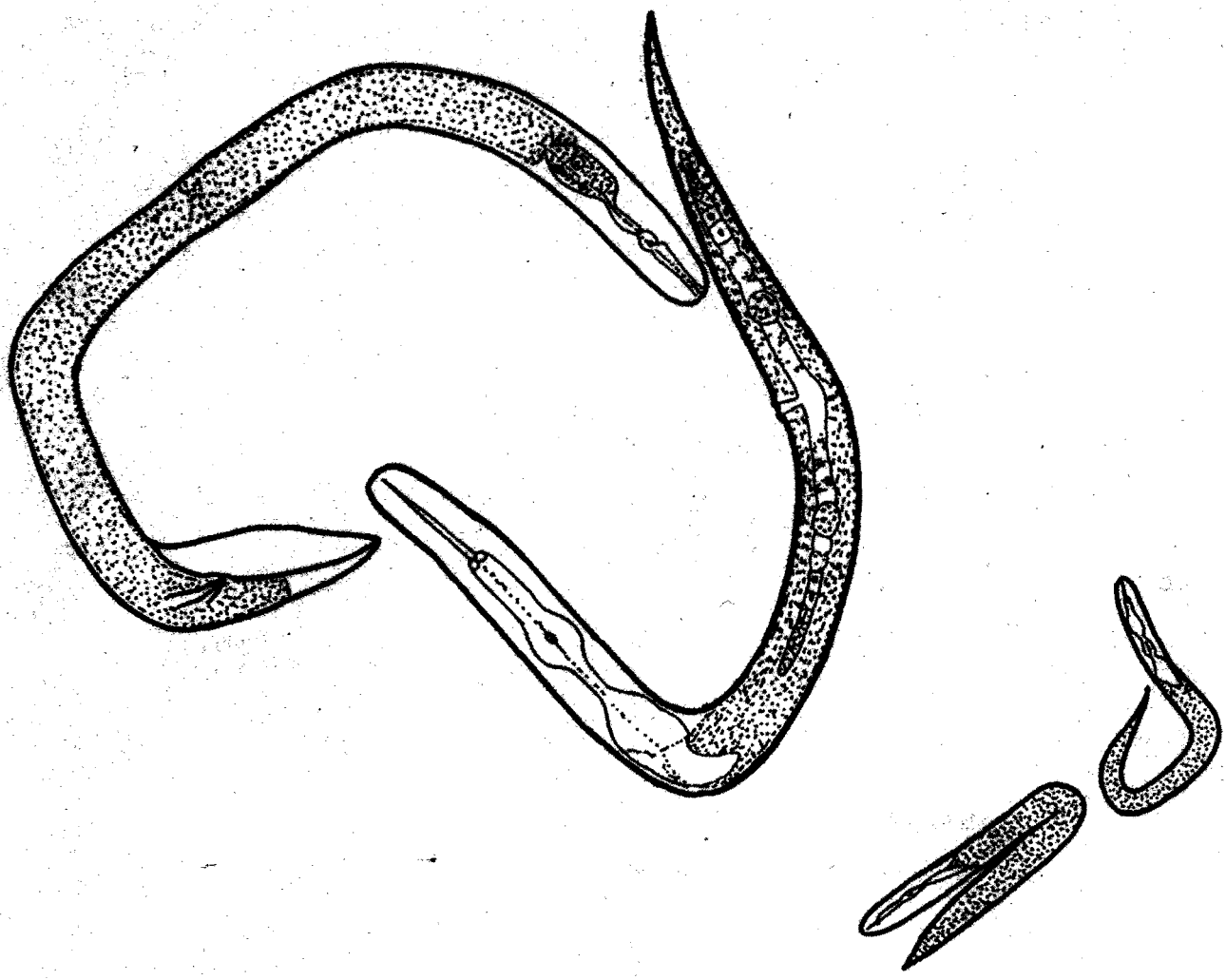
AUSTRALASIAN NEMATOLOGY NEWSLETTER



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From the Editor(s)

We are particularly thankful to those of you who took valuable time to contribute to this newsletter.

We have finally reached the 20th Century and have access to E-mail. If you are also on E-mail you can send your articles to any of the following addresses:

scurrah.maria@pi.sa.gov.au
bertozzi.terry@pi.sa.gov.au
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We recently tried to call several AAN members and many phone and fax numbers were wrong. If you have changed your address and/or phone number, please advise Nora Galway, Plant Science Centre, CSIRO Division of Entomology, GPO 1700 Canberra ACT 2601. An updated directory will be printed in the January newsletter.

Association News

Retirement of Dr JM Fisher

John Fisher retired from the University of Adelaide in May, 1994. We enormously miss his sense of fun, thoughtfulness, and help. John is an excellent teacher and supervisor, and continues to supervise several students at the Waite. He is humorous, patient and always happy to discuss problems and act as Devil's advocate. He loves to "stir", and enjoys debating hare-brained ideas. With his huge knowledge of nematodes, we have all consulted him as a resource person. Many students recall John's unorthodox methods of biological control of mice in the lab (talk about physical comedy). Others speak affectionately of his gladiatorial efforts at various staff vs. students sports events.

John came to the Waite Institute in 1956, the first lecturer in nematology appointed to an Australian university. He had worked as a Plant Pathologist for the NSW Department of Agriculture for a few years. This solid background and training in plant pathology has stayed with him always and has been of invaluable assistance to many of us in these days of specialisation and narrow fields of interest. He was awarded a Fulbright Scholarship (1961), a British Council Scholarship (1967), and the Urrbrae Award (1987).

John says that when he first came to South Australia, he spent a few years familiarising himself with local nematode problems and trying to decide which were most important. He saw these as cereal cyst nematode, annual rye grass toxicity, stem nematode, root rots of cereals and (more recently), poor growth of pasture legumes Most of his own and his students' research has been directed at CCN and ARGT and has led to control of these problems. He has also been interested in physiological problems associated with growth and development and with stress tolerance in nematodes.

Over the years John has trained and worked with many nematologists from both Australia and overseas. Amongst these were Adrian Evans, Bob Banyer, Kerrie Davies, Graham Stirling, Chris O'Brien, Walter Chit, Alan Dubé, Alan McKay, Julie Stanton, Robert Asiedu and Vivien Vanstone.

John hasn't revealed his immediate plans, but we can imagine him basking on North Queensland beaches, in his board shorts, sampling the sunshine, the waves, and littoral nematodes. We wish John the very best and hope to see him often.

Kerrie Davies, Alan Dubé, Alan McKay, Frances Reay

AAN Meeting 1995

The 1995 AAN meeting will be held in conjunction with the 10th. Biennial APPs conference on the 28 to 30 August and the venue is at Lincoln University New Zealand. As mentioned in the last Newsletter I have undertaken to organise the nematology meeting and I have been able to enlist the assistance of my other nematology friends.

However, the returns, from the first circular show that very few nematologist are planning to come. I know that it is expensive to get to NZ but we can offer you some very good hospitality if you can make it.. It is taken for granted that the scientific content will be great. I am trying to arrange a keynote speaker to talk on nematode/host interactions and some of the novel approaches being used (No it wont be exclusively molecular biology he actually fiddles with nematodes).

Planning is advancing and we will have a one day workshop probably on 18th friday preceding the conference proper. The title of the workshop will be :

CYST and ROOT KNOT NEMATODES"
Impact, Interactions, Identification and Control.

The workshop title is deliberately broad to insure that it covers the nematological interests of both countries, is topical and should provide a substantial justification to put with your application for travel funds.

To those of your that are not directly involved with this group of nematodes, come along and increase your experience. You never know when this group may become a problem in your area. Sounds like a good justification for coming???

If anybody has any suggestions for additional topics I would be pleased to hear from you.

AAN convener 1995.
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Revision of George Khairs 'List of plant parasitic nematodes of Australia'

Work on the revision is progressing well. Three days discussion and cooperative work in Adelaide during February proved to be very helpful. It is expected that the manuscript will be ready for printing in September, so publication is expected by the end of 1994.

It is not intended that copies will be sent out automatically. There will be a nominal charge to cover postage and packing - a request form will be included in the next newsletter. Anyone interested in receiving a copy, please contact Rod McLeod or Frances Reay.

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Frances Reay, University of Adelaide, Waite Campus, Department of Crop Protection, Glen Osmond, South Australia 5064. Tel: (08) 303 7321.

Frances Reay

Travel and Meetings

New Frontiers in Nematology

G.R. Stirling, DPI, Indooroopilly

1. From April 25-28, 1994 I attended a workshop in Jerusalem, Israel on 'Non-conventional control of plant-parasitic nematodes and soil-borne diseases'. The meeting was one of the best scientific meetings I have ever attended. Participants were mainly researchers from the USA and Europe who were at the forefront of research on plant-nematode interactions. Participation was by invitation only and I was the only person present from the southern hemisphere.

2. The highlight of the meeting was a paper by Dr C. Opperman, North Carolina State University, who has recently produced the first transgenic plants with resistance to root-knot nematode. I believe this is one of the most important nematological breakthroughs in the 25 years I have been a nematologist, as it has the potential to revolutionise the way we control *Meloidogyne*.

   I don't claim to be a molecular biologist, but I understand that Opperman and colleagues have found a promoter which is turned on in *Meloidogyne* giant cells. They have linked this to an anti-sense system, so that the giant cell is destroyed as soon as the cells are established. It is a neat and very specific system which should have widespread application. For those who missed it, the earlier part of this work made the front cover of Science on January 14, 1994 (Vol. 263 pages 221 - 223).

   The technology has been licensed to Monsanto Ltd, who plan to concentrate initially on commercialising it in potatoes and other vegetable crops. Commercialisation is expected to take 5-7 years. Some crops of interest to developing countries (e.g. rice, cassava) are not included in the licensing arrangement.

3. Many other areas of research are going on overseas and some of these are likely to lead to practical developments in the next few years. These include:

   - cloning of a nematode resistance gene from tomato
   - understanding the process by which nematodes modify plant cells, and using this information to develop strategies which interfere with that process.
   - transformation of plants to produce antibodies specific for particular pests and pathogens.
   - understanding genetic variation in nematode populations and using this information to improve strategies for deploying host plant resistance.
   - comparative studies of the nervous systems of nematodes and mammals which will lead to the development of specific drugs which target nematodes but have no effect on humans.

4. The meeting provided a good demonstration of the potential of molecular biology to improve current pest and disease control practices. New technologies are emerging rapidly and in the next few years there are likely to be advances which will have a major impact on agriculture.

Banana Nematode Meeting in Malaysia

In May this year, I was fortunate enough to be asked to attend the INIBAP/ASPNET (International Network for Improvement of Banana and Plantain/Asia & Pacific Network) Conference/workshop on Banana Nematodes and Weevil Borer which was held at MARDI, Malaysia. Representatives of many Asia/Pacific regions attended along with several other banana nematode experts, including Simon Gowen, Jean-Louis Sarah and Paul Speijer.

The meeting aimed to find out what is known in the region and to set priorities for future research. There had been a similar meeting some time ago on Fusarium diseases of banana and several projects came out of that meeting immediately. I think that this was the expectation of the nematode/weevil borer meeting. However, it became apparent that we are a long way behind in nematode work. This is probably due to the fact that there are few people in the region with nematological expertise and this is spread very thinly.

Radopholus similis was considered the most important nematode problem on bananas throughout the Asia/Pacific region including Australia. Other genera, including *Helicotylenchus*, *Pratylenchus* and *Meloidogyne*, contain species which are considered to cause significant yield losses but these problems appear to be less widespread. However, the importance of nematode pests to banana production is poorly understood. Many countries have conducted extensive surveys but there is little known about nematode pathogenicity in China, Indonesia, Malaysia, Thailand and some areas of the Pacific Islands. Discussions suggested that, in these countries, the most urgent need is to establish the importance of nematodes to banana production.

Nematodes are currently controlled almost universally by chemical nematicides and application usually occurs without knowledge of the nematode status of the crop and, therefore, potential economic benefits. Participants generally agreed that strategies which minimise the use of chemical nematicides are required. Even though it is accepted that clean planting material is the key to preventing introduction to crops, it seemed that this was not used often enough. There appeared a need to encourage farmers to treat planting material or use disease-free tissue cultured plants. Little resistance to important nematode pests has been identified and this was seen as a priority.

In the discussion session, several topics were covered and these were relevant to both nematode and weevil borer problems. We are currently developing an ACIAR project to address some of the most important issues. A 'rapid rural appraisal' will relate root necrosis and toppling to nematode populations on selected banana genome groups and elevations. This will identify potential risk areas based on nematode species and populations. Biological control agents and natural enemies may also be found during this study. Understanding mechanisms of damage was also seen as important so this issue will also be tackled with a view to improving tolerance to weevil borer and developing transgenic resistance to *R. similis*.

(Julie Stanton, QDPI Indooroopilly)

Regional News

Nematology in the Crop and Food Research Institute, Lincoln New Zealand

Journées around the Institute:

With the dissolution of the DSIR and MAF and the formation of Crown Research Institutes I find myself back in a crop based organisation. A curious fact seeing as it was the same group in which I started my career 20 yrs ago. I have now worked in five institutes, (DSIR Crop Research, DSIR Plant Diseases, DSIR Entomology, DSIR Plant Protection and finally back to Crop & Food Research) always on nematodes and yet have not moved off the original campus.

With the new emphasis on plants we have been slowly reorientating our programme to reflect this fact and have increased the emphasis on host parasite interactions, nematode resistance in plants and in particular we are working at increasing the range of genes resistance to Potato cyst nematode (PCN).

PCN detection:

Simon Bulman continues to work on the development of PCR based species specific primers for both species of PCN. This work has progressed well and we should have this completed by next year. Our future interest is in developing some means of detecting small subspecies (ie pathotype) differences in the hope that we can detect virulence in a population of PCN before it becomes a problem. Research in this area has not been as straight forward because the genetics of PCN is very poorly understood. We are currently looking at a range of options to improve our knowledge in this area.

Overseas

Last year I spent three months in Europe (two in Germany and the rest looking at labs in the Netherlands France and UK and a NATO conference in Italy on molecular nematology). My main focus was PCN characterisation and population genetics.
It is always good to visit other laboratories to see what is being done but I find it much more beneficial as an opportunity to discuss your own ideas and see how they compare with to other workers ideas.
I never cease to be amazed how similar the other workers insights, aspirations and problems are to my own. I also experienced the down side of commercialised science and contracts in that some institutes have become so concerned that they will not allow their staff to talk openly for fear of giving some information that may be useful to the " opposition".

However, as a result of my travels I have formed the following conclusions;
The main form of control for PCN, in the future, will be the targeted application of resistant plants with genes that confer the appropriate form of dueable resistance. These plants will be either normally breed or transformed plants containing constructs that confer resistance.
Associated with these plants will be the development of detection methods for the species and their pathotypes. The basic science problem will be to understand the mechanism of virulence development in PCN populations. This work will have beneficial spin off for nematology in general.

Future

Having had this opportunity I returned to NZ with renewed vigour and expanded the operation of our nematode quarantine station. This laboratory allows for the direct importation of wild *Solanum* species and the testing against our local PCN populations as well as overseas populations. Only those lines of *Solanum* with very high levels of resistance will be retained.In addition to this project we established an invitro culturing method (Developed by Werner Selig at Kiel University, Germany) and set up a programme to determine the extent of virulence in our PCN populations. Once the virulent populations have been detected we will increase the frequency of the virulence genes within the population by continuous *in vitro* culture on partially resistance potato plants.
We then plan to challenge these now highly virulent populations with the new sources of resistance found in our novel resistance germplasm programme. In this way we should be able to anticipate the type of resistance needed by the breeder for the next generation of resistant potato cultivars.
This programme will be developed in collaboration with Drs Jurgen Rumpenhorst, Wolfgang Burgermeister and Charlie Pastrik at Braunschweig Germany and Drs Colin Fleming and Sue Turner at Dept of Agriculture Northern Ireland and we will exchange material and methods as they develop.

Other notable events

Recently we were successful with an HRDC application to characterise Australian PCN populations and determine the level of virulence within the populations. This work will compliment an existing screening project with the Victorian potato breeder Roger Kirkham. Roger has been breeding lines with potential resistance to *G. rostochiensis* and has not been able to test them in Australia. Using the quarantine station mentioned earlier we can test them for him. At present we use our local PCN populations but when we have built up sufficient Australian PCN we will test with them.

A possible first: An extinction curve for PCN.

In 1976 we set up separate populations of *G. rostochiensis* and *G. pallida* in three different soil types and locations. No hosts were planted with them and changes in the populations were the result of natural hatch or mortality.
The viability of the populations has been monitored over the last 18 years. In 1994 we can report that both species have died out.
There were differences in the decline rate between species and soil types.

John Marshall

News from the West

Research on the biological control of the annual ryegrass toxicity (ARGT) nematode and bacteria over the last three years was funded by the Australian Wool Research and Promotion Organisation (AWRAP). The research has given most interesting results. It appears that the twist fungus (*Dilophospora alopecuri*) is having an important role in the natural decline of ARGT in Western Australia. As the fungus is common in South Australia and Victoria, it is likely to be doing a similar job there. Experiments with container-grown ryegrass confirmed field observations and showed that the impact of the fungus was far greater on the bacterium than the nematode. The fungus was successfully established at experimental sites in the Midlands region of WA where ARGT continues to be a problem and the fungus does not occur naturally.

The plans for the next few years are to monitor the effects of the fungus on the ARGT organisms in the inoculated field sites, continue experimental studies on the biology of the fungus and to develop methods for its mass culture and distribution. There are large areas of WA that are infested with the ARGT organisms but are outside the current distribution of the fungus. Experimental studies would cover aspects such as host specificity, optimal strain selection, examination of genetic variation, population dynamics and optimisation of inoculant preparation and storage.

Unfortunately in the current funding climate AWRAP was unable to support the new project for the forthcoming financial year. However, my department views the twist fungus as the most promising opportunity for long-term control of ARGT and work will continue with internal funding.

Technical support is provided by Nuccia Eyres; having returned from maternity leave, Nuccia now Job-shares with Sandy-Mack.

Ian Riley, Western Australian Department of Agriculture, South Perth

Research

Pratylenchus thornei is causing yield losses in Victorian wheat crops.

Russell Eastwood, Angela Smith and Jayne Wilson
Victorian Institute for Dryland Agriculture, Horsham, VIC.

Introduction

In Victoria, little is known about the importance of *P. thornei* in cropping systems, but in recent years chickpeas have become an important crop often grown in rotation with wheat. This has created a situation where the nematode is able to multiply to high numbers in the soil.

These experiments used the nematicide Temik (aldicarb) to determine yield losses caused by *P. thornei* in Meering, Gatcher and GS50A wheat, Schooner barley, Bonzer field pea and Desavic chickpea and from this to suggest management strategies to minimise yield loss.

Materials and Methods

Trials were located on the properties of four farmers situated at Swanwater, Gooroc, Donald and Vectis. Sites were selected that had low, moderate and high populations of *P. thornei* and very low cereal cyst nematode levels.

The design of field trials comprised of 20mx6 row (1m) plots, with 3-4 reps and randomised plots split for Temik application.

Gooroc, Swanwater and Vectis trials were grown on friable grey clay, and the Donald trial on friable red clay.

Nematode populations were estimated from 2 x 200g wet wt soil plus roots sampled 0-15, 15-30, 30-50 and 50-70 cm with a 7.5cm diameter soil auger at 10 points within each plot.

Results

Temik effectively controlled *P. thornei* to a depth of 30cm (Figure 1), however more than 50% of the total nematode population was found below 30cm in the soil at some sites. Further research will investigate the depth profile of nematode numbers in the soil.

Nematode numbers significantly decreased during the November sampling at the Swanwater site (Figure 1). This appears to be an effect of the nematode extraction procedure used (Smith, 1994).

Figure 1. Effect of Temik and crop on *P. thornei* soil plus roots population, 0-30cm, Swanwater.

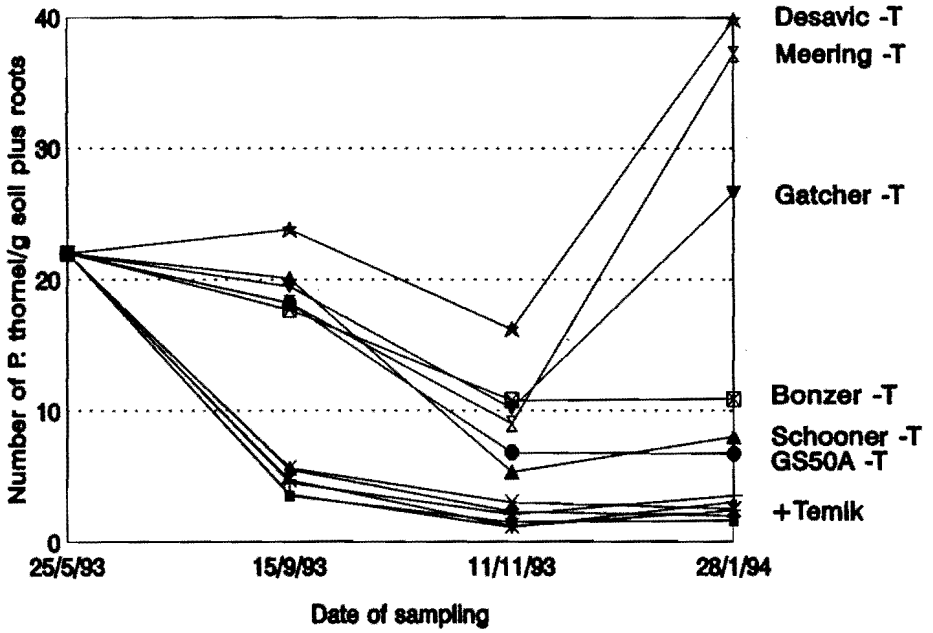


Table 1. Effect of Temik application on grain yield and plant top dry matter at four field sites.

Site and character assessed	Initial nematode population *P. thornei*/g soil	Crop [a]Response to Temik (%)					
		Wheat Meering	Wheat Gatcher	Wheat GS50A	Barley Schooner	Chickpea Desavic	Field pea Bonzer
'Swanwater'	22						
Grain Yield		44***	8	3	10	13*	16*
Top Dry Matter		34**	9	3	11	30***	16**
'Vectis'	13						
Grain Yield		22***	21**	-2	8**	3	6
'Gooroc'	8						
Grain Yield		8	NA	NA	-5	-	-
Top Dry Matter		5	NA	NA	-6	-3	23
'Donald'	4						
Grain Yield		9	NA	NA	13	1	-14

NA - Not applicable, these cultivars were not sown at these sites.

[a] (+Temik - -Temik / -Temik x 100 = %)

*** Very significant difference (only 1% likelihood of the difference being due to chance)

** Highly significant difference (only 5% likelihood of the difference being due to chance)

* Significant difference (only 10% likelihood of the difference being due to chance)

Desavic Meering and Gatcher multiplied nematode numbers to between 120 and 180% of the initial population during a single cropping cycle at the Swanwater site. Bonzer, Schooner and GS50A caused a decline in the nematode population to between 38 and 54% of the initial levels.

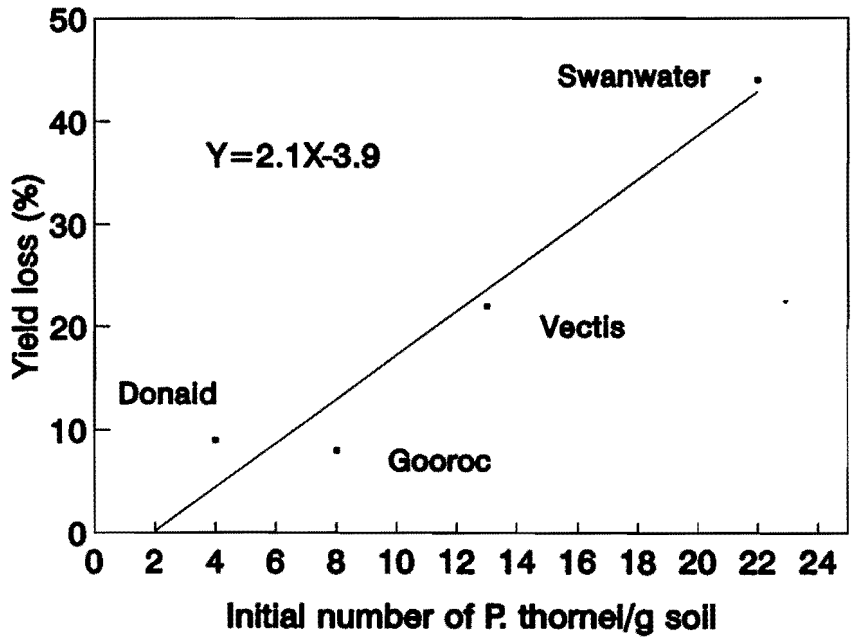
Temik significantly increased grain yield at two sites (Table 1). At Swanwater increases in the yield of Meering, Desavic Bonzer of 44, 13 and 16% respectively were associated with an initial nematode population of 22 *P. thornei*/g soil. At Vectis increases in the yield of Meering, Gatcher and Schooner of 22, 21 and 8% respectively were associated with an initial nematode population of 13 *P. thornei*/g soil. No significant yield responses were observed at the Gooroc and Donald sites where initial soil populations of *P. thornei* were relatively low. No yield data could be obtained from the chickpea and pea plots at Gooroc as these plots were destroyed by sheep.

Plant top dry matter increased in response to Temik application at the Swanwater site for Meering, Desavic and Bonzer and all were associated with yield responses.

An association between yield loss (%) and initial number of *P. thornei*/g soil for Meering wheat was estimated from the yield losses measured at the four sites (Figure 2). The relationship was:

Yield loss = 2.1 x Initial number of *P. thornei*/g soil - 3.9

Figure 2. Yield loss vs initial density of *P. thornei*/g soil for Meering wheat.



Discussion

The sites used in this study were selected because of the frequency with which wheat and chickpeas had been grown in the rotation. As wheat and chickpeas are good hosts of

P. thornei these sites were expected to have high nematode populations, which they had. The site at Swanwater had at least five consecutive years of good hosts and the nematode population was at a level which caused significant yield losses. The other sites in the study had similar histories, although the site at Donald had two years 'break' (barley and fallow) in the previous six years and also had the lowest number of nematodes of the four sites.

The Swanwater site had to be resown due to mice damage. A few plants survived from the initial sowing and these showed less yellowing and growth reduction in the absence of nematicide than did plants from the second sowing of this site. This could indicate that *P. thornei* is more damaging when the crop is sown later, or that temik is more effective when applied several weeks before sowing of the crop. This is currently being investigated in our 1994 field trials.

Nematode numbers from soil and root samples from these field trials indicate that Schooner, GS50A and Bonzer were poor hosts of *P. thornei*, that Gatcher was an intermediate host and that Meering and Desavic were good hosts. In 1994, plots have been sown over the 1993 plots at the Swanwater and Vectis sites to use the different numbers of *P. thornei* generated by the previous crops, to determine their effect on wheat and chickpea yields. This will provide a measure of the effect of controlling *P. thornei* by means other than a nematicide.

These results are the first evidence that *P. thornei* is causing yield losses in field crops in Victoria and that it has the potential to reduce yields by at least 44% in wheat and by smaller amounts in other crops. These measurements are from one year only and should be interpreted with caution, however they suggest that *P. thornei* causes approximately 2% yield loss per *P. thornei*/g soil for Meering and that there is a threshold level below which no yield loss occurs. This may be around 2 *P. thornei*/g soil.

These results suggest that the yield loss can be managed and minimised by rotation of crop species. We hope to demonstrate this in a three year rotation trial which has been established in 1994. A wide range of crops are being used to demonstrate whether a single or two year break crop is sufficient to manage nematode numbers below a potentially damaging level.

As well as determining what levels of yield loss root lesion nematodes can cause, it is important to know what proportion of cropping land has nematode populations at damaging levels. To determine this a survey is being conducted across the Wimmera, Mallee and North Central regions of Victoria. Cropping rotations over the past six years are being detailed and related to these nematode populations. Results of this survey will be included in future articles.

References

Smith, A.V. (1994). Examining the rate of extraction for Pratylenchus thornei in soil and root samples. *Australasian Nematology Newsletter*. 5(2) (This issue).

Examining the rate of extraction for *Pratylenchus thornei* in soil and root samples.

Angela Smith, Victorian Institute for Dryland Agriculture,
Horsham, VIC.

Introduction

The work at VIDA Horsham involves determining whether *Pratylenchus thornei* causes yield losses in cereal and grain legumes in the Wimmera region of Victoria. This requires extensive soil sampling and extraction to accurately estimate nematode populations.

Typically we extract duplicate 200g wet weight soil and root subsamples in a mesh tray lined with two tissues, which is then placed in a slightly larger plastic tray. A 2g/l solution of aluminium sulphate is added to the bottom tray until the soil is just wet. Distilled water is then added until the soil is saturated, but not waterlogged, with excess water in the tray.

Samples are extracted at 22 degrees for four days with additional water added where needed.

Unexpected results from trials in 1992 and 1993, where total nematode numbers appeared to decline during the growing season (Eastwood *et.al*, 1994), led us to question if a four day extraction is sufficient time to extract the majority of the *P.thornei* population, and is it sufficient time to extract a consistent proportion of the total population? Experiments were conducted to determine the rate of extraction of *P.thornei* from soil and root samples.

Materials and Method

Soil and root extractions

Samples were collected from Vectis and Swanwater trial sites in December and January over a range of different crops. Extractions followed our usual procedure. At the end of the four day period the water was removed and fresh distilled water was added. The extraction then proceeded for another four days and again the water was removed and replaced. This was carried out over a twelve day period.

Root extractions

Root samples were collected in November from the range of different crops in our trial at Gooroc. Within each plot, root systems were collected from five plants at three different points. Roots were washed, cut into smaller fragments, and a five gram wet weight subsample placed in a 250ml Schott bottle, with 100ml of rainwater. The samples were placed on a mechanical shaker and every two to three days the water was collected and replaced.

Results

Soil and roots

Figures 1 and 2 demonstrate that by day twelve the number of nematodes are approaching the maximum that will be extracted. In the soil samples from Vectis, an average of 70% (range 61-76%) of the nematodes were extracted by day four, (Figure 1, table 1). Similarly, 78% (range 61-89%) of the nematodes were extracted by day four from the Swanwater soil samples, (Figure 2, table 1).

Roots

In the root samples from Gooroc, an average of 57% (range 45-68%) of the nematodes were extracted by day five and 72% (range 61-84%) by day seven, (Figure 3, table 2).

Discussion

Soil and roots

The soil and root samples were taken late in the season, when the crops were almost fully mature and so the roots were likely to be relatively unfavourable for the nematodes, at which time we expect they would be relatively easy to extract; similar to extraction from soil alone. As the extraction times were increased the percentage of nematodes extracted was more consistent, however by increasing the extraction time from four to eight days, only 20% more nematodes were extracted. Given the limitations of space, extraction materials and the need to extract a large number of soil samples, it seems that an eight day extraction is not warranted for such samples.

In a four day extraction approximately 70-80% of the total number of nematodes which could be extracted will be extracted.

Roots

The rate of extraction from live roots appears to be slower than from soil, with dead roots present. Also there is indication that cereal crops (Schooner and Meering) require longer extraction times than grain legumes (Desavic and Bonzer). This knowledge has implications for monitoring nematode populations during the growing season. When a large number of fresh roots are present in the soil, most of the *P.thornei* population may be inside the roots. If however samples are then taken which include both soil and roots, the proportion of the total population extracted over four days may be lower during the growing season because of the lower rate at which the nematodes emerge from roots compared to soil. This may be why the total *P.thornei* populations 'apparently' decreased at the November sampling in the trials of (Eastwood *et.al*, 1994). The implications of this are, longer extraction times are necessary to accurately estimate *P.thornei* populations if soil plus root samples are extracted. Eight days may be a more appropriate extraction time, but for each time of sampling it would be beneficial to estimate the total possible extraction by using even longer extraction times on some of the samples.

References

Eastwood, R. *et.al* (1994). Pratylenchus thornei is causing yield losses in Victorian wheat crops. *Australasian Nematology Newsletter*. 5(2) (This issue).

Figure 1:- Rate of extraction of *P.thornei* from soil samples. Vectis (10/12/93)

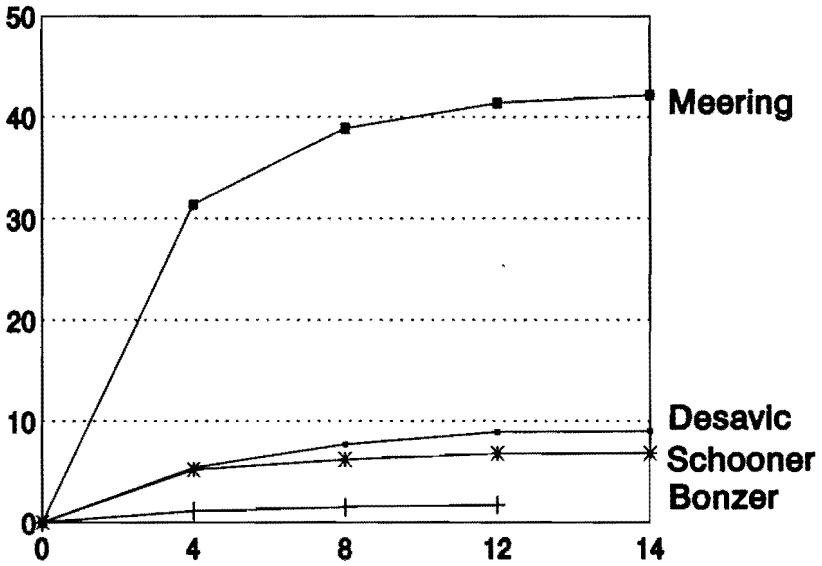


Table 1:- Rate of extraction of *P.thornei* from soil samples as a percentage of the total number extracted at 12 days. Samples taken from Vectis (10/12/93) and Swanwater (28/1/94) trial sites.

	Vectis		Swanwater	
Crop	**4 days(%)**	**8 days(%)**	**4 days(%)**	**8 days(%)**
Desavic	61	87	89	96
Bonzer	65	88	75	93
GS50A	-	-	86	98
Gatcher	-	-	78	96
Schooner	76	91	78	96
Meering	76	94	61	82
Mean	70	90	78	94

Figure 2:- Rate of extraction of *P.thornei* from soil samples. Swanwater (28/1/94)

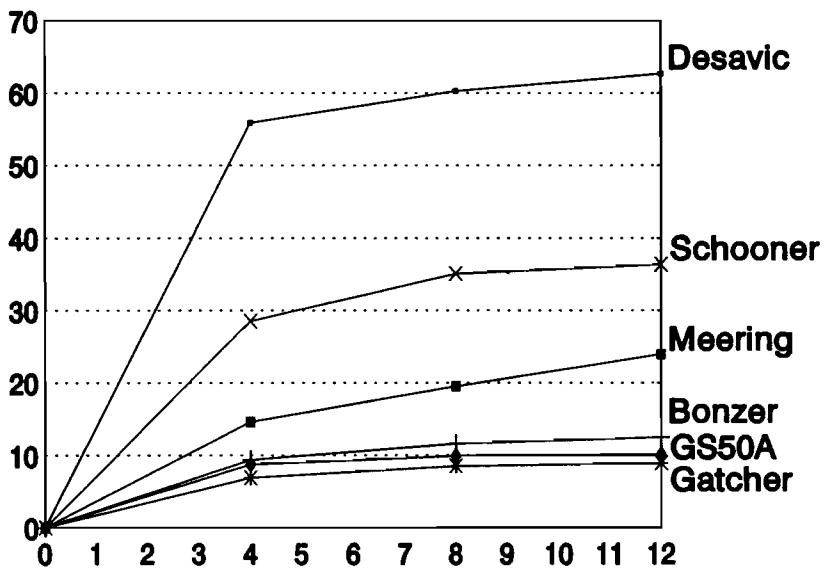


Figure 3:- Rate of extraction of *P.thornei* from root samples. Batters (Gooroc) 26/10/93.

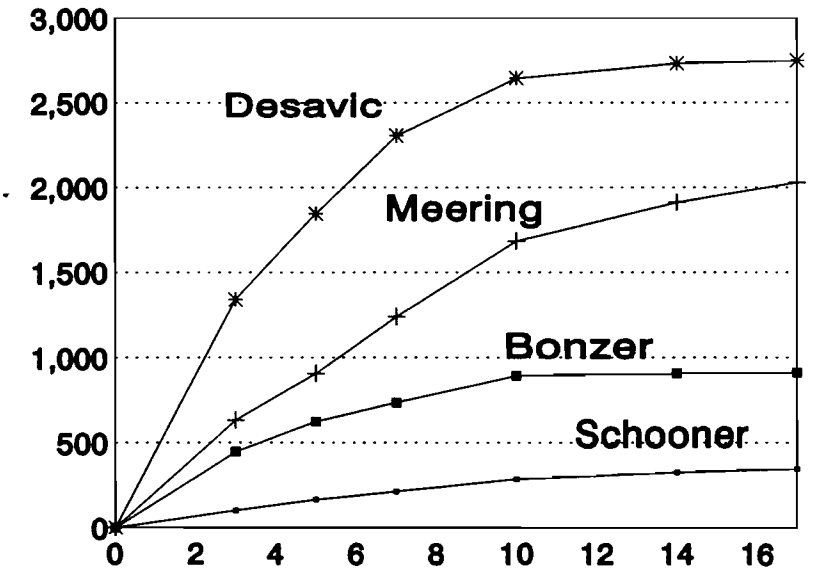


Table 2:- Rate of extraction of *P.thornei* from root samples as a percentage of the total number extracted at 17 days. Samples taken from Gooroc (26/10/93) trial site.

Crop	3 days(%)	5 days(%)	7 days(%)	10 days(%)	14 days(%)
Desavic	49	67	84	96	99
Bonzer	49	68	81	98	99
Schooner	30	48	62	82	94
Meering	31	45	61	83	94
Mean	40	57	72	90	97

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