Weed surveys of Bundaberg and Cudgen sweetpotato farms

PW17001 Final report Appendix 8 Integrated pest management of nematodes in sweetpotato

Mary Firrell August 2023

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The Department of Agriculture and Fisheries proudly acknowledges all First Nations peoples (Aboriginal peoples and Torres Strait Islanders) and the Traditional Owners and Custodians of the country on which we live and work. We acknowledge their continuing connection to land, waters and culture and commit to ongoing reconciliation. We pay our respect to their Elders past, present and emerging.

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Introduction

Surveys of commonly occurring weeds in sweetpotato crops were made at intervals from November 2019 – September 2022 at both Cudgen and Bundaberg.

Methodology

The weeds were identified to species or genus level and the nematode-host database, Nemaplex, was used to determine if the most commonly occurring weeds identified, were root knot nematode hosts. As this is a large database with multiple entries for many species, some conflicting host status has been reported, no doubt due to genetic, edaphic and climatic factors affecting both plant and nematode.

Results and Discussion

A list of weeds surveyed, was tabulated with the common and scientific names of the weeds, the season and district they were found in and the susceptibility of these weeds to *Meloidogyne javanica, M. incognita* and M. *enterolobii* and to *Rotylenchulus reniformis*. This susceptibility information is sourced solely from the Nemaplex database and although the status of *M enterolobii* (Guava root knot nematode) is often unknown, it would be reasonable to assume for each weed, that this would be similar to other Meloidogyne species. The table is contained in Appendix 8.

Observations of note during the in-field surveys are as follows.
Despite a mature sweetpotato crop giving good coverage which should out compete weeds, crops were observed during the survey, with heavy, nematode susceptible, weed infestations.
During the field surveys, observations were also made of paddocks with nematode resistant cover crops which had been mulched and left on the soil surface to provide a dense trash blanket. This was extremely effective in suppressing weed growth, while allowing the cover crop to regrow and provide more biomass for later incorporation.

Although the tabulated information in appendix 8 lists susceptibility or resistance status of weeds to root knot nematode, the best method of avoiding the proliferation of plant pathogenic nematodes is cover cropping with a known nematode resistant cover crop, as even relatively poor hosts can allow root-knot nematode to persist in a field between crops.

Bare fallow is also an effective strategy for reducing nematode populations, however, is not recommended from a soil health perspective and control of weeds in bare fallow is essential.

Conclusion

Ad hoc sampling of weeds in field trials and during grower visits revealed the presence of root-knot nematode on many common horticultural weeds and demonstrated the very wide host range of the pests. Even relatively poor hosts can allow root-knot nematode to persist in a field at elevated levels between sweetpotato crops, so control of weeds in bare fallows and resistant rotations is essential. Due to the very wide host range, it is wise to assume that all weeds are hosts for root-knot nematode.

Key points

A table has been produced identifying the most commonly encountered weeds in sweetpotato crops and the host status recorded of susceptibility to root knot nematode. See appendix 8.

As root knot nematode have a very wide host range all weeds should be considered hosts.

Control of weeds in a resistant cover crop or bare fallow is essential.

Introduction

Information on the host status of the most common weeds was obtained, and by using the Nemaplex website and other literature to locate published information. by checking roots for galling and egg masses representative collection of weeds in the field

Methodology

During the project, a number of weed species were identified during soil sampling trips to grower's farms in Cudgen and Bundaberg.

Collections were made in:

- November 2019
- October 2020
- January 2021
- September 2021
- April 2022
- September 2022

Only species that were commonly occurring in a single paddock or were occurring across a range of farms were identified for use with the nematode – host database, Nemaplex.

The database 'Nemaplex' was developed by Howard Ferris at University of California Davis in 1999, and is a continually updated and maintained international, interactive database which can be accessed through a web browser. Research papers are referenced, and information extracted and compiled to give a host status of plants. Currently Nemabase has 61,701 entries with data on 7,285 different plants from 236 plant families and 1,614 nematode species. It references publications from all countries and over many years with some from the 1950s to the present.

Within Nemaplex, is a database of plant - host status and this was used to summarise and produce a table to compile information about the most commonly encountered weeds in sweetpotato paddocks in both Bundaberg and Cudgen. Some weeds were assessed for nematodes through observation of galls either in-field (image 3) or by growing field-collected seed in nematode inoculated pots in the GRF glasshouse where observation of galling was made (image 4). This was an opportunistic study as not all weeds were treated this way, but it allowed for casual observation using some readily available resources.

Results and discussion

Nemaplex is a large database with many entries for each weed species and some have conflicting susceptibility status, reported by various references (Figure 1 and Figure 2). As this is an international database, these differences could perhaps be attributed to different races of nematodes or even variations within weed species between countries. Where multiple entries document conflicting status, the worst case (and often the most frequently reported is used) in the table. The table contains duplicate entries of the same weed to capture the occurrence of a species throughout the seasons and regions e.g.: Blackberry nightshade (Solanum nigrum) was present in Bundaberg in late spring and summer and in Cudgen in mid-spring. Naturally, it may also occur at other times throughout the year, but our survey represents a snapshot of a particular location (farm) and time. Visual identification of cultivars and sometimes species, in field collected plants isn't always possible, so in some cases genus only, is used to identify the weed e.g.: Sorghum spp. This presents a complication as susceptibility can be cultivar dependent.

Table 1 below lists the common and scientific names of the weeds observed, the season and district they were found in and the susceptibility of these weeds to Meloidogyne javanica, incognita and enterolobii and to Rotylenchulus reniformis. This susceptibility information is sourced solely from the Nemaplex database and although the status of M enterolobii (Guava root knot nematode) is often not specified or unknown, it would be reasonable to assume, for each weed this would be similar to other Meloidogyne species.

Host Status of Plants to Nematodes

Do Another Search

Change Type of Search

Return to Nematode Management Menu

Go To Nemaplex Main Menu

or use your Browser Back Button to return to a nematode species page

Click on the any column head to sort by that parameter

If the form is blank, Nemabase was unable to find data on non-hosts or resistant plants for either of these species
Please note that does not mean that all plant species are hosts! Although resistant varieties and cultivars are reported, non-host status of plants is seldom reported in the literature

Susceptibility Glossary (Susc Column)

S = Susceptible	- high level of nematode reproduction
MS = Moderately Susceptible	- nematode reproduction somewhat reduced
MR = Moderately Resistant	- nematode reproduction considerably reduced
R = Resistant	- nematode reproduction severely suppressed
I = Immune	- no evidence of nematode feeding or reproduction

PgenusPspec	Pvar	Pcult	Pcommon	Pfamily	NgenusNspec	Nrace	Ncommon	Susc	REFERENCE
Bidens pilosa L.			Bidens; Bur Marigold; Hairy Beggarticks; Romeriilo; Picao-preto;	Asteraceae	Meloidogyne incognita		Meloidogyne; Southern Root-knot Nematode; Root-knot Nematode; Cotton Root-knot Nematode	R	Ntidi, K.N., H. Fourie & M. Daneel (2016) Greenhouse and field evaluations of commonly occurring weed species for their suitability to Meloidogyne species, International Journal of Pest Management, 62:1, 11-19, DOI: 10.1080/09670874.2015.1
Bidens pilosa L.			Bidens; Bur Marigold; Hairy Beggarticks; Romeriilo; Picao-preto;	Asteraceae	Meloidogyne incognita		Meloidogyne; Southern Root-knot Nematode; Root-knot Nematode; Cotton Root-knot Nematode	MR	Tsay, T.T., Wu, S.T., Lin, Y.Y. 2004. J. Nematology 36:36-41.
Bidens pilosa L.			Bidens; Bur Marigold; Hairy Beggarticks; Romeriilo; Picao-preto;	Asteraceae	Meloidogyne incognita		Meloidogyne; Southern Root-knot Nematode; Root-knot Nematode; Cotton Root-knot Nematode	R	Powers, L. E., and A. Pitty. 1993. Resistance of common weeds in Honduras to Meloidogyne incognita. Nematropica 23(No 211.
Bidens pilosa L.			Bidens; Bur Marigold; Hairy Beggarticks; Romeriilo; Picao-preto;	Asteraceae	Meloidogyne incognita		Meloidogyne; Southern Root-knot Nematode; Root-knot Nematode; Cotton Root-knot Nematode	S	Whitehead, A. G. 1969. The distribution of root-knot nematodes (Meloidogyne spp.) in tropical Africa. Nematologica 15:31

Figure 1 An extract from Nemaplex showing conflicting susceptibility status of Cobblers peg (Bidens Pilosa) to Meloiogyne incognita

PgenusPspec	Pvar	Pcult	Pcommon	Pfamily	NgenusNspec	Nrace	Ncommon	Susc	REFERENCE
Richardia scabra L.			Richardia; Mexican Clover; Florida Pusley;	Rubiaceae	Rotylenchulus reniformis		Rotylenchulus; Reniform Nematode;	S	Robinson, A. F., Inserra, R. N., Caswell-Chen, E. P., Vovlas, N., Troccoli, A. 1997. Review: Rotylenchulus species: Identification, distribution, host ranges, and crop plant resistance. Nematropica 27:127-180.
Richardia scabra L.			Richardia; Mexican Clover; Florida Pusley;	Rubiaceae	Rotylenchulus reniformis		Rotylenchulus; Reniform Nematode;	R	Davis, R.F. and Webster, T.M. 2005. Relative Host Status of Selected Weeds and Crops for Meloidogyne incognita and Rotylenchulus reniformis. Journal of Cotton Science 9:41-46.

PgenusPspec	Pvar	Pcult	Pcommon	Pfamily	NgenusNspec	Nrace	Ncommon	Susc	REFERENCE
Richardia scabra L.			Richardia; Mexican Clover; Florida Pusley;	Rubiaceae	Meloidogyne incognita		Meloidogyne; Southern Root-knot Nematode; Root-knot Nematode; Cotton Root-knot Nematode	S	Rich, J. R., J. A. Brito, R. Kaur, and J. A. Ferrell. 2008. Weed species as hosts of Meloidogyne : A review. Nematropica 39:157-185.
Richardia scabra L.			Richardia; Mexican Clover; Florida Pusley;	Rubiaceae	Meloidogyne incognita	Race 3	Meloidogyne; Southern Root-knot Nematode; Root-knot Nematode; Cotton Root-knot Nematode	R	Davis, R.F. and Webster, T.M. 2005. Relative Host Status of Selected Weeds and Crops for Meloidogyne incognita and Rotylenchulus reniformis. Journal of Cotton Science 9:41-46.

Figure 2 An extract from Nemaplex showing the conflicting susceptibility status of White eye (Richardia scabra) to R. reniformis (top) and Meloidogyne incognita (bottom).

Table 1 List of broadleaf weeds occurring in sweetpotato fields.

List of broadleaf weeds occurring in sweetpotato production fields. Mary Firrell DAF, August 2023.									
Common Name	**Scientific Name**	**Family**	**Region**	**Date**	**Season**	**Host Status M javanica**	**Host status M. incognita**	**Host status M. enterolobii**	**Rotylenchulus reniformis**
Bellvine	Ipomoea plebia	Convolvulaceae	Bundaberg	November 2019	Late Spring	Not specified	Not specified	Not specified	Not specified
Blackberry nightshade	Solanum nigrum	Solanaceae	Bundaberg	November 2019	Late Spring	Susceptible	Susceptible	Not specified	Susceptible
Fleabane	Conyza species	Asteraceae	Cudgen	November 2019	Late Spring	Susceptible	Susceptible	Not specified	Susceptible
Wild Radish	Raphanus raphanistrum	Brassicaceae	Cudgen	November 2019	Late Spring	Not specified	Susceptible	Not specified	Not specified
Thickhead	Crassocephalum crepidoides	Asteraceae	Cudgen	November 2019	Late Spring	Susceptible	Susceptible	Not specified	Not specified
Peppercress	Lepidium spp	Brassicaceae	Cudgen	November 2019	Late Spring	Susceptible	Susceptible	Not specified	Susceptible
Cobblers Peg	Bidens pilosa	Asteraceae	Cudgen	October 2020	Spring	Susceptible	Susceptible	Not specified	Susceptible
Blackberry Nightshade	Solanum nigrum	Solanaceae	Cudgen	October 2020	Spring	Susceptible	Susceptible	Not specified	Susceptible
Cress	Coronopus spp	Brassicaceae	Cudgen	October 2020	Spring	Susceptible	Susceptible	Not specified	Susceptible
Wild Hops or Apple of Peru	Nicandra physalodes	Solanaceae	Cudgen	October 2020	Spring	Susceptible	Susceptible	Not specified	Not Specified
Fat Hen	Chenopodium album or (less likely C murale)	Chenopodiaceae	Cudgen	October 2020	Spring	Susceptible	Susceptible	Not specified	Mod susceptible - Immune
Amaranth	Amaranthus sp	Amaranthaceae	Cudgen	October 2020	Spring	Susceptible	Susceptible	Not specified	Mod resistant
Milk thistle or Sow thistle	Sonchus oleraceus	Asteraceae	Cudgen	October 2020	Spring	Susceptible	Susceptible	Not specified	Susceptible
Castor oil	Ricinus communis	Euphorbiaceae	Cudgen	October 2020	Spring	Susceptible	Susceptible	Not specified	Susceptible
Fat Hen	Chenopodium album or (less likely C murale)	Chenopodiaceae	Cudgen	October 2020	Spring	Susceptible	Susceptible	Not specified	Mod susceptible - Immune
Wild Turnip	Brassica tournefortii -B. spp	Brassicaceae	Cudgen	October 2020	Spring	Susceptible	Susceptible	Not specified	Susceptible
Volunteer sweetpotato	Ipomoea batatas	Convolvulaceae	Cudgen	October 2020	Spring	Variety dependent	Variety dependent	Variety dependent	Variety dependent
Nut Grass	Cyperus rotundus or C esculentus	Cyperaceae	Cudgen	October 2020	Spring	Susceptible	Susceptible	Susceptible	Mod resistant
Sorghum	Sorghum spp	Poaceae	Cudgen	October 2020	Spring	Mod susceptible - Mod resistant	Mod susceptible - Mod resistant	Resistant	Susceptible
Volunteer sweetpotato	Ipomoea batatas	Convolvulaceae	Cudgen	October 2020	Spring	Variety dependent	Variety dependent	Variety dependent	Variety dependent
Phasey Bean	Macroptilium lathyroides	Fabaceae	Bundaberg	January 2021	Summer	Not specified	Susceptible	Not specified	Not specified
Nutgrass	Cyperus rotundus or C esculentus	Cyperaceae	Bundaberg	January 2021	Summer	Susceptible	Susceptible	Susceptible	Mod susceptible - Resistant
Blue Heliotrope	Heliotropum amplexicaule	Boraginaceae	Bundaberg	January 2021	Summer	Not specified	Not specified	Not specified	Not specified
Black Pigweed	Trianthema portulacastrum	Aizoacaea	Bundaberg	January 2021	Summer	Susceptible	Not specified	Not specified	Immune
White eye/ Mexican clover	Richardia scabra	Rubiaceae	Bundaberg	January 2021	Summer	Not specified	Susceptible	Not specified	Susceptible
Blackberry nightshade	Solanum nigrum	Solanaceae	Bundaberg	January 2021	Summer	Susceptible	Susceptible	Not specified	Susceptible
Bellvine	Ipomoea plebia	Convolvulaceae	Bundaberg	January 2021	Summer	Not specified	Not specified	Not specified	Not specified

Pigweed	Portulaca oleraceae	Portulacaceae	Bundaberg	January 2021	Summer	Susceptible	Susceptible	Susceptible	Susceptible
Potato weed	Galinsoga parviflora	Asteraceae	Bundaberg	January 2021	Summer	Susceptible	Susceptible	Not specified	Susceptible
Blue billygoat weed	Ageratum houstonianum and A conyzoides	Asteraceae	Bundaberg	January 2021	Summer	Susceptible	Susceptible	Not specified	Susceptible
Couch grass	Cynodon spp	Poaceae	Bundaberg	January 2021	Summer	Susceptible	Susceptible	Not specified	Mod Resistant
White eye	Richardia scabra	Rubiaceae	Bundaberg	September 2021	Spring	Not specified	Susceptible	Not specified	Susceptible
Blue billygoat weed	Ageratum houstonianum and A conyzoides	Asteraceae	Bundaberg	September 2021	Spring	Susceptible	Susceptible	Unknown	Susceptible
Potato weed	Galinsoga parviflora	Asteraceae	Bundaberg	September 2021	Spring	Susceptible	Susceptible	Not specified	Susceptible
Volunteer sweetpotato	Ipomoea batatas	Convolvulaceae	Bundaberg	September 2021	Spring	Variety dependent	Variety dependent	Variety dependent	Variety dependent
Milk thistle	Sonchus oleraceus	Asteraceae	Cudgen	April 2022	Autumn	Susceptible	Susceptible	Not specified	Susceptible
Nutgrass	Cyperus rotundus or C esculentus	Cyperaceae	Cudgen	April 2022	Autumn	Susceptible	Susceptible	Susceptible	Mod susceptible - resistant
Sedge	Cyperus iria or C difformis	Cyperaceae	Cudgen	April 2022	Autumn	Not specified	Not specified	Not specified	Not specified
Wild Hops	Nicandra physalodes	Solanaceae	Cudgen	April 2022	Autumn	Susceptible	Susceptible	Not specified	Not specified
Stinking Roger	Tagetes minuta	Asteraceae	Cudgen	April 2022	Autumn	Mod Resistant	Resistant	Not specified	Not specified
Rhodes grass	Chloris gayana	Poaceae	Cudgen	April 2022	Autumn	Variety dependent	Susceptible	Not specified	Immune
Siratro	Macroptilium atropurpureum	Fabaceae	Cudgen	April 2022	Autumn	Not specified	Susceptible	Not specified	Not specified
Rattlepod	Crotalaria spp	Fabaceae	Cudgen	April 2022	Autumn	Not specified	Not specified	Not specified	Not specified
Capeweed	Arctotheca calendula	Asteraceae	Cudgen	September 2022	Spring	Not specified	Not specified	Not specified	Not specified
Wild radish	Raphanus raphanistrum	Brassicaceae	Cudgen	September 2022	Spring	Not specified	Susceptible	Not specified	Not specified

Observations of note during the in-field surveys are as follows.

Despite a mature sweetpotato crop giving good coverage which should out compete weeds, crops were observed during the survey, with heavy, nematode susceptible, weed infestations.

Image 1 A sweetpotato crop with an infestation of potato weed (Galinsoga parviflora)

During the field surveys, observations were also made of paddocks with nematode resistant cover crops which had been mulched and left on the soil surface to provide a dense trash blanket. This was extremely effective in suppressing weed growth, while allowing the cover crop to regrow and provide more biomass for later incorporation.

Image 2 A sorghum cover crop with a dense trash blanket suppressing weed growth.

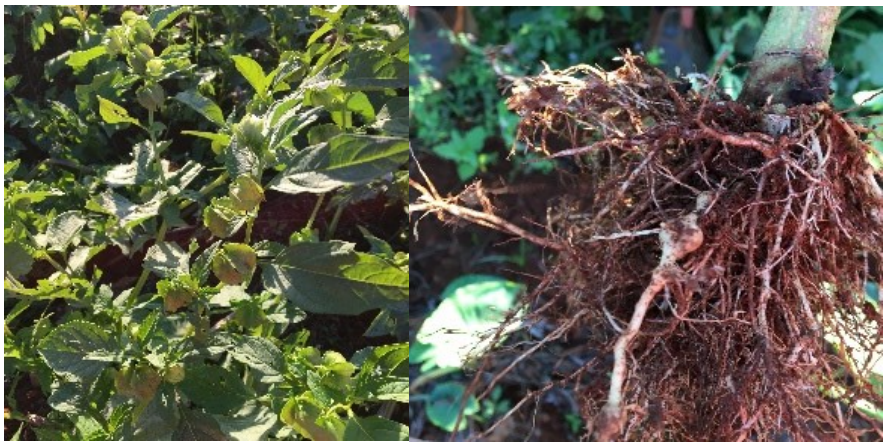

Image 3 Gooseberry (*Physalis angulata*) weed from a sweetpotato field with galling on the root.

Image 4 Amaranth spp., collected from a sweetpotato field and grown in a pot inoculated with nematode (b) galling on the root of the amaranth plant (c).

Photographs were taken and images of some weeds identified during the survey are included below.

Image 5 Left, Blue heliotrope (Heliotropum amplexicaule). Right, Black Pigweed (Trianthema portulacastrum)

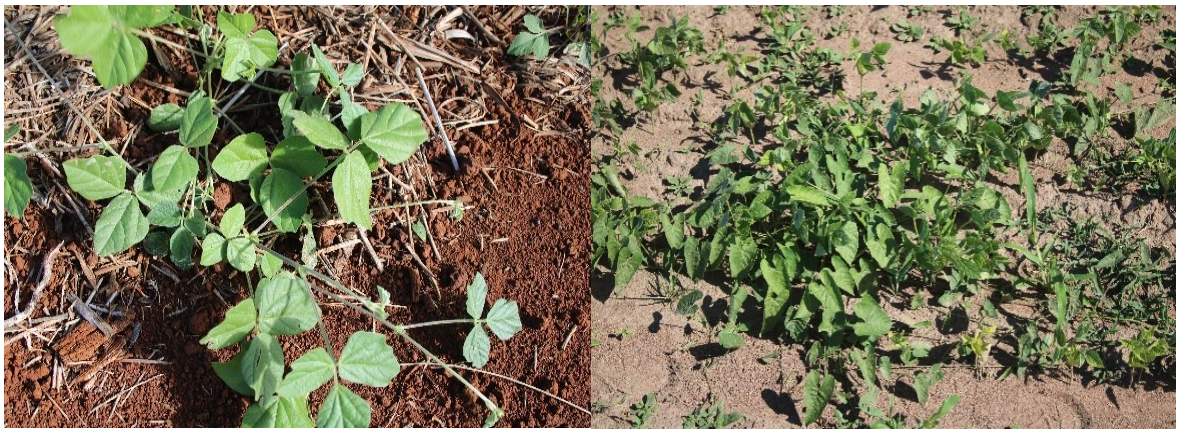

Image 6 Left, Siratro (Macroptilium atropurpureum). Right, Bellvine (Ipomoea plebia).

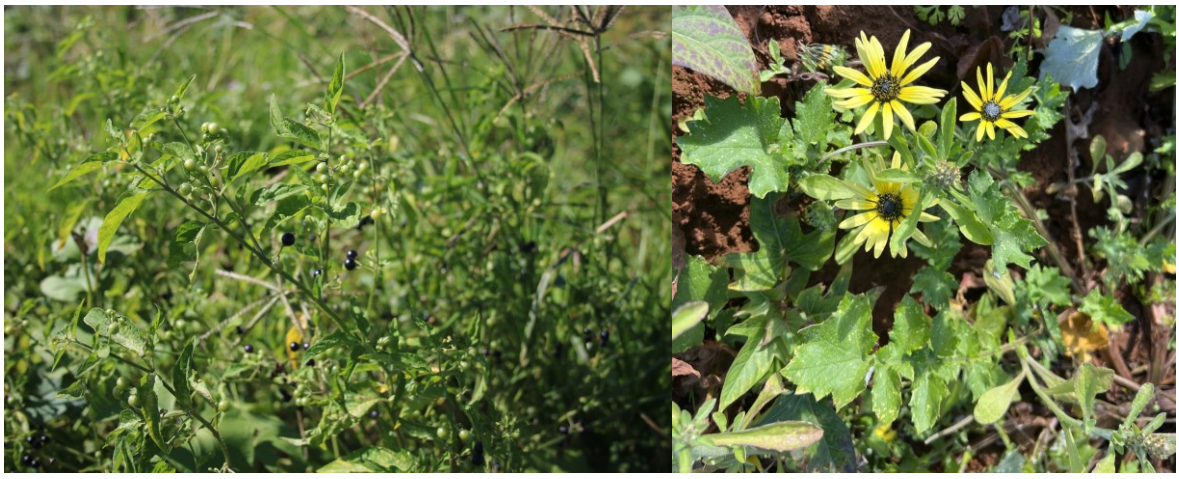

Image 7 Left, Blackberry nightshade (Solanum nigrum). Right, Capeweed (Arctotherca calendula).

Image 8 Mexican poppy (Argemone spp)

Conclusion

Ad hoc sampling of weeds in field trials and during grower visits revealed the presence of root-knot nematode on many common horticultural weeds and demonstrated the very wide host range of the pests. While table 1 in appendix 8 lists susceptibility or resistance status of weeds to root knot nematode, the best method of avoiding the proliferation of plant pathogenic nematodes is cover cropping with a known nematode resistant cover crop, as even relatively poor hosts can allow root-knot nematode to persist in a field between crops. Bare fallow is also an effective strategy for reducing nematode populations, however, is not recommended from a soil health perspective and control of weeds in bare fallow is essential. Due to the very wide host range, it is wise to assume that all weeds are hosts for root-knot nematode.

References

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