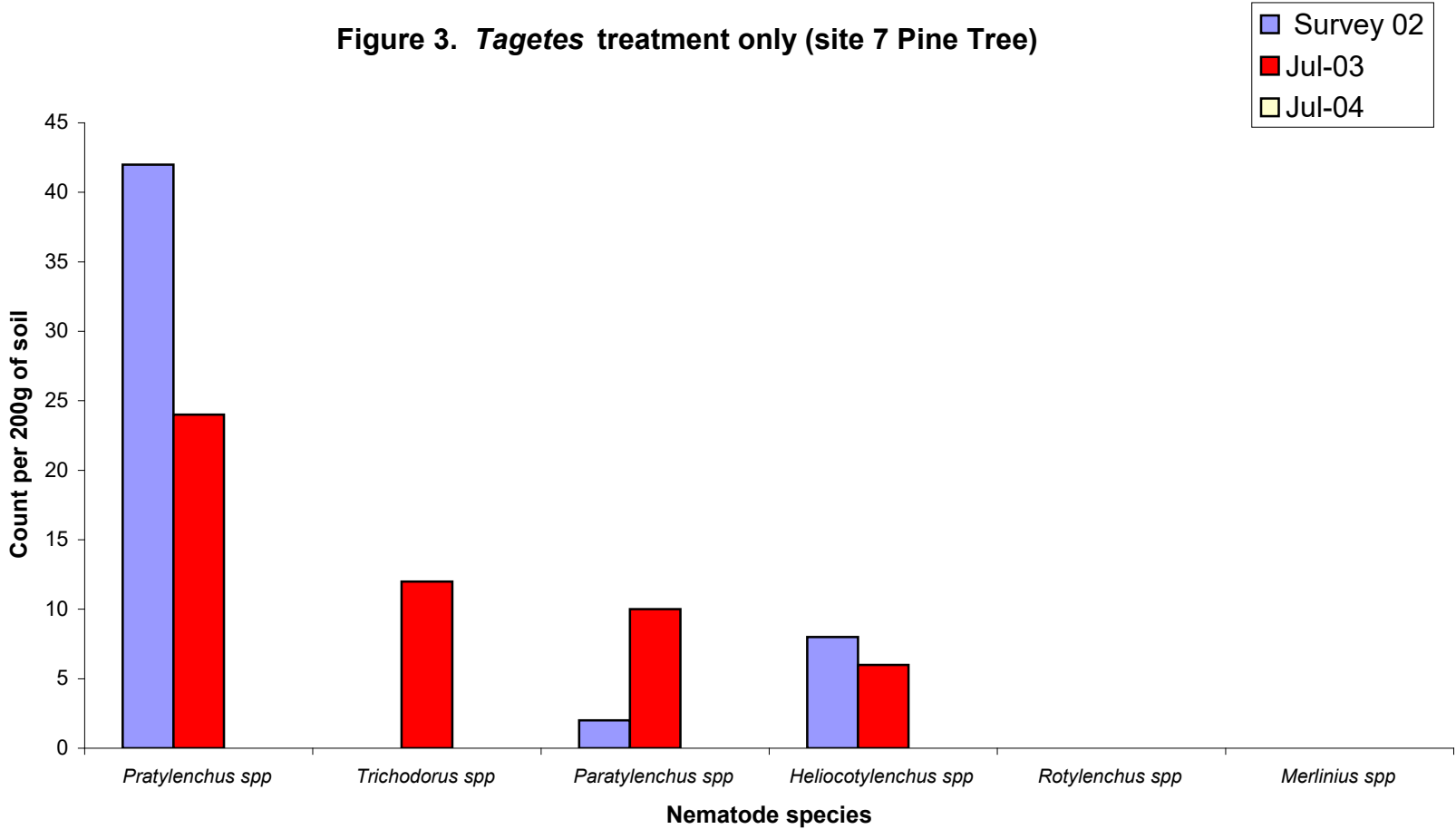


Figure 4. *Tagetes* and Telone treatment (site 7 Pine Tree)

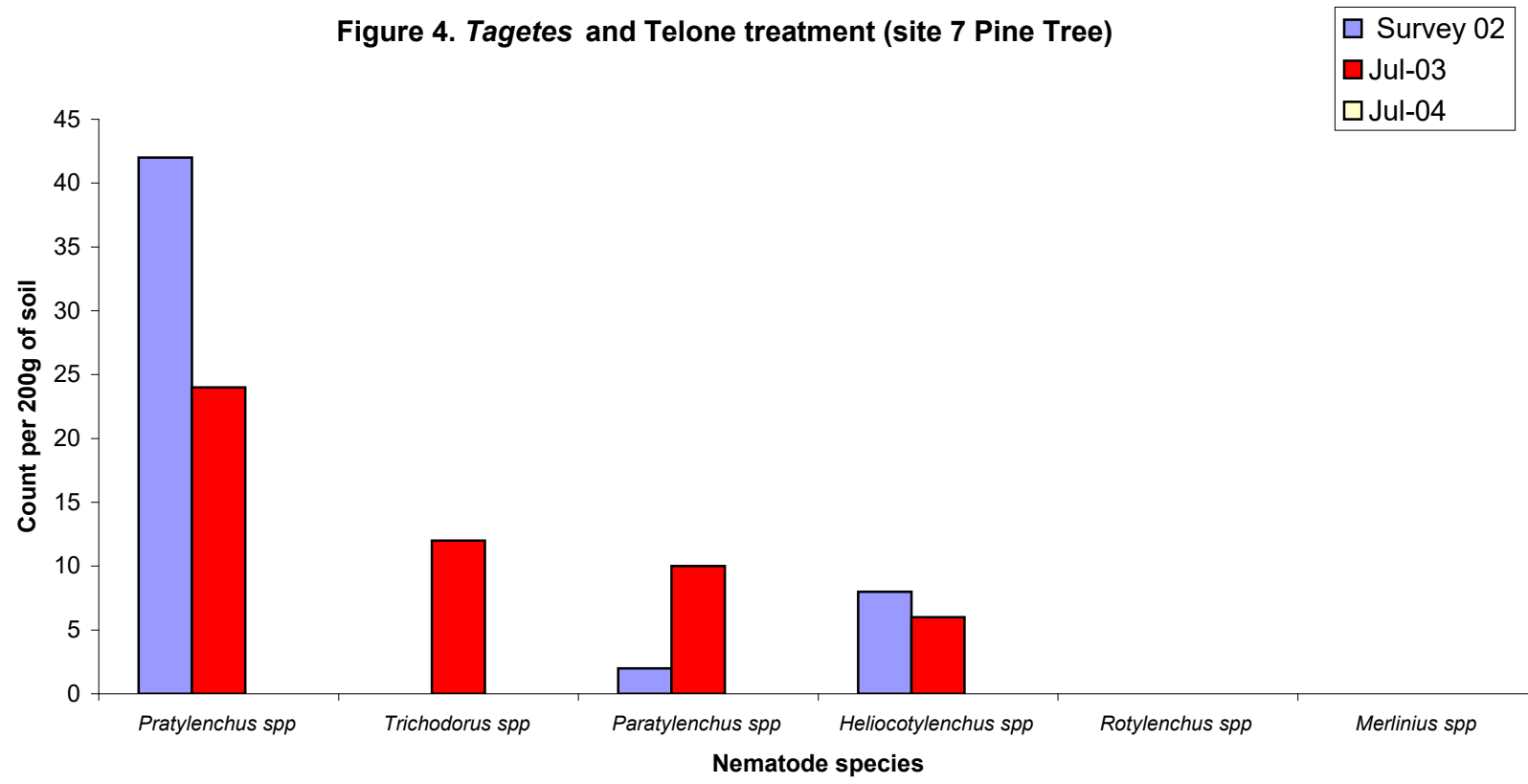


Figure 5. Untreated control (site 10 Airport)

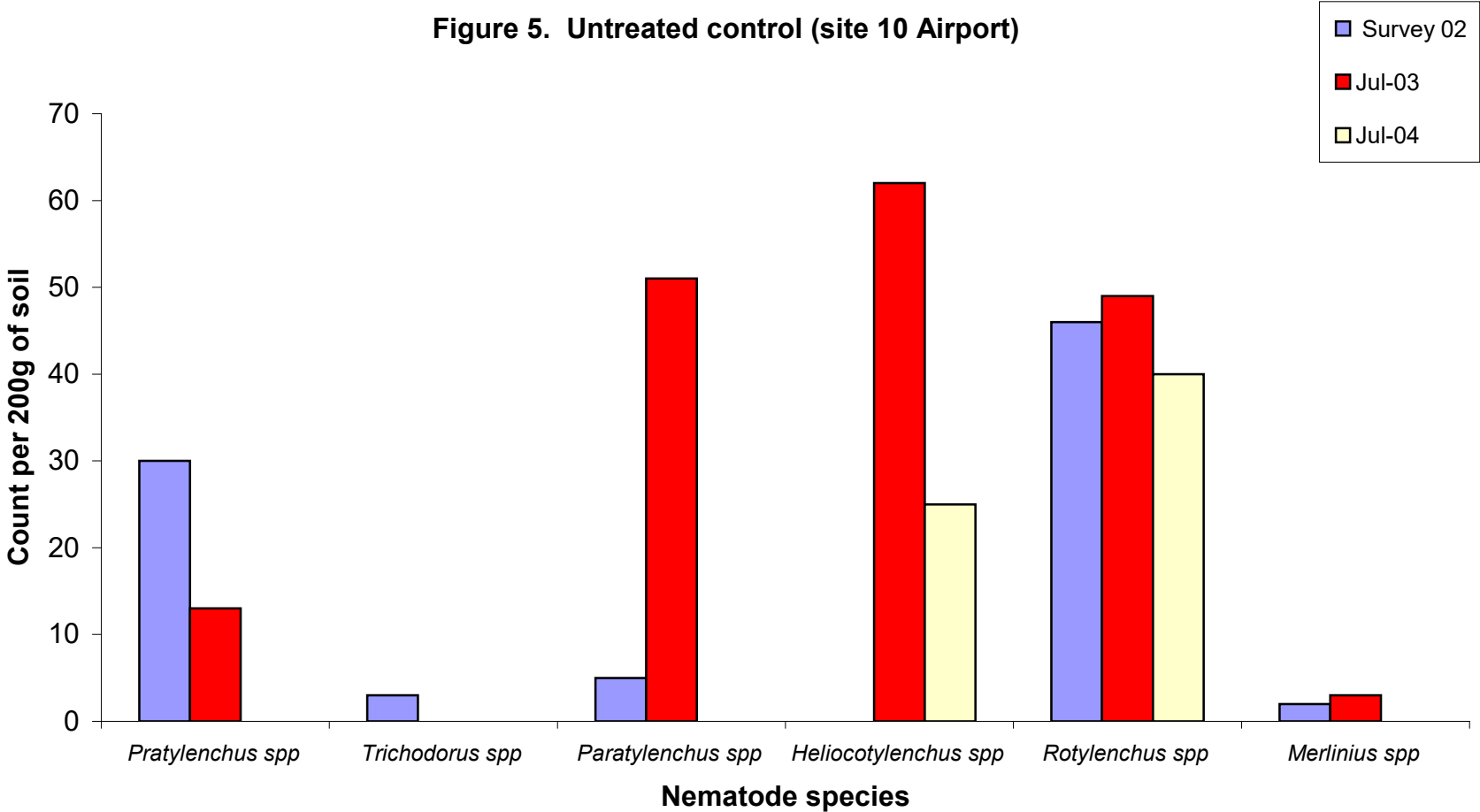


Figure 6. Telone treatment only (site 10 Airport)

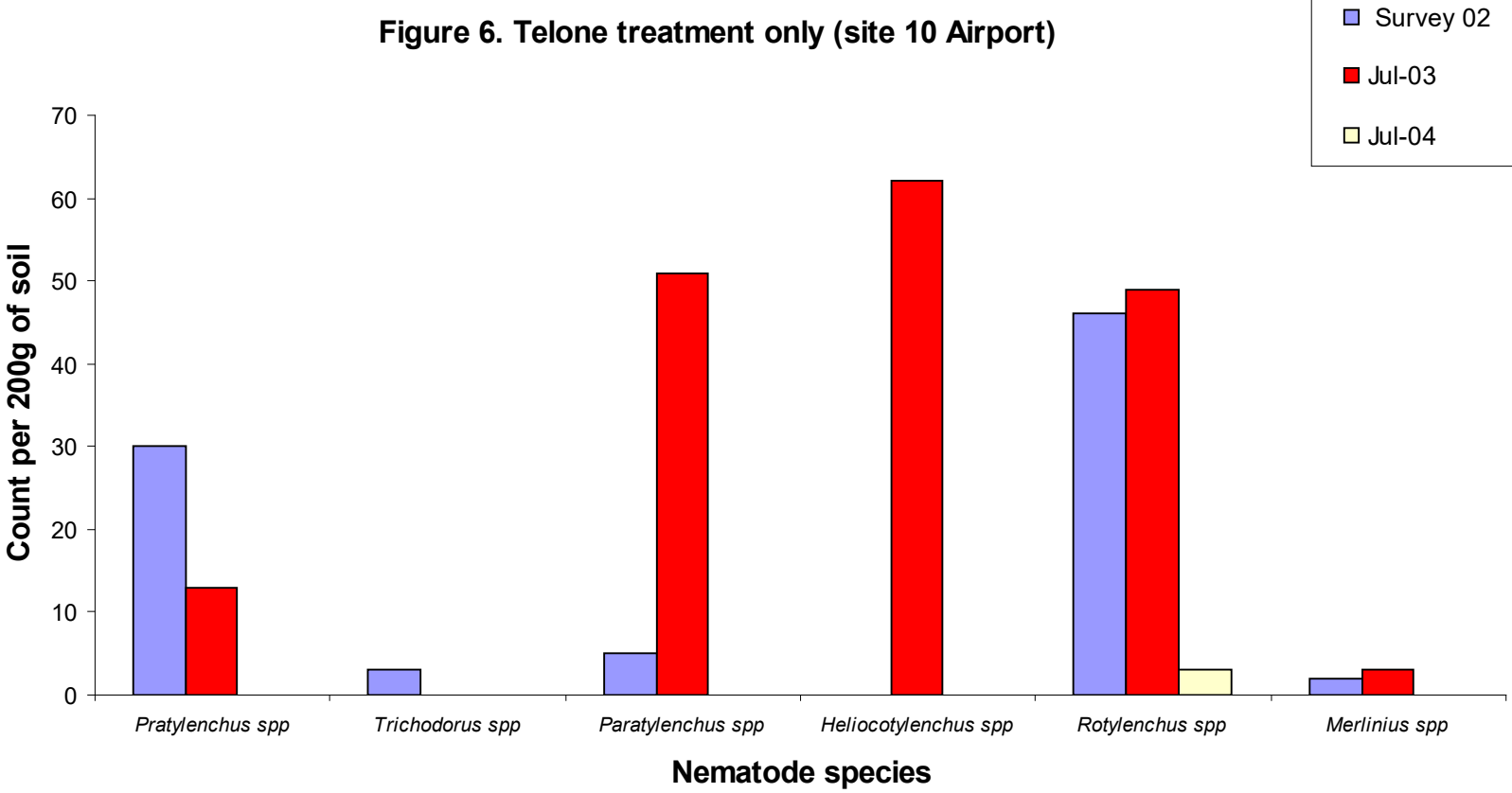


Figure 7. *Tagetes* treatment only (site 10 Airport)

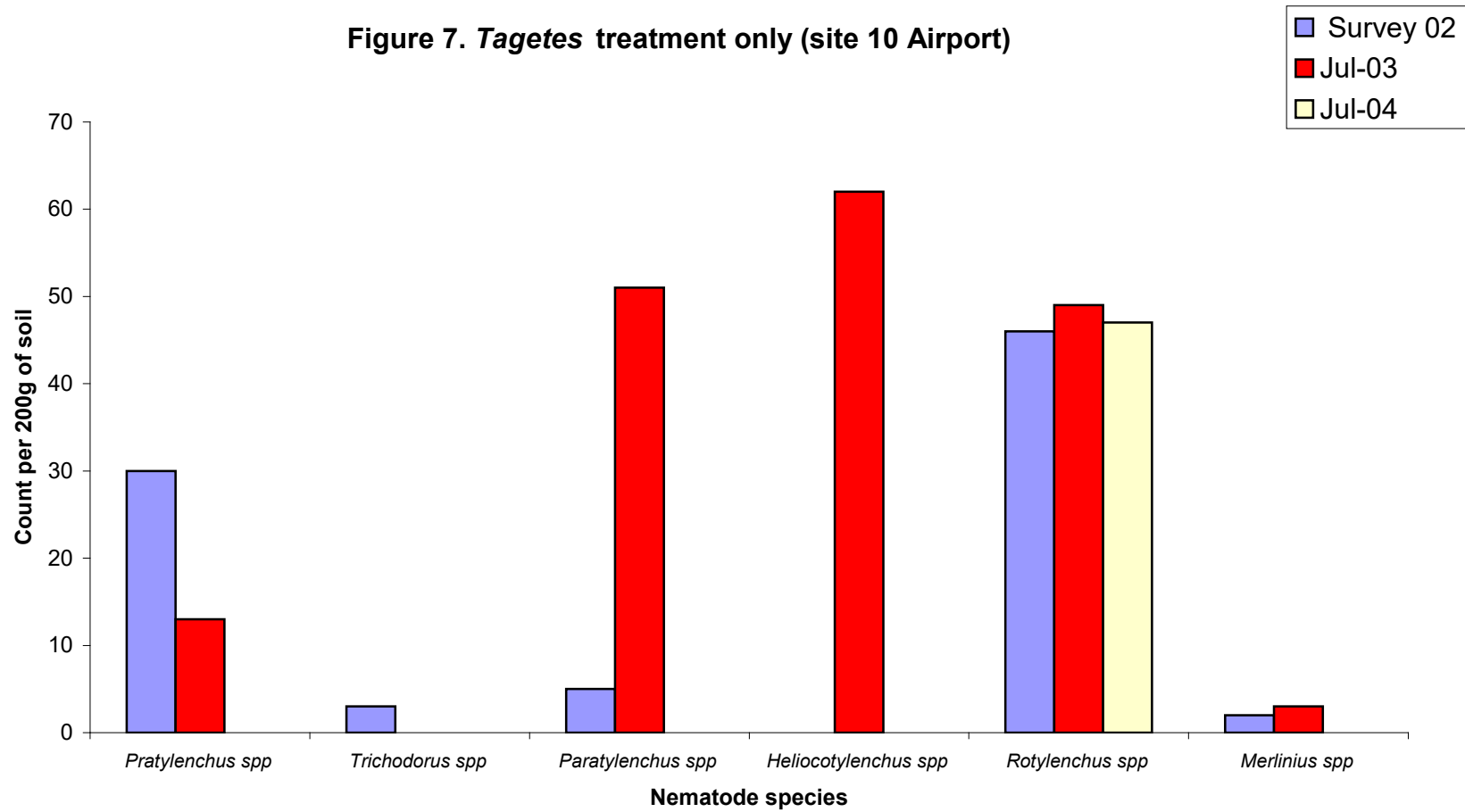
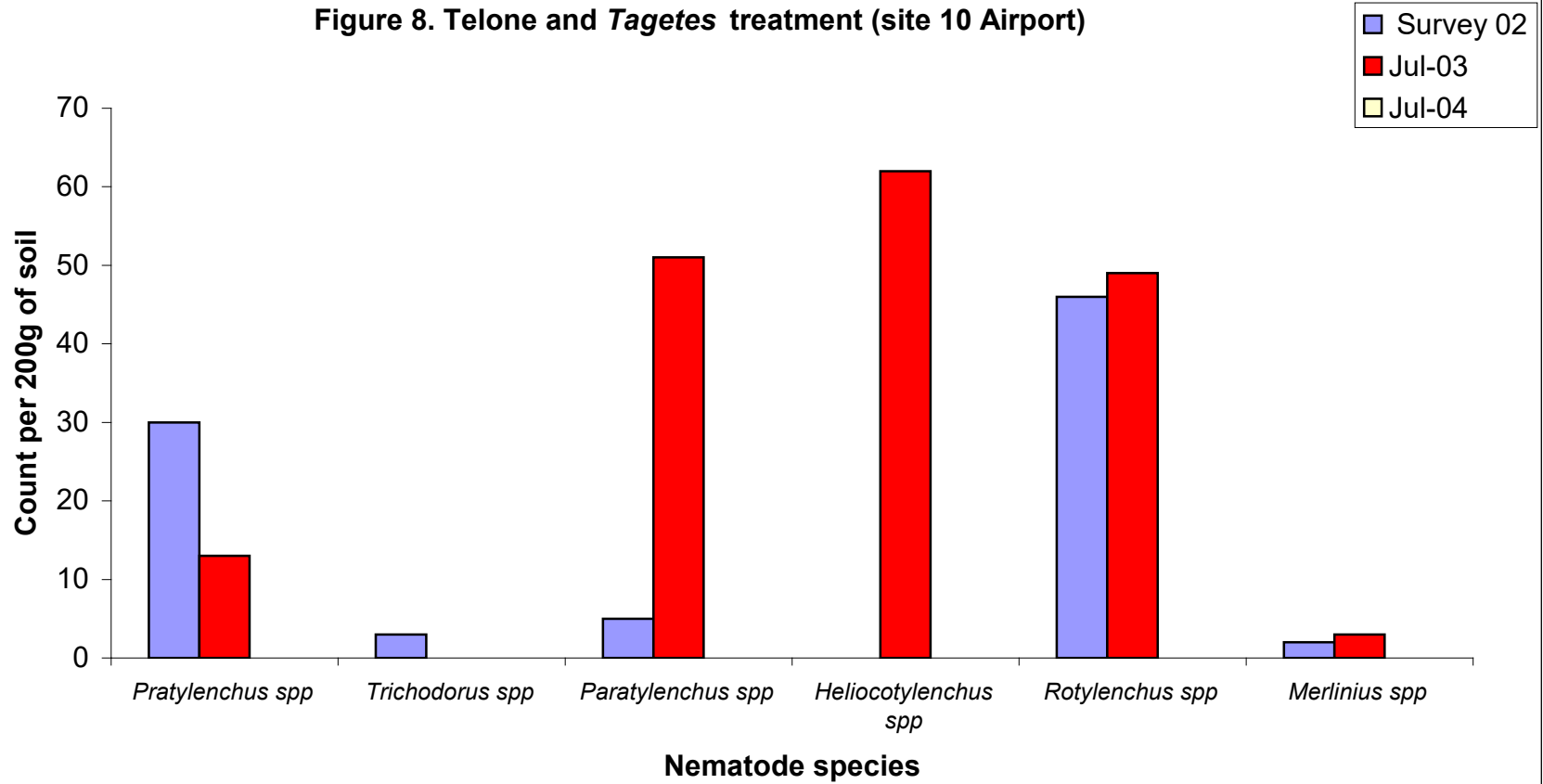


Figure 8. Telone and *Tagetes* treatment (site 10 Airport)



## Glossary

**Bio-fumigant crops:** Crop plants such as *Tagetes patula* (French marigolds), which by their chemical constituents, or other means, can reduce the population of certain pathogens.

***Cylindrocarpon radicicola* (*Nectria radicicola*):** A root rotting fungus regularly associated with nematode damage.

**Free living nematodes (eelworms):** Non-specific soil-inhabiting nematodes capable of damaging the roots of many crops.

***Heliocotylenchus* spp. (spiral nematode):** Not usually considered an important plant parasite, but its feeding may contribute to overall root damage.

***Merlinius* spp. (stunt nematodes):** As for the spiral nematodes *Heliocotylenchus* spp.

***Paratylenchus* spp. (pin nematode):** As for the spiral nematodes *Heliocotylenchus* spp.

***Pratylenchus* spp. (root lesion nematode):** A well-known root damaging nematode in many crops. Root damage is aggravated by fungal entry.

***Rotylenchus* spp. (spiral nematode):** As for the spiral nematodes *Heliocotylenchus* spp.

***Trichodorus* spp. (stubby root nematode):** Damaging to roots and a vector for several viruses.

## Acknowledgements

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