21st Symposium

of the

Nematological Society of Southern Africa (NSSA)

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Programme of Events
7 - 10 May 2017

SUNDAY 7 May 2017	
14:00 - 18:00	**REGISTRATION**
18:00 - 21:00	**WELCOMING FUNCTION**
MONDAY 8 May 2017	
07:30 - 07:50	**REGISTRATION**
	OPENING
07:50 - 08:00	**WELCOME -** Mr. MC Pretorius - President of the NSSA
08:00 - 08:10	**SYMPOSIUM ARRANGEMENTS -** Mrs Prabashnie Ramouthar - Symposium Chairperson
SESSION 1: CHAIRPERSON - Rinus Knoetze	
08:10 - 09:10	**GUEST/OPENING SPEAKER** NEW BEGINNINGS? PREPARING FOR, AND ADAPTING TO, PROJECTED CLIMATE CHANGE IN SOUTH AFRICA'S AGRICULTURE SECTOR Prof. Roland Schulze
09:10 - 09:40	**KEYNOTE SPEAKER** SOIL AGROECOLOGY: UNDERSTANDING MULTI-TROPHIC INTERACTIONS IN THE SOIL TO ENHANCE THE BIOCONTROL OF INSECTS Raquel Campos-Herrera
09:40 - 09:55	STATUS OF ENTOMOPATHOGENIC NEMATODES AND THEIR ASSOCIATED SYMBIOTIC BACTERIA FROM SOUTH AFRICA Antoinette Malan
09:55 - 10:10	ENTOMOPATHOGENIC NEMATODE APPLICATIONS IN ORCHARDS: INSECT ASSASSINS OR FOOD FOR THE NEMATODE NATION Caro Kapp
10:10 - 10:40	**REFRESHMENTS**
SESSION 2: CHAIRPERSON - Tia Ferreira	
10:40 - 10:55	POTENTIAL OF ENTOMOPATHOGENIC NEMATODES TO CONTROL WOOLLY APPLE APHID (*ERIOSOMA LANIGERUM*) Nomakholwa Stokwe
10:55 - 11:10	FORMULATION OF *STEINERNEMA YIRGALEMENSE* IN ALGINATE BEADS AND DIATOMACEOUS EARTH Nicholas Kagimu
11:10 - 11:25	POTENTIAL OF *STEINERNEMA YIRGALAMENSE* AS BIOLOGICAL CONTROL AGENT OF THE AFRICAN STEM BORER COMPLEX Sonia Steenkamp

11:25 -11:40	EFFICACY OF ENTOMOPATHOGENIC NEMATODES AGAINST SOUTH AFRICAN WHITE GRUBS Brett Hurley
11:40 - 11:55	ENTOMOPATHOGENIC NEMATODES (STEINERNEMATIDAE AND HETERORHABDITIDAE) FROM THE NORTH-EASTERN PARTS OF SOUTH AFRICA AND THEIR BIOCONTROL POTENTIAL AGAINST THE FALSE CODLING MOTH, *THAUMATOTIBIA LEUCOTRETA* (LEPIDOPTERA: TORTRICIDAE) Willem Steyn
11:55 - 12:10	EVALUATION OF THE ABOVE-GROUND APPLICATION OF ENTOMOPATHOGENIC NEMATODES FOR THE CONTROL OF DIAPAUSING CODLING MOTH (*CYDIA POMONELLA)* Deidre Odendaal
12:10 - 12:25	ENTOMOPATHOGENIC NEMATODES FOR THE CONTROL OF *BRADYSIA IMPATIENS* (DIPTERA: SCARIDAE) UNDER OPTIMAL CONDITIONS Agil Katumanyane
12:25 - 12:40	ENTOMOPATHOGENIC NEMATODES FOR THE CONTROL OF THE FALL ARMY WORM *SPODOPTERA FRUGIPERDA* Tia Ferreira
12:40 - 12:55	NEMATODES ASSOCIATED WITH TERRESTRIAL SLUGS IN THE WESTERN CAPE PROVINCE OF SOUTH AFRICA Jenna Ross
13:00 - 14:00	**LUNCH**
SESSION 3: CHAIRPERSON - **Driekie Fourie**	
14:00 -14:15	DOES MORPHOLOGICAL AND MOLECULAR DATA SYNCHRONIZE FOR THE FAMILY CEPHALOBIDAE (NEMATODA, RHABDITIDA)? Ebrahim Shokoohi
14:15 - 14:30	USE OF VARIOUS MOLECULAR AND MORPHOLOGICAL TECHNIQUES TO IDENTIFY *MELOIDOGYNE ENTEROLOBII* POPULATIONS FROM SOUTH AFRICA Milad Rashidifard
14:30 - 14:45	EXTRACTION AND IDENTIFICATION OF COMMON FREE-LIVING NEMATODE FAMILIES FROM SOUTH AFRICA Gerhard Du Preez and Milad Rashidifard
14:45 - 15:00	MOLECULAR IDENTIFICATION OF *MELOIDOGYNE* SPECIES PARASITISING MAIZE IN SOUTH AFRICA Maretha Pretorius
15:00 - 15:15	CURVE-FITTING ALLELOCHEMICAL RESPONSE DATA COMPUTER MODEL FOR PHYTONEMATICIDE CONCENTRATIONS Phato Mashela
15:15 - 15:30	VILLA CROP PROTECTION TO INTRODUCE NEW TECHNOLOGIES IN CROP PROTECTION John MacIntyre
15:30 - 16:00	**REFRESHMENTS**
16:00 - 17:00	**MEETING - BGM**
19:00 - 21:00	**EPN WORKSHOP Chairpersons: Mieke Daneel and MC Pretorius**

TUESDAY 9 May 2017	
08:00 - 10:20	**BAYER WORKSHOP**
CHAIRPERSON - Dirk Uys and MC Pretorius	
08:00 - 08:20	Opening Address: Dr. Andre Jooste - ECONOMICS OF NEMATODE CONTROL IN POTATO
08:20 - 08:35	A REAPPRAISAL OF STRATEGIES USED TO CONTROL NEMATODE PESTS IN SOUTH AFRICAN GRAIN-BASED CROPPING SYSTEMS Driekie Fourie
08:35 - 08:50	NEMATODE CONTROL IN DECIDUOUS FRUITS Sheila Storey
08:50 - 09:05	NEMATODE CONTROL IN VEGETABLE CROPS - WHAT IS THE WAY FORWARD? Mieke Daneel
09:05 - 09:20	AVICTA® COMPLETE CORN – A GLOBAL STANDARD FOR NEMATODE CONTROL Brigitte Slaats
09:20 - 10:20	Discussion
10:20 - 10:40	**REFRESHMENTS AND SYMPOSIUM PHOTO**
SESSION 4: CHAIRPERSON - Brigitte Slaats	
10:40 - 11:10	**KEYNOTE SPEAKER** THE ROLE OF NATURAL SUPPRESSION IN MANAGING ROOT-KNOT NEMATODES IN COTTON Patricia Timper
11:10 - 11:25	REDUCING PESTICIDE USE AND RELIANCE IN URBAN VEGETABLE SYSTEMS THROUGH NEMATODE CONTROL Danny Coyne
11:25 - 11:40	COMPARING EFFICACIES OF PHYTONEMATICIDES AND SYNTHETIC CHEMICAL NEMATICIDES ON REPRODUCTIVE POTENTIAL OF ROOT-KNOT NEMATODES ON FIELD POTATOES Kgabo Pofu
11:40 - 11:55	"WRAP & PLANT": USE OF A BANANA PAPER BIODEGRADABLE MATRIX FOR THE CONTROL OF PLANT PARASITIC NEMATODES (*GLOBODERA ROSTOCHIENSIS* AND *MELOIDOGYNE* SPP.) IN POTATO AND YAM IN SUB-SAHARAN AFRICA Laura Cortada
11:55 - 12:10	SENSITIVITY OF *MELOIDOGYNE INCOGNITA* JUVENILE HATCH AND MORTALITY TO NEMARIOC-AL PHYTONEMATICIDE Zakheleni Dube
12:10 - 12:25	SOIL AMENDMENTS WITH EXTRACTED JUICES AND OILS OF FIVE PLANT SPECIES OF CITRUS FRUITS FOR THE CONTROL OF *MELOIDOGYNE* SPP ON TOMATO UNDER FIELD CONDITIONS Grace Tefu

12:25 - 12:40	CONSERVATION AGRICULTURE – DO WE GET BETTER YIELDS AND WHAT IS BEHIND IT? Mieke Daneel
12:40 - 12:55	HOST-STATUS AND HOST-SENSITIVITY OF SWEET POTATO CULTIVAR MVUVHELO TO *MELOIDOGYNE INCOGNITA* Mmboniseni Meshack Makhwedzhana
12:55 - 13:10	TOWARDS IMPROVING NEMATODE TOLERANCE TESTING FOR SUGARCANE VARIETIES Prabashnie Ramouthar
13:10 - 14:00	**LUNCH**
SESSION 5: CHAIRPERSON - Prabashnie Ramouthar	
14:00 - 14:30	**KEYNOTE SPEAKER:** HATCHING AND HOST LOCATION: NEMATODE SURVIVAL TACTICS Roland Perry
14:30 - 14:45	THE EFFECTS OF GLYPHOSATE ON NEMATODE ASSEMBLAGES OF MAIZE AND SOYBEAN Akhona Mbatyoti
14:45 - 15:00	INTERACTIVE EFFECTS OF *STEINERNEMA FELTIAE* , *TRICHODERMA HARZIANUM* AND CUCURBITACIN-CONTAINING PHYTONEMATICIDES ON *MELOIDOGYNE* SPECIES Jacqueline Madaure
15:00 - 15:15	IDENTIFYING PROBLEM AREAS AND IMPROVE PRODUCTION IN QUEEN PINEAPPLE CULTIVATION THROUGH DIAGNOSTIC SERVICES Elmarie Rabie
15:15 - 15:30	HOST-STATUS AND HOST-SENSITIVITY OF BIOFORTIFICATED SWEET POTATO CV. BOPHELO TO *MELOIDOGYNE JAVANICA* POPULATIONS IN SOUTH AFRICA Nduduzo Maseko
15:30 - 15:45	POTENTIAL OF INDIGENOUS NEMATODES TO CONTROL INVASIVE MOLLUSCS IN SOUTH AFRICA Annika Pieterse
15:45 - 16:00	THE USE OF DITERA™ (*MYROTHECIUM VERRUCARIA)* FOR THE MANAGEMENT OF PLANT PARASITIC NEMATODES IN COMMERCIAL TABLE GRAPE BLOCKS AND SIMULTANEOUS EFFECT ON SOIL HEALTH Jeanne de Waal
16:00	**REFRESHMENTS and BEER TASTING AT ZIMBALI**
WEDNESDAY 10 May 2017	
SESSION 6: CHAIRPERSON - Caroline Mouton	
08:00 - 08:30	**KEYNOTE SPEAKER** METHODS TO MEASURE THE OXYGEN CONSUMPTION RATES OF PLANT-PARASITIC NEMATODES Willie van Aardt

08:30 - 08:45	NEMATODES ASSOCIATED WITH HONEYBUSH (*CYCLOPIA* SP) AND ROOIBOS (*ASPALATHUS LINEARIS*) CULTIVATION IN THE WESTERN CAPE Fiasyo Daramola
08:45 - 09:00	NEMATODES FOUND IN GRASS SEEDS IN THE TELPERION NATURE RESERVE, SOUTH AFRICA Chantelle Girgan
09:00 - 09:15	BIODIVERSITY INFORMATION MANAGEMENT AT THE NATIONAL COLLECTION OF NEMATODES: A THIRTY YEAR PERSPECTIVE Mariette Marais
09:15 - 09:30	NEMATODES AS BIOINDICATORS OF IRRIGATED SOIL HEALTH Gerhard Du Preez
09:30 - 09:45	CHARACTERISTICS OF SOIL NEMATODE COMMUNITIES AS AFFECTED BY ORGANIC AND CONVENTIONAL FARMING SYSTEMS UNDER VARIOUS CROPPING SYSTEMS Janet Atandi
09:45 - 10:00	RING NEMATODE, *CRICONEMOIDES XENOPLAX*, WITH SPECIAL REFERENCE TO GRAPEVINE AND STONE FRUIT Maryna Odendaal
10:00 - 10:30	**REFRESHMENTS**

SESSION 7: CHAIRPERSON - Jeannie van Biljon

10:30 - 13:00	**POSTERS**
1	A CYST NEMATODE FROM A UNIQUE HABITAT IN SOUTH AFRICA Antoinette Swart
2	*GLOBODERA AGULHASENSIS*, A NEW CYST NEMATODE FROM SOUTH AFRICA Rinus Knoetze
3	RESISTANCE IN MAIZE TO SOUTH AFRICAN ROOT-KNOT NEMATODE SPECIES Sonia Steenkamp
4	NEMATODE BIODIVERSITY IN SOYBEAN-BASED CROPPING SYSTEMS IN SOUTH AFRICA Akhona Mbatyoti
5	EVALUATING NEMATODE AND YIELD DATA – WHAT INFORMATION DO WE NEED TO COLLECT? Mieke Daneel
6	NEMATODE DIVERSITY OF THE TELPERION NATURE RESERVE, SOUTH AFRICA Chantelle Girghan
7	CAN FUNGICIDES HELP IN THE BATTLE AGAINST *MELOIDOGYNE*? PRELIMINARY *IN VITRO* ASSESSMENTS. Uvendri Pillay
8	MOBILITY OF PHYTONEMATICIDES IN DIFFERENT SOIL TYPES USING BIOINDICATORS Zakheleni Dube

9	SCREENING TWELVE SWEET POTATO CULTIVARS AGAINST *MELOIDOGYNE* SPECIES IN SOUTH AFRICA Edward Legong
10	MECHANISM OF NEMATODE RESISTANCE IN SWEET POTATO CULTIVAR MVUVHELO TO *MELOIDOGYNE INCOGNITA* Mmboniseni Meshack Makhwedzhana
11	RESEARCH OF ALTERNATIVE METHODS OF SUGAR BEET PROTECTION AGAINST SUGAR BEET CYST NEMATODE *HETERODERA SCHACHTII* (SCHMIDT, 1871) Marie Maňasová
12	MECHANISM OF RESISTANCE IN SWEET POTATO CULTIVAR BOPHELO TO *MELOIDOGYNE JAVANICA* Nduduzo Maseko
13	GLASSHOUSE SCREENING AND FIELD EVALUATIONS OF COMMONLY OCCURRING WEEDS AND LEAFY VEGETABLES TO *MELOIDOGYNE INCOGNITA* AND *M. JAVANICA* Nancy Ntidi
14	CONCENTRATION-RESPONSES OF *STEINERNEMA FELTIAE* TO CUCURBITACIN A: PRELIMINARY FINDINGS Jacqueline Madaure
15	NEW TECHNIQUES FOR CONTROL OF NORTHERN ROOT-KNOT NEMATODE *MELOIDOGYNE HAPLA* IN THE CZECH REPUBLIC Miloslav Zouhar
16	PHYLOGENETIC RELATIONSHIPS OF THE DOMINANT FAMILIES OF THE SUBORDER MONONCHINA BASED ON SMALL SUBUNIT RIBOSOMAL DNA Ebrahim Shokoohi
17	PERMACULTURE - IS THIS A PRACTICAL SOLUTION FOR COMMERCIAL FARMING Grace Tefu
18	MORPHOLOGICAL AND MOLECULAR CHARACTERIZATION OF BURROWING AND ROOT LESION NEMATODES ASSOCIATED WITH *MUSA* SPECIES IN TANZANIA Doreen Mgonja
19	NEMATODE INFESTATION OF QUEEN PINEAPPLE VARIETIES, CLONES AND SELECTIONS IN HLUHLUWE, SOUTH AFRICA Musa Mbatha
20	OCCURRENCE AND DISTRIBUTION OF PLANT PARASITIC NEMATODES ASSOCIATED WITH SUGARCANE IN TANZANIA Minza Masunga
21	SCREENING OF PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) FOR BIOLOGICAL CONTROL OF *MELOIDOGYNE* (TYLENCHIDA) ON CARROTS (*DAUCUS CAROTA* L.) BY MEANS OF A SEEDLING BIOASSAY Nico Labuschagne
22	POPULATION OF *SCUTELLONEMA* FROM SOUTH AFRICA Ebrahim Shokoohi

23	A STUDY OF *TYLENCHULUS SEMIPENETRANS* ISOLATED FROM CITRUS ORCHARDS IN SOUTH AFRICA USING 28S RDNA Ebrahim Shokoohi
24	POTENTIAL OF SOUTH AFRICAN ENTOMOPATHOGENIC NEMATODE ISOLATES FOR THE CONTROL OF THE BLACK CUTWORM (*AGROTIS IPSILON)* Tshima Ramakuwela
25	CITRUS FRUIT AMENDMENTS – CAN THEY BE USED FOR NEMATODE CONTROL? Rachael Mohlala
26	THE REPRODUCTION POTENTIAL OF *ROTYLENCHULUS PARVUS* AND *MELOIDOGYNE INCOGNITA* IN ROOTS OF MAIZE P.R. Janse van Rensburg
27	NEMATODES ASSOCIATED WITH WHEAT CROPS IN SOUTH AFRICA: A REVISION AND THE WAY FORWARD Siphamandla Lamula
28	THE ABUNDANCE AND DISTRIBUTION OF ROOT-KNOT NEMATODES IN SUNFLOWER PRODUCTION AREAS OF SOUTH AFRICA Elizma Dippenaar
29	EVALUATION OF A NOVEL, ANTINEMATODAL PRODUCT FOR ITS EFFECT IN REDUCING *MELOIDOGYNE INCOGNITA* POPULATION DENSITIES IN ROOTS OF SIX SUNFLOWER CULTIVARS Phillip Buckle
30	LIFE-STAGE DEVELOPMENT OF *MELOIDOGYNE ENTEROLOBII* AND *MELOIDOGYNE INCOGNITA* IN ROOTS OF A SUSCEPTIBLE TOMATO CULTIVAR: A COMPARATIVE STUDY Raymond Collet
31	IDENTIFICATION AND DISTRIBUTION OF NEMATODE ASSEMBLAGES IN AN IRRIGATED MAIZE FIELD AND ASSOCIATIONS WITH SOIL PHYSICAL PROPERTIES Ané Loggenberg and Nathan Foxcroft
32	SOIL MICROBIAL COMMUNITY DYNAMICS AND NEMATODE SUCCESSION IN MEDIC-WHEAT ROTATIONAL SEQUENCES UNDER VARYING SOIL DISTURBANCE DURING A FOUR-YEAR CROPPING CYCLE Mariette Marais
13:00 - 14:00	**LUNCH**
SESSION 8: CHAIRPERSON - Sonia Steenkamp	
14:00 -14:15	THE IDENTITY OF SOUTH AFRICAN *MELOIDOGYNE* SPECIES THAT PARASITISE FRUIT, VEGETABLE AND GRAIN CROPS Melissa Agenbag
14:15 - 14:30	DISTRIBUTION OF PLANT PARASITIC NEMATODES ASSOCIATED WITH BANANA CROPS IN TANZANIA Nessie Luambano
14:30 - 14:45	PLANT-PARASITIC NEMATODE ASSEMBLAGES ASSOCIATED WITH *AMARANTHUS CRUENTUS* (ACCESSION ARUSHA) IN FOUR PROVINCES OF SOUTH AFRICA Nancy Ntidi

14:45 - 15:00	NEMATODE ASSEMBLAGES ASSOCIATED WITH THREE OIL-BEARING CROPS IN THE GIYANI REGION (LIMPOPO PROVINCE) Mudau Ndivuho
15:00 - 15:15	PREVALENCE AND IMPLICATIONS OF POTATO CYST NEMATODE IN KENYA Solveig Haukeland
15:15 - 15:30	NEMATODE SURVEY FROM ONE OF AFRICA'S LAST UNSPOILED WILDERNESSES Candice Jansen van Rensburg
15:30 - 15:45	ANOTHER NEMATODE PEST OF GROUNDNUT IN THE VAALHARTS IRRIGATION SCHEME (SOUTH AFRICA) Driekie Fourie
15:45 - 16:00	A STUDY OF THE CARROT CYST NEMATODE, *HETERODERA CAROTAE*, IN SOUTH AFRICA Adoration Shubane
16:00 - 16:30	**REFRESHMENTS**
18:30 for 19:00	**GALA DINNER - OYSTER BOX, UMHLANGA**

NEW BEGINNINGS? PREPARING FOR, AND ADAPTING TO, PROJECTED CLIMATE CHANGE IN SOUTH AFRICA'S AGRICULTURE SECTOR

RE Schulze

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Climate change is real and will become even more of a reality in years to come. We have just experienced the globally hottest decade on record, the hottest year on record and almost every single month in the past year has seen temperature records being broken in South Africa. The agriculture sector is one of the most impacted by climate change. This is not so much because of the "push" factor of higher average temperatures or changes in mean annual rainfall, but rather because of the "pulse" factor of, for example, high critical threshold temperatures being exceeded more frequently, or more heat stress days for plants, a reduction in frost days as well as projected increases in year-to-year variability of temperature and rainfall. We therefore have to prepare for such a future. By assuming that we are having a breakfast 30-40 years from now of orange juice, porridge with milk and sugar as well as toast, impacts of projected climate change on the citrus industry, on maize and sugarcane production and on heat stress to dairy cattle will be evaluated. That is followed by a lunch, three decades hence, of potatoes and pork washed down with a glass of wine, during which projected impacts of future climates on potato and pork production as well as on viticulture in South Africa are assessed. In concluding with general questions on adaption in the various components making up our agriculture sector, an overview is also given of the presenter's new "*Handbook for Farmers, Officials and Others on Adapting to climate Change in the South African Agriculture Sector*".

SOIL AGROECOLOGY: UNDERSTANDING MULTI-TROPHIC INTERACTIONS IN THE SOIL TO ENHANCE THE BIOCONTROL OF INSECTS

R Campos-Herrera

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The study of abiotic-biotic linkages provides opportunities to learn how to exploit ecological scenarios that favour biological control of crop pests. Entomopathogenic nematodes (EPNs) are excellent biological control agents of soil dwelling insects. The pioneer development of molecular tools (species-specific primers/probes) for the evaluation of EPN soil food webs in Florida allowed expanding our ability to predict EPN occurrence in relation to soil properties and how it can be manipulated to conserve/enhance EPN services in the agroecosystem. In addition, molecular tools were successfully employed to demonstrate that cultural practices useful to manage huanglongbing can alter the soil food web in ways that increase the severity of another critical pest–disease complex, *Diaprepes-Phytophthora*. The same approach was implemented to evaluate the native EPN populations in Swiss fields where different cropping strategies have been compared for over 30 years, demonstrating its low occurrence and high impact on annual crops independently of the management. Currently, we are investigating how various entomopathogens (fungi, nematodes) interact with the pest and other organisms in the rhizosphere community. We are expanding knowledge about belowground multitrophic interactions in Mediterranean ecosystems, particularly the antagonistic interactions that modulate EPN efficacy in crops. This presentation will cover some of the key aspects of those various systems and illustrate routes to advance the implementation of belowground agro-ecological strategies that enhance pest control.

STATUS OF ENTOMOPATHOGENIC NEMATODES AND THEIR ASSOCIATED SYMBIOTIC BACTERIA FROM SOUTH AFRICA

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Since the first report, in 1953, of an entomopathogenic nematode (EPN) in South Africa, and the identification of an associated bacterium in 1996, research on EPN occurrence and distribution has escalated. All Africa augurs extremely well for the bioprospecting of EPN. Of the few surveys that have been conducted in South Africa so far, the main aim has been to research the outdoor application of EPNs as biocontrol agents against key insect pests. The most recent results conclude that *H. bacteriophora* is the most frequently encountered species in most provinces. A total of seven *Heterorhabditis* species and 11 *Steinernema* species were described from South Africa. The bacterial symbionts associated with South African EPNs consist of *Xenorhabdus bovienii, X. indica, X. khoisanae*, *Photorhabdus luminescence* subsp. *laumondii,* and *P. luminescence* subsp. *noenieputensis*. Notably, three different species of bacteria were found to be associated with local *H. zealandica*. However, such commercially produced species as *S. carpocapsae* and *S. feltiae* have not yet been reported from South Africa. Knowledge of EPN species and their associated bacteria in South Africa will add to the body of knowledge regarding their distribution and occurrence, as well as regarding regulations governing their import as biological control agents.

ENTOMOPATHOGENIC NEMATODE APPLICATIONS IN ORCHARDS: INSECT ASSASSINS OR FOOD FOR THE NEMATODE NATION

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The application of entomopathogenic nematodes (EPNs), from the families Heterorhabditidae and Steinernematidae, as biological control agents, is a viable inclusion in integrated pest management programmes worldwide. These nematodes occur naturally in the soil as low background populations. This study aims to establish the effect of the prescribed rate of EPN application, in addition to excessive application rates, on the natural nematode community in an apple orchard. Moreover, we hypothesised that the population of omnivorous and predatory nematodes would increase significantly, due to an increased food source, resulting in improved soil health. This was accomplished by means of applying *Heterorhabditis bacteriophora* to a 1 m^2 area around the base of the apple trees. Soil samples were collected pre-treatment to establish baseline population structure and function, and again at intervals of 2 days, 21 days and 42 days after EPN application. The nematodes, which were extracted by means of Cobbs' decanting and sieving method and were allowed to clear of debris using a modified Baermann funnel. The nematodes were then enumerated, identified to family level, positioned in various feeding groups, and given their corresponding cp-values. Various statistical analyses were applied to determine the orchard soil's health status, at the various time intervals mentioned.

POTENTIAL OF ENTOMOPATHOGENIC NEMATODES TO CONTROL WOOLLY APPLE APHID (*ERIOSOMA LANIGERUM*)

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Woolly apple aphid (WAA), *Eriosoma lanigerum*, is an important pest of apples worldwide. The aphid feeds above ground on buds and leaf axils and on the roots of apple trees. Entomopathogenic nematodes (EPNs) of the two families, Steinernematidae and Heterorhabditidae, and their symbiotic bacteria have generated extensive interest as inundative applied biological control agents of insects. With the development of the resistance of WAA to chemicals, export restrictions, and the inability of parasitoids to control the aphid successfully early in the season, considering EPNs as an alternative biocontrol agent is important. Seven EPN species were tested for their pathogenicity against WAA. Laboratory bioassays identified *S. yirgalemense* and *H. zealandica* as being the most virulent against the subterranean stage of the WAA, with a mortality rate of 48% and 38%, respectively. Studies on the effect of WAA size showed that the last instar is the most susceptible to infection, whereas smaller instars appear to be too small for nematode penetration and infection. Neither increasing the exposure period of the aphids, nor increasing the nematode concentration affected the infection rate positively. The haemolymph of WAA showed an inhibitory effect on the development of the symbiotic bacteria, preventing the completion of the nematode's life cycle.

FORMULATION OF *STEINERNEMA YIRGALEMENSE* IN ALGINATE BEADS AND DIATOMACEOUS EARTH

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Biological control of insect pests using entomopathogenic nematodes is fraught by costly and scarce formulation and application techniques. For conceivable solutions, we evaluated *Steinernema yirgalemense* using different formulation techniques. Encapsulation of the infective juveniles (IJs) in alginate beads, as well as the use of diatomaceous earth with reduced water activity (a_w -value at 0.97) to induce quiescence, and to reduce the metabolism of the IJs were undertaken. Survival of the IJs in the formulations was determined at 6^0C, 14^0C and 25^0C over 4 weeks. Nematodes readily survived the encapsulation process, with 10-20% being able to break through the bead, at varying temperatures. At 6^0C the desiccation effect of diatomaceous earth had the greatest affect on the survival of IJs. In both formulations, survival significantly differed at 6^0C compared to 14^0C and 25^0C, with a drastic decrease over time. *Steinernema yirgalemense* did not survive at low temperatures in either formulation methods. The beads successfully retained most of the IJs, and can therefore be stored for a longer time. Of the two methods, diatomaceous earth is the formulation that requires further investigation, since it can easily be optimised, dissolved in water and applied in the field.

POTENTIAL OF *STEINERNEMA YIRGALAMENSE* AS BIOLOGICAL CONTROL AGENT OF THE AFRICAN STEM BORER COMPLEX

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The economically most important pests of maize in Africa are the stem borer species, *Busseola fusca*, *Chilo partellus*, *Sesamia calamistis* and *Eldana saccharina*. Such stem borer species can cause crop failure of 10% and above. Typical stem borer damage symptoms occur on the whorl, stem and ear of the maize plant, which leads to crop losses, stem breakage and damage to the ears. Field resistance of *B. fusca* to Bt (*Bacillus thuringiensis*) maize in South Africa prompted this study to seek for alternative, sustainable pest control methods for the stem borer complex. The objective of this study was to determine whether the entomopathogenic nematode, *Steinernema yirgalemense*, shows potential to control the active larvae of such stem borer species under laboratory conditions. A hundred and twenty stem borer larvae from each stem borer species were inoculated with 100 infective *S. yirgalemense* juveniles and incubated at 25°C, while for the control, in each case, only water was used. Larvae mortality, confirmed by nematode infection, was recorded 48 and 72 hours after inoculation. Results indicated that *S. yirgalemense* have the potential to control all stem borer species tested.

EFFICACY OF ENTOMOPATHOGENIC NEMATODES AGAINST SOUTH AFRICAN WHITE GRUBS

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The root-feeding larvae of various species of scarab beetles (Coleoptera: Scarabaeidae) commonly referred to as white grubs, cause significant damage to many important forestry and agricultural crops in South Africa. Management of these pests has been heavily dependent on chemical insecticides and cultural control, but entomopathogenic nematodes (EPNs) provide a potential alternative. A total of seven EPN species/strains were compared for their ability to infect and kill the larvae of *Heteronychus licas* under laboratory conditions as an initial step towards developing a biological control program. These included five indigenous EPN species isolated in South Africa, namely *Steinernema fabii*, *S. sacchari*, *S. yirgalemense, Heterorhabditis bacteriophora* (SA strain) and *H. baujardi.* Two non-native commercial products, *H. bacteriophora* and *S. feltiae,* were also included. Larval mortality was recorded every two days over a period of 12 days. The South African strain of *H. bacteriophora* gave the highest and most rapid levels *H. licas* larval mortality. This was followed by the commercially available strain of *H. bacteriophora.* The results suggest that native EPNs could provide an option for soil-insect management in South Africa.

ENTOMOPATHOGENIC NEMATODES (STEINERNEMATIDAE AND HETERORHABDITIDAE) FROM THE NORTH-EASTERN PARTS OF SOUTH AFRICA AND THEIR BIOCONTROL POTENTIAL AGAINST THE FALSE CODLING MOTH, *THAUMATOTIBIA LEUCOTRETA* (LEPIDOPTERA: TORTRICIDAE)

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A survey was conducted to determine the diversity and frequency of endemic entomopathogenic nematodes (EPN) in subtropical fruit tree crops in the Mpumalanga, Limpopo and KwaZulu-Natal provinces of South Africa. A total of 136 soil samples were randomly taken from cultivated and uncultivated habitats, including subtropical fruit tree crops (avocado, litchi, macadamia, mango and guava) and natural vegetation. EPNs were isolated from 14 samples (10.3 %) by baiting with the larvae of *Tenebrio molitor* (mealworm). *Heterorhabditis* was the most common genus isolated from 12 samples, while *Steinernema* species were isolated from two samples. The most common *Heterorhabditis* isolated were *Heterorhabditis noenieputensis* and *H. zealandica* which were both isolated from four different localities. Other species recovered were two unknown *Heterorhabditis* sp. and two *Steinernema* species, both unknown species. Laboratory bioassays, using 24-well bioassays plates were conducted to determine the potential of local EPNs to control the false codling moth (FCM). Last instar larvae of FCM were screened for susceptibility to seven nematode species. Six of the nematodes species were obtained during the survey and one, *S. yirgalemense,* was obtained from the nematode collection of the University of Stellenbosch. Last instar FCM larvae were found to be most susceptible to *S. yirgalemense*, an unidentified *Steinernema* sp. (WS9) and *H. zealandica* (WS23), causing 100%, 94% and 94% mortality respectively.

EVALUATION OF THE ABOVE-GROUND APPLICATION OF ENTOMOPATHOGENIC NEMATODES FOR THE CONTROL OF DIAPAUSING CODLING MOTH (*CYDIA POMONELLA*)

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Codling moth (CM), *Cydia pomonella*, is the key pest of apples and pears in South Africa. After harvest and prior to the winter months, when the entire CM population enters diapause, no control measures for this pest are applied in infested orchards. Entomopathogenic nematodes (EPNs) can fill an important niche in an integrated pest management strategy, providing supplementary, environmentally friendly control of this pest. Environmental factors influencing EPN efficacy were thus investigated in both the field and the laboratory. Three commercially available EPN strains (*Steinernema feltiae* and *Heterorhabditis bacteriophora* Hb1 and Hb2) and two local species (*S. jeffreyense* and *S. yirgalemense*) were evaluated for the biological control of the CM. The objectives were to identify which nematode isolates effectively control diapausing CM larvae under local field conditions. EPNs were cultured *in vivo,* using CM larvae. Both laboratory and field trials were conducted using 32 wire mesh cages, each filled with apple tree bark and 20 CM larvae. Cages were hung in treatment trees and sprayed with EPN suspensions. Mortality was determined by dissection of larvae. Biocontrol potential of the above-mentioned EPN isolates will be discussed.

ENTOMOPATHOGENIC NEMATODES FOR THE CONTROL OF *BRADYSIA IMPATIENS* (DIPTERA: SCIARIDAE) UNDER OPTIMUM CONDITIONS

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Certain fungus gnat species, belonging to the subfamily Megalosphyinae of the Sciaridae, fall under the larval habitat category of living plants. The larvae mine into growing plants, while a few group members have become major insect pests to many crops that are cultivated under cover, being especially problematic under humid conditions. Control of *Bradysia* spp. has, so far mainly been done using chemical pesticides. However, the use of entomopathogenic nematodes (EPNs) has proven to be relatively advantageous, since sciarids are mostly pests of protected crops that are either close to harvest, or where the application of pesticides is unsuitable. Previous studies with EPNs pointed to the use of *Steinernema feltiae* as a biocontrol agent. However, the use of *S. feltiae* could be undesirable in areas where the species has not previously been isolated. In this study, different nematode species, nematode concentrations and insect life stages were screened by using 24-well bioassay plates, under optimum laboratory conditions. Since the potting media influence the survival and infectivity of EPNs, the effect of three different potting media were also investigated. Results showed four local EPN species achieving higher than 80% mortality from the different bioassays concerned.

ENTOMOPATHOGENIC NEMATODES FOR THE CONTROL OF THE FALL ARMY WORM *SPODOPTERA FRUGIPERDA*

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The Fall Army Worm *Spodoptera frugiperda* has recently invaded South Africa and established itself mainly in maize but also in sorghum, cotton, some vegetables and possibly sunflower. So far it has been recorded in seven South African Provinces. The eggs are laid on the leaves and can range between 50 and 250 eggs/moth. Larvae hatch and start feeding on exposed leaf surfaces. As soon as larvae penetrate too deep into the whorl or feed inside the cob it becomes extremely difficult to effectively control them using insecticides. Entomopathogenic nematodes can move into those cryptic habitats such as inside the whorl and cob where the insecticides cannot reach. In this study *Heterorhabditis zealandica* and *Steinernema yirgalemense* were screened at different concentration by using 24-well bioassay plates. The effect of adding an adjuvant to suspensions of EPNs, in order to improve control as a foliar application, was investigated as well as the tolerance of *H. zealandica* and *S. yirgalemense* to an insecticide. Results will be discussed.

NEMATODES ASSOCIATED WITH TERRESTRIAL SLUGS IN THE WESTERN CAPE PROVINCE OF SOUTH AFRICA

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Terrestrial slugs are important economic pests worldwide. In South Africa, they are a particular pest of canola crops, targeting the seedling stage. Current methods for controlling slugs in South Africa depend on chemical molluscicides, however these are often ineffective and toxic to non-target organisms. Therefore, a viable alternative is the use of biologicals containing nematodes. To date, the most successful nematode for controlling slugs in Europe is *Phasmarhabditis hermaphrodita*. The nematode is mass produced by BASF and sold under the trade name of Nemaslug®. The product works by releasing infectious nematodes that seek out and kill slugs within 4-21 days. However, thus far, this product cannot be sold in South Africa due to Amendment of Act 18 of 1989 under the Agricultural Pest Act 36 of 1947, which forbids the introduction of exotic animals. Therefore, the only way forward is to examine other indigenous nematode parasites. Surveys of the Western Cape Province have identified four nematode families thus far, viz. Agfidae, Angiostomatidae, Mermithidae and Rhabditidae. Within the Rhabditidae family, several *Phasmarhabditis* spp. have been isolated, one of which has shown potential at controlling slugs.

DOES MORPHOLOGICAL AND MOLECULAR DATA SYNCHRONIZE FOR THE FAMILY CEPHALOBIDAE (NEMATODA, RHABDITIDA)?

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Results from 18S rDNA supports that Cephalobidae is a monophyletic group but that several genera are paraphyletic (especially *Acrobeloides*). Bayesian Inference tree topology for *Acrobeloides* (SSU ribosomal DNA) agrees with topology in literature. Further morphological studies are needed for elucidating the identity of some *Cephalobus* and *Acrobeloides* spp. Surprisingly; *Acrobeles*, *Cervidellus* and *Zeldia* spp. are grouped in separate clades, whereas *A. mariannae* and *C. vexilliger* are placed close to each other, *Z. spannata* is close to *Pseudacrobeles variabilis* and *Cephalobus persegnis*. Another intriguing scenario exists for *Acrobeles*, *Cervidellus*, *Chiloplacus*, and *Nothacrobeles*, as species of the same genus often are included in separate clades. Using 28S rDNA, *Paracrobeles deserticola* was placed together with *N. abolafiai* and *N. hebetocaudatus*. However, SEM studies showed they have a similar pattern in their lip regions. Molecular analysis of some *Nothacrobeles* spp. (*N. abolafiai*, *N. borregi*, *N. hebetocaudatus*, *N. spatulatus* and *N. triniglarus*) placed them in separate and distant clades suggesting that *Nothacrobeles* could be polyphyletic. More molecular studies are necessary to validate this hypothesis. Morphological and molecular identification do not necessarily agree, suggesting that more data (other species and/or other genes, *e.g.* mtDNA,) be obtained to understand evolutionary relationships of this group and revision of some species and genera of the Cephalobidae.

USE OF VARIOUS MOLECULAR AND MORPHOLOGICAL TECHNIQUES TO IDENTIFY *MELOIDOGYNE ENTEROLOBII* POPULATIONS FROM SOUTH AFRICA

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During surveys in the Limpopo and Mpumalanga provinces of South Africa, 36 populations of *Meloidogyne enterolobii* were collected from various crops and weeds at 17 localities. The identity of these populations was determined by means of morphological, morphometrical and molecular techniques to accurately identify *M. enterolobii* and other *Meloidogyne* spp. present. Morphological data generally suggested that 16 of the *Meloidogyne* populations sampled contained *M. enterolobii*, either as single or mixed species. The perineal-patterns of these South African populations showed intra-species variation but in general conform to *M. enterolobii* populations described from different countries. Morphometrical characteristics that might be valuable in identifying this species, were found to be the relatively long distance from the anus to the vulva and phasmids that are distinctly visible on the perineal patterns of females. Molecular characteristics of *M. enterolobii* populations based on sequences of the 28S rDNA placed them in a group (97% bootstrap values) with the same species from USA (KP901079) and China (KT354576). In addition, phylogenetic analysis based on the sequence of COI placed them together with *M. enterolobii* from China (JX683714; KM887151) and Kenya (KT936633) in a well-supported clade (99% bootstrap values). Currently a third molecular technique, based on NADH5 mtDNA, is in process as well as a fourth (namely SCAR-PCR analyses) to verify the identity of these 16 *M. enterolobii* populations.

EXTRACTION AND IDENTIFICATION OF COMMON FREE-LIVING NEMATODE FAMILIES FROM SOUTH AFRICA

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Free-living, further referred to as non-parasitic, nematodes are well known for the beneficial role they play in terrestrial and aquatic ecosystems. In South Africa, however, emphasis has till recently been placed on economically important plant-parasitic nematodes. Nevertheless, with an increased focus on ecological studies, it is worth discussing the main considerations for sampling and extracting free-living nematodes, while also providing a basic diagnostic key for identifying the common families (excluding dorylaimids). The sampling design of any study must be based on the objectives and an extraction method (e.g. Baermann funnel or centrifugal-flotation) selected by considering the different benefits and available infrastructure. A basic presentation is given on how to differentiate among the most common non-parasitic, terrestrial (and water-inhabiting in some cases) nematode families in South Africa. These are Cephalobidae, Diplogasteridae, Monhysteridae, Panagrolaimidae, Plectidae, Rhabditidae and Tripylidae. The discussion is mainly based on differentiating between these families by studying only key morphological features such as the mouth and oesophagus using a light or inverted microscope. Once identified the data can easily be used in nematode specific analyses (e.g. faunal and maturity indices). However, it is worth noting that ecological responses may not be uniform at genus or species level and depending on the nature of the study, this should also be considered.

MOLECULAR IDENTIFICATION OF *MELOIDOGYNE* SPECIES PARASITISING MAIZE IN SOUTH AFRICA

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Maize crops infected by *Meloidogyne* spp. in local production areas is a common phenomenon. Yield losses ascribed to such nematode parasitism are, however, often overlooked. Maize samples from 79 fields in the maize production areas of South Africa were obtained and identification of *Meloidogyne* spp. pursued from 60 of these samples using the molecular SCAR-PCR approach. DNA was extracted from either 20 mature, egg-laying females per population or eggs and J2 and compared to DNA from *Meloidogyne arenaria*, *M. chitwoodi*, *M. enterolobii*, *M. fallax*, *M. hapla*, *M. incognita* and *M. javanica* (species standards). *Meloidogyne incognita* was present in 38 (63%) of the 60 samples, while none of them contained *M. arenaria*. Assays to identify *M. javanica* and/or other *Meloidogyne* spp. in the samples are underway. Phylogenetic analysis of the data will also be done once all the data are available. This study represents an extensive initiative to get a better understanding of the *Meloidogyne* spp. that currently hamper local maize production.

CURVE-FITTING ALLELOCHEMICAL RESPONSE DATA COMPUTER MODEL FOR PHYTONEMATICIDE CONCENTRATIONS

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Most efficacy trials of phytonematicides do not go beyond in vitro stages due to the phytotoxicity of the products. The Curve-fitting Allelochemical Response Data (CARD) model, developed in Australia and popularised in South Africa, can be used to generate non-phytotoxic concentrations of phytonematicides. The concentration that would not be phytotoxic to plants, referred to as mean concentration stimulation point [MCSP = D_m + (R_h/2)], was researched and developed in South Africa. This presentation outlines (1) the CARD model, (2) how it is used to generate the MCSP, (3) the quantitative interpretation of MCSP and (4) the overall sensitivity of phytonematicides to crops which are being protected against nematodes.

VILLA CROP PROTECTION TO INTRODUCE NEW TECHNOLOGIES IN CROP PROTECTION

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Villa Crop Protection is a leading supplier of crop protection solutions to distributors in Southern Africa. During the latter part of 2015, the USA based company Land O' Lakes, a Fortune 500 global agribusiness and food company based in Minnesota, USA, assumed a majority ownership stake in Villa Crop Protection. The Land O' Lakes crop input brand, WinField United, represents best-in-class agronomic excellence, industry-leading expertise, insights, products, programs and services. Through Winfield United, Villa now has access to new technologies and levels of agronomic expertise that will benefit growers, especially those involved in the implementation of precision agriculture. The presentation briefly discusses some of the technological advances that Land O' Lakes will be introducing into the South African agricultural market.

ECONOMIC IMPACT OF NEMATODES ON POTATOES

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Plant-parasitic nematodes cause significantly more damage than insects on potato. Losses are estimated at 12.3% ($ 157 billion) worldwide. Keetch (1989) estimated the damage at 16.7% ($7 Million) annually but it is difficult to determine since the pest is often not correctly identified. Survival of nematodes is dependent on their growth and reproduction as well as factors such as soil moisture, soil temperature and availability of host plant material. It is also important to know that nematology is a relatively new science where only 0.2% of the damage is researched while only 3% of all the nematode species have been identified. It is therefore very difficult to estimate and quantify the extent of nematode damage. Root knot nematode (*Meloidogyne*) and lesion nematode (*Pratylenchus*) are the two main culprits responsible for financial losses in the potato industry in South Africa due to reduced yields and poor marketability. The golden cyst nematode, a quarantine nematode in South Africa, is limited to international trade. Analysis of data from the fresh produce markets shows nematode damage is responsible for 6% to 11% of the downgrading of potatoes. The highest nematode problems occur in the Northern Cape, West Free State and Eastern Free State production areas. Several scenarios and the relative economic impact of nematode damage will be discussed.

A REAPPRAISAL OF STRATEGIES USED TO CONTROL NEMATODE PESTS IN SOUTH AFRICAN GRAIN-BASED CROPPING SYSTEMS

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Nematode problems experienced by local grain producers reached great proportions during the past decade. Reducing nematode-pest populations, particularly in maize-based cropping systems, is becoming increasingly difficult. Despite the application of highly effective, registered nematicides, extremely high population densities of particularly root-knot nematodes have been recorded from roots/other below-ground plant parts of crops. Without doubt, no single nematode management strategy, not even the most effective chemical nematicide, is in many cases successful anymore in reducing extremely high root-knot nematode population densities. Alternative and supplementary strategies have to be exploited and their application carefully planned to complement the responsible use of nematicides. This will assist producers to minimize quality and yield crop losses, and conserve our soils. One such strategy that should be relied on heavily is the use of root-knot nematode resistant or poor-host cultivars, while the practice of traditional crop rotation has to be revisited. Removal of weeds also has to receive priority since many of them maintain root-knot nematodes, particularly during 'warmer winters'. These and other practices are discussed for use in combination with the limited number of nematicides registered on grain crops in South Africa. Producers and related industries have to accept that nematode pests represent a definite production constraint, hampering the sustainable production of crops and most importantly adversely affecting food security.

NEMATODE CONTROL IN DECIDUOUS FRUITS

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Control of nematodes in pome fruit, stone fruit and vines is done at three different stages viz. pre-plant, post-plant and then on bearing trees. The key to any approach on managing nematodes is knowledge of the genera present. The plant parasitic nematodes that affect vines and deciduous fruit trees vary, as well as the type of control measures available in these crops for the different nematode genera. Their life cycles differ, as well as their mode of infection (ecto- or endoparasite). The host range also varies, but the major nematodes affecting these crops are *Meloidogyne* spp., *Pratylenchus* spp., *Criconemoides xenoplax, Paratrichodorus* spp., *Xiphinema* spp. and to a lesser extent *Hemicycliophora* and *Paratylenchus* spp. The success of an integrated pest management programme is based on six principles: prevention, monitoring, risk determination, decision-making, intervention and evaluation. There are different types of control measures available, eg. resistance, chemical control, biological control, plant material, rootstocks. A lot of factors also play a role in deciding which control measures to follow and what environmental factors will impact on the decision-making.

NEMATODE CONTROL IN VEGETABLES CROPS – WHAT IS THE WAY FORWARD?

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Nematodes can cause severe damage to vegetable crops when left untreated, even resulting in complete crop destruction. Control is therefore of utmost importance. Chemical control has always been a straightforward and effective method. However, due to the high toxicity of the nematicides usedtheir application has been restricted and new avenues have to be investigated to ensure effective nematode control. Besides a range of new chemicals, other options include crop rotation with none susceptible host plants, cover crops including Brassicacae, intercropping, bionematicides, biological control, resistant cultivars and organic amendments. All these strategies require much more involvement from the producer concerning soil preparation, selection of the correct crop(s), fertilization, correct timing and placement of chemicals and irrigation to name a few. From results obtained over the years, there is no 'one fits all' solution as climatic and geographical differences play an important role in the feasibility of the strategies. The same research has however shown that many of the strategies can work when the conditions are good. It is the role of the producer to select the best strategy for his set of conditions. And with new information becoming available continuously he can adapt the strategy.

AVICTA® COMPLETE CORN – A GLOBAL STANDARD FOR NEMATODE CONTROL

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Many different nematode species can attack corn, the most prevalent group of species globally are root-lesion nematodes (*Pratylenchus* spp.). Lesion nematodes do not cause distinctive damage to corn, however symptoms of damage can include thin plant stand, yellowing of leaves, uneven tasseling, lack of finer roots and branching of roots as well. Recent changes in production practices have greatly increased corn nematode numbers which led to a huge demand for a seed treatment nematicide on this crop. Syngenta Crop Protection developed abamectin as a nematicidal seed treatment for use in field crops such as cotton, corn and soybean for protection against a range of plant-parasitic root nematodes. Syngenta Seedcare initiated an extensive testing of the yield benefit of Avicta™ Complete Corn (a combination of an insecticide, fungicides and abamectin as a nematicide) in nematode infested field sites across the USA, Brazil and South Africa between 2005 and 2015. Results generally showed that Avicta Complete Corn outyielded the standard fungicide/insecticide seed treatment in over 70% of the trials delivering a yield increase of 5% on average. Overall, the application of Avicta™ Complete Corn provided a reliable protection each season and allowed plants to thrive, despite adverse growing conditions.

THE ROLE OF NATURAL SUPPRESSION IN MANAGING ROOT-KNOT NEMATODES IN COTTON

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The root-knot nematode *Meloidogyne incognita* is the most important pathogen of cotton in the southeastern USA. Many growers in this region grow cotton continuously, sometimes leading to a build-up of natural enemies of the nematode. This research focuses on identifying practices that preserve or enhance the activity of these natural enemies. In two separate field studies, we evaluated the effect of the fumigant 1,3-dichloropropene (1,3-D) on carnivorous nematodes and on *Pasteuria penetrans*. The fumigant reduced numbers of carnivorous nematodes early in the season, but their populations later recovered. The abundance of carnivorous nematodes was correlated with suppression of plant-parasitic nematodes. Yearly application of 1,3-D resulted in somewhat lower populations of *P. penetrans* than when no fumigant was applied. However, there was considerable year-to-year variation in abundance of *P. penetrans* with a range of 11 to 0.4 spores/assay nematode which was unrelated to 1,3-D. When analyzed across years, spore abundance in the spring was inversely correlated with root galling in the fall indicating that the bioassay to estimate spore numbers in the spring was a good predictor of the level of nematode suppression. In a greenhouse study, the fungus *Purpureocillium lilacinum* was more effective in suppressing populations of *M. incognita* when rye or clover was grown before planting cotton than when the soil was left fallow.

REDUCING PESTICIDE USE AND RELIANCE IN URBAN VEGETABLE SYSTEMS THROUGH NEMATODE CONTROL

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In sub-Saharan Africa the highly intensive urban and peri-urban vegetable production systems tend to attract excessive, and inappropriate use of pesticides. Under the intensive production conditions, high pest and disease pressures create an ever increasing need for their control. This often results in farmers becoming heavily reliant on pesticide applications, with direct effect on the safety of farmers, consumers, and the environment. Among the pest and disease problems affecting these smallholder farmers are plant parasitic nematodes, which farmers are mostly unaware of. Root damage by nematodes affect the crop health status, leading to greater pest and disease problems in general. To address overall health and productivity of vegetables, resistant germplasm, healthy seedlings and microbial enhancement were assessed for their ability to reduce nematode damage, general pest and disease damage and pesticide usage, especially under high pest and disease pressures. Root knot nematodes were the most common nematode pest in the vegetable systems, and highly prevalent. The use of improved seedlings increased crop productivity in East Africa but especially when combined with good agricultural practices, significantly reducing pesticide levels. It was also shown that private initiatives to supply healthy seedlings can be profitable and sustainable.

COMPARING EFFICACIES OF PHYTONEMATICIDES AND SYNTHETIC CHEMICAL NEMATICIDES ON REPRODUCTIVE POTENTIAL OF ROOT-KNOT NEMATODES ON FIELD POTATOES

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The efficacy of Nemarioc-AL phytonematicide (P) and Nemafric-BL phytonematicide (P) on nematode suppression was compared with that of Velum and fenamiphos on the potato cv. Mondial G3 under field conditions. All products were applied once and assessed using the reproductive potential (RP) at 56 days after initiating the treatments. Relative to the untreated control, fenamiphos and Nemafric-BL phytonematicide reduced RP values of root-knot nematodes by 74 and 61%, respectively. Relative to the untreated control, both Velum and the Nemarioc-AL phytonematicide reduced RP values by 100%. Relative to the untreated control, Velum reduced the RP by 76%, whereas Nemafric-AL phytonematicide had an increased RP of 119%. In conclusion, the efficacy of the Nemarioc-AL on nematode suppression was comparable to those of the two synthetic nematicides

"WRAP & PLANT": USE OF A BANANA PAPER BIODEGRADABLE MATRIX FOR THE CONTROL OF PLANT PARASITIC NEMATODES (*GLOBODERA ROSTOCHIENSIS* AND *MELOIDOGYNE* SPP.) IN POTATO AND YAM IN SUB-SAHARAN AFRICA

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Potato (*Solanum tuberosum*) and white yam (*Dioscorea rotundata*) are key staple food crops in Kenya and Nigeria, respectively. The efficacy of several solutions to reduce the infestation of the potato cyst nematode (PCN) in Kenya, and root-knot nematodes (RKN) in Kenya and Nigeria, was determined. Field and greenhouse trials were conducted to assess a: i) Field Deployable Nutrient-Rich Biodegradable Matrix produced from banana fibre ("banana-paper"), to act as a carrier to deliver abamectin and beneficial soil microorganisms (*Trichoderma asperellum* isolate TR900; Real Trichoderma® -Real IPM) at the rhizosphere level; ii) commercial free-solution of abamectin (Tervigo®- Syngenta); iii) free solution of TR900; iv) an organic fertilizer (Plantmate®- Richfund International Co. Ltd.); and v) a neem-based soil supplement (Neem Gold®- Neem India Products Pvt. Ltd.). Seed potatoes and yam minisetts were planted after wrapping them with the banana-paper band and analyses on the multiplication rate (Pf/Pi) of PCN and RKN and crop productivity were conducted. The banana paper had a positive effect on controlling PCN and increasing potato yields, as did the free commercial solutions of abamectin and *T. asperellum*, compared to the untreated control plots. Further studies on the profitability of the proposed interventions were done and will be discussed.

SENSITIVITY OF *MELOIDOGYNE INCOGNITA* JUVENILE HATCH AND MORTALITY TO NEMARIOC-AL PHYTONEMATICIDE

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The active ingredient of Nemarioc-AL phytonematicide, cucurbitacin A, affected hatch of second-stage juveniles (J2) and the mortality of *Meloidogyne incognita* with Curve-fitting Allelochemical Response Data (CARD) model demonstrating moderate to high sensitivity of the two. However, information on how J2 hatch and mortality would respond to Nemarioc-AL phytonematicide at concentrations below and above the recommended 3% had not been established. The objective of this study was to determine the sensitivity of *M. incognita* J2 hatch and mortality to increasing concentrations of Nemarioc-AL phytonematicide. Eggs and freshly hatched J2 of *M. incognita* were exposed to phytonematicidal concentrations of 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5 and 5.0% diluted in distilled water. Data were subjected to the CARD model to generate the sensitivity values. Three independent experiments with three replications each were conducted in an incubator set at 25 ± 3 °C and counts were made at 24, 48 and 72 h exposure periods. CARD-model was able to generate the sensitivity values for J2 hatch and mortality with ranges of 0 – 1 and 0 – 4 unit, respectively. Juvenile hatch and mortality were highly sensitive to concentrations of the tested phytonematicide at all exposure periods making the product an ideal alternative in nematode management.

SOIL AMENDMENTS WITH EXTRACTED JUICES AND OILS OF FIVE PLANT SPECIES OF CITRUS FRUITS FOR THE CONTROL OF *MELOIDOGYNE SPP* ON TOMATO UNDER FIELD CONDITIONS

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Previously glasshouse experiments were conducted to evaluate the effect of soil amendments with extracted juices (grapefruit, lemon, naartjie and sweet orange) and oils (lemon, lime and orange) for the control of *Meloidogyne incognita*. The organic amendment consisting of lemon juice gave the best reduction of nematodes but had no positive impact on yield while orange juice persistently gave the best improvement in plant growth. Oils consistently performed weaker than the juice in controlling nematodes and enhancing plant growth. The current study was carried out to confirm the potential of these organic amendments on the control of *Meloidogyne* spp. in the field. A randomised complete block design was planted in naturally infested field. Similar juice and oil extracts as in the glasshouse experiments were applied in the field at 50ml/ plant to determine the effect of the amendments on nematode control and yield. Considerable reduction of root-knot nematodes was achieved with lemon juice extract which compared well with standard nematicides. On the other hand orange juice extract provided the highest plant growth compared to the other treatments. While oils had resulted in poor growth in the glasshouse, this negative effect was not observed in the field.

CONSERVATION AGRICULTURE – DO WE GET BETTER YIELDS AND WHAT IS BEHIND IT?

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Conservation Agriculture (CA) is based on minimum soil disturbance, crop rotation and soil cover to increase yields, soil fertility and health. The objective was to determine the effect of CA on maize yield in different maize-cropping sequences including monoculture maize produced under conventional practices (CT) compared with monoculture maize and maize rotated with cowpea/sunflower only or cowpea/sunflower and pearl millet sequence under CA practices. These trials were conducted over a four-year period in Buffelsvallei (sandy loam soil – North West) and Erfdeel (sandy soil – Free State) as part of a CA programme of the ARC – GCI. Annual maize yield was determined while nematodes and soil nutrients were sampled annually. Multi-table analysis was performed to determine the effect of plant-parasitic nematodes, soil chemistry and crop rotation sequences on yield over the 4-year period, allowing four years to be compared in one graph known as a compromise. Plant-parasitic nematodes seemed to have a greater impact on yield than soil chemistry in both sites. At Erfdeel, plots with higher *Pratylenchus, Nanidorus* and *Meloidogyne* numbers showing the lower yields coinciding with monoculture maize and maize/cowpea/pearl millet/maize rotations. At Buffelsvallei, plots in which *Meloidogyne* dominated, had lower yields and consisted of monoculture crop sequences while higher yielding plots had high *Scutellonema* and *Rotylenchulus* numbers and were found in crop rotation treatments.

HOST-STATUS AND HOST-SENSITIVITY OF SWEET POTATO CULTIVAR 'MVUVHELO' TO *MELOIDOGYNE INCOGNITA*

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The previous screening study suggested that sweet potato cv. 'Mvuvhelo' was non-host to *Meloidogyne incognita*, with limited information on its degree of nematode resistance to this nematode species. The objective of this study was to determine the host-status and host-sensitivity of sweet potato cv. 'Mvuvhelo' to *M. incognita* under greenhouse conditions. Cuttings were planted in 20-cm diameter plastic pots containing steam-pasteurised loam soil and Hygromix-T at 3:1 (v/v) ratio. Cuttings were irrigated every other day using 250 mL water and fertilised using 2 g NPK and 2 g Multifeed two weeks after planting. Treatments comprised 0, 25, 50, 125, 250, 625, 1250 and 3125 eggs and second-stage juveniles. Fifty six days after inoculation, the reproductive factor (RF = Pf/Pi) was less than one at all levels of inoculation, whereas nematode infection had no significant effects on plant variables. In conclusion, since the RF was less than one and plant variables were not affected by nematode infection, cv. 'Mvuvhelo' was resistant to *M. incognita*.

TOWARDS IMPROVING NEMATODE TOLERANCE TESTING FOR SUGARCANE VARIETIES

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Nematode tolerance testing of sugarcane varieties is a core function at the South African Sugarcane Research Institute. Historically, variety field trials planted throughout the industry with or without nematicide treatments were used. However, the high diversity of nematodes associated with sugarcane and the wide range of agro-climatic conditions under which sugarcane is grown, introduces high variability to the data making rating difficult. An investigation into improving the methods was thus conducted. This included: development of a pot trial method, refinement of field trial soil sampling and determination of optimum soil sampling time. A significant reduction in root and shoot growth compared to the uninoculated control was detected for varieties N23 (31% and 26%, respectively) and N26 (25% and 14%, respectively), grown in pots under controlled conditions. In the same pot trial, varieties N43 and N53 appeared tolerant. Increasing the number of samples taken per 50 m^2 plot from two to ten improved the accuracy of detecting *Meloidogyne* in field trials from R^2 = 0.78 to 0.93. An optimum time for taking soil samples could not be identified as frequent sampling during crop growth was required to obtain significant differences between various treatments. Future rating of varieties will focus primarily on the pot trial data. Field trial data will be used if required.

HATCHING AND HOST LOCATION: NEMATODE SURVIVAL TACTICS

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The hatching response and host location by second-stage juveniles (J2) of cyst nematodes are central aspects of the overall survival strategy of this very successful group of nematodes. The hatching response of cyst nematode shows a spectrum of dependence on host root diffustes, from those species that hatch well in water to those that depend on host root diffusates to initiate hatch. Different survival strategies are associated with the degree of dependence on hatch stimulation from the host plant. Diffusates from host plants are also implicated in ensuring the hatched J2 locate a host as soon as possible, in order to limit their non-feeding phase in the soil. These aspects will be discussed to emphasise the importance of understanding nematodes biology, especially in relation to survival and the possibilities of perturbing hatch and host location for novel management strategies.

THE EFFECTS OF GLYPHOSATE ON NEMATODE ASSEMBLAGES OF MAIZE AND SOYBEAN

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Herbicides with glyphosate (Round-up®) as the active substance is used extensively worldwide. However, limited and contradictory knowledge exist about its effect on nematodes. Field experiments were conducted to determine the response of nematode communities where glyphosate-treated soybean and maize crops were grown consecutively (2013/14 and 2014/15) at Potchefstroom. The field was split in two parts (0.013 ha each). One plot was treated with glyphosate at 2 l/ha when weeds were 10-20 cm tall, while the other plot was not treated. Ten days after each application and also at crop maturity, root and soil samples were collected to determine nematode populations. Six plant-parasitic nematode genera were identified (*Criconema*, *Helicotylenchus*, *Meloidogyne*, *Nanidorus*, *Pratylenchus* and *Tylenchorhynchus*). For *Meloidogyne* spp./50 g roots no significant differences were found between the treated and untreated plot, while significant differences were evident for *Pratylenchus* spp./5g roots ($p < 0.003$) and *Helicotylenchus* spp. ($p < 0.001$). No significant differences were observed between the two treatments for the other parasitic and non-parasitic (*Acrobeles*, *Acrobeloides*, *Aphelenchoides*, *Aphelenchus*, *Aporcelaimellus*, *Cephalobus*, *Discolaimium*, *Ditylenchus*, *Eucephalobus*, *Euteratocephalus*, *Leptonchus*, *Panagrolaimus*, *Tylencholaimus* and *Tylenchus*) nematode genera. To further improve the knowledge of the effects of glyphosate on nematodes, large scale and long term experiments from different agro ecosystems should be undertaken.

INTERACTIVE EFFECTS OF *STEINERNEMA FELTIAE, TRICHODERMA HARZIANUM* AND CUCURBITACIN-CONTAINING PHYTONEMATICIDES ON *MELOIDOGYNE* SPECIES

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A factorial experiment, with the first, second and third factors being *Steinernema feltiae* (S), *Trichoderma harzianum* (T) and Nemarioc-AL or Nemafric-BL phytonematicide (P) respectively, was conducted on tomato (*Solanum lycopersicum*) plants. Eight treatments comprising various permutations were arranged in randomised complete block design and replicated 10 times. Fifty-six days after the treatments, most of the interactions of the biological control agents and phytonematicides on nematodes were not significant, whereas limited interactions were significant on plant variables. In conclusion, there was sufficient empirical evidence that the two phytonematicides and the two biocontrol agents were compatible.

IDENTIFYING PROBLEM AREAS AND IMPROVE PRODUCTION IN QUEEN PINEAPPLE CULTIVATION THROUGH DIAGNOSTIC SERVICES

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Nematodes, and in particular *Pratylenchus brachyurus*, are considered a major pest of pineapple in Hluhluwe, Northern KwaZulu-Natal. Since pineapples are cultivated under dry-land conditions, chemical control formed the backbone of nematode control. The diagnostic service offered by the Hluhluwe research station is an initiative to improve Queen pineapple production by identifying problem areas and by involving the farmers in exploring new concepts and stimulate innovation. Results of the service are used to understand the population dynamics of the pests subjected to the cultivation practices applied by the grower. Food safety and environmental issues associated with pineapple production focused the attention on Integrated Pest Management (IPM) and the approach will then be to apply several control strategies such as length of the fallow period, preparation of pineapple fields (i.e. reducing the inoculum), planting of cover crops, application of soil amendments in combination with optimizing dosage as well as application time and frequency for chemical control to solve a pest problem. The effect of the factors influencing pest control strategies are evaluated for each farmer and control strategies are optimized. Each year more farmers are making use of the diagnostic service on a more regular basis, indicating the value of the service to the farmers.

HOST-STATUS AND HOST-SENSITIVITY OF BIOFORTIFICATED SWEET POTATO CV. 'BOPHELO' TO *MELOIDOGYNE JAVANICA* POPULATIONS IN SOUTH AFRICA

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In plant-parasitic nematodes, the degree of nematode resistance is established through host-status and host-sensitivity. The objective of this study was to investigate the host-status and host-sensitivity of the biofortificated sweet potato cv. 'Bophelo' to *Meloidogyne javanica*. Uniform sweet potato cuttings were propagated in 20-cm-diameter pots filled with steam-pasteurized loam soil (300°C for 1 h) and Hygromix-T at 3:1 (v/v) ratio. Treatments consisting of 0, 25, 50, 125, 250, 625, 1250 and 3125 eggs and second-stage juveniles (J2), were arranged in a randomised complete block design, replicated five times. The reproductive factor (RF) at all levels of inoculation was less than one, whereas nematode infection had no effect on all plant variables measured. The RF for cv. Bophelo was less than one and nematode infection did not reduce plant growth; this cultivar is therefore resistant.

POTENTIAL OF INDIGENOUS NEMATODES TO CONTROL INVASIVE MOLLUSCS IN SOUTH AFRICA

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Molluscs are typically controlled in South Africa using chemical molluscicide pellets, however they can be ineffective, and cause adverse effects on non-target organisms and the environment. The use of mollusc-parasitic nematodes is a viable environmentally-friendly alternative. To date, *Phasmarhabditis hermaphrodita* is the only nematode to have been successfully developed as a biological molluscicide in Europe. However, current legislation prohibits its sale and use in South Africa. Therefore, the aim of this study was to examine local nematode isolates, and investigate their pathogenicity against mollusc pests, and their potential for mass production. Following surveys of the Western Cape, the nematode isolate, *Phasmarhabditis* sp. SA4, was found to be capable of reproducing under laboratory conditions, and of causing mortality of the invasive mollusc, *Deroceras panormitanum*. Monoxenic cultures of *Phasmarhabditis* sp. SA4 wer.investigated. Five bacterial isolates were isolated from the intestine of mollusc hosts, identified using 16S rRNA gene sequences, and their pathogenicity tested by means of injecting directly into the haemocoel of mollusc hosts. *Kluyvera* sp., which was found to cause the highest mortality rate among the molluscs concerned, was chosen for monoxenic culturing. Cultures containing *Phasmarhabditis* sp. SA4 and *Kluyvera* sp. were optimised using temperatures ranging from 15°C to 25°C, with results showing that 15°C was the optimum growth temperature.

THE USE OF DITERA™ (*MYROTHECIUM VERRUCARIA*) FOR THE MANAGEMENT OF PLANT PARASITIC NEMATODES IN COMMERCIAL TABLE GRAPE BLOCKS AND SIMULTANEOUS EFFECT ON SOIL HEALTH

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Plant parasitic nematodes are known to have several negative direct and indirect effects on commercial table grape production. In order to ensure optimal crop yields it is recommended that plant parasitic nematodes are controlled. Several control options can be integrated to achieve this, preferably in a manner which is not only effective but also without negatively impacting the soil food web structure. Current registered control options for export table grapes are limited due to strict export requirements and consumer demands. DiTera™ (*Myrothecium verrucaria*) is one of the few registered nematicides which has a favourable toxicological profile and product attributes which could positively impact the general soil health state and overall plant performance. Five local trials were undertaken to evaluate the effectiveness of this product in local table grape orchards in the Northern and Western Cape. *Mycorrhizae* was also applied for some of the treatments to evaluate whether there was an additive benefit on soil health. Plant parasitic nematode numbers were determined pre- and post- treatment and free living nematodes were used as an indicator of Soil Health. Positive results were obtained and results can be used to help formulate an integrated control approach for the sustainable management of plant parasitic nematodes in table grape blocks.

METHODS TO MEASURE THE OXYGEN CONSUMPTION RATES OF PLANT-PARASITIC NEMATODES

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Oxygen consumption data of nematodes are useful and assist nematologists in understanding the effect of anti-nematodal products on the physiology of plant-parasitic nematodes, and indicate inherent differences existing between genera/species. The use, (pros and cons) of three different methods (old and newly developed) are discussed. Cartesian diver technology (manometric changes in the flotation tube containing nematodes) showed that oxygen consumption rate (OCR) of one gram of *P. zeae* individuals at 25 °C were 500 times more compared to that of horse tissue at 37 °C. Polarographic, Clark oxygen sensors (oxidation of oxygen occurring in an electrochemical cell) showed that i) stirring had no effect on the OCR of *M. incognita* second-stage juveniles (J2) and ii) substantial OCR differences among *M. enterolobii*, *M. incognita* and *M. javanica*. Also, the OCR of *M. incognita* and *M. javanica* was significantly lower for J2 suspended in CropGuard® compared to the untreated control. Using state-of-the-art optical sensors (based on the dynamic quenching of an oxygen-sensitive fluorescent dye in sensor tips) demonstrated that only five J2 can be used to accurately determine the OCR, and that the OCR of a non-filtered product (containing microbes) and J2 was significantly lower (42%) compared to that of the same product without J2.

NEMATODES ASSOCIATED WITH HONEYBUSH (*CYCLOPIA SP*) AND ROOIBOS (*ASPALATHUS LINEARIS*) CULTIVATION IN THE WESTERN CAPE

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The negative impact of intensified agriculture on both the environment and soil health has attracted increasing concern. Nematode assemblages, which are a key component of the soil food web, are commonly used to indicate ecosystem health. Rooibos (*Aspalathus linearis)* and Honeybush (*Cyclopia* spp.), unique African herbal teas that are rich in antioxidants, possess amazing health benefits. Little information is available on the association of nematodes with these important medicinal plants. Therefore, the assessment of spatial changes in nematode assemblage in the cultivation and conservation of such endangered plant species is imperative. A survey to determine the biodiversity and the functionality of nematodes associated with cultivated *Aspalathus linearis* and *Cyclopia* spp. in the western coastal regions of South Africa was conducted. Soil samples were collected from the plants' rhizosphere, and nematodes were collected using a modified Baermann's extraction tray method for the extraction of nematodes from the soil samples. The Maturity Index (MI) indicated that most of the soil samples had values below 1.5, indicating soil disturbance. Plant-parasitic nematodes frequently found in association with the plants included *Xiphinema, Pratylenchus, Scutellonema, Hoplolaimus*, and *Hemicycliophora* species. The study also indicated that Honeybush is highly susceptible to the depredations of root-knot nematodes, *Meloidogyne* species.

NEMATODES FOUND IN GRASS SEEDS IN THE TELPERION NATURE RESERVE, SOUTH AFRICA

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The Nematology Unit of the ARC-PPRI Biosystematics Division founded the South African Plant-Parasitic Nematode Survey (SAPPNS) in 1987, with a comprehensive assessment of the nematode biodiversity resources of South Africa as its aim. Since the start of the SAPPNS various surveys have been undertaken in protected areas to record the diversity of the plant nematode fauna. Samples were collected over four consecutive seasons (winter 2015 to autumn 2016) in the Telperion nature Reserve in Mpumalanga, including 20 samples of grass seeds collected during the 2016 summer season. Nematodes were found in 5 of the 20 seed samples, and the species were identified as *Aphelenchoides* spp., *Aphelenchoides africanus*, *Aphelenchoides besseyi, Aphelenchoides lichenicola*, *Aphelenchoides rutgersi, Aphelenchoides spicomucronatus, Aphelenchus* sp. and *Panagrolaimus leperisini.* This study has produced new and important data for the SAPPNS and National Collection of Nematodes. *Aphelenchoides africanus* is reported for the first time since its description. *Aphelenchoides besseyi* has been reported numerous times in South Africa, however this is the first report of this species from seeds in this country. Species that are reported for the first time in South Africa are *Aphelenchoides lichenicola, A. rutgersi, A. spicomucronatus* and *Panagrolaimus leperisini.*

BIODIVERSITY INFORMATION MANAGEMENT AT THE NATIONAL COLLECTION OF NEMATODES: A THIRTY YEAR PERSPECTIVE

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Biodiversity Information management forms an integral part of the mandate and the management of natural history collections. Biological collections contain vast amounts of data, with the National Collection of Nematodes (NCN) housed at the Plant Protection Research Institute, Agricultural Research Council in Pretoria being no different. Since the late 1950s nematodes have been collected, identified and deposited in the NCN and the biodiversity of the nematode fauna recorded. The NCN entered the electronic era in the mid-1980s was when it initiated the South African Plant-Parasitic Nematode Survey (SAPPNS) to record the biodiversity of plant nematodes in South Africa. We discuss the planning stages, the advent of the first records being read into a DBase III database in 1987 and subsequent progress leading a web based information system and the digitising of the National Collection of Nematodes. We provide a perspective of 30 years, 9000 localities, 7210 type specimens and 176139 specimens.

NEMATODES AS BIOINDICATORS OF IRRIGATED SOIL HEALTH

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Food security in South Africa is threatened by severe droughts and deteriorating water quality. Some of the major irrigation systems, including the Hartbeespoort Dam and Crocodile West water schemes, utilise water sourced as urban and industrial runoff. Studies have shown that these waters contain toxicants, which may pose a threat to soil health and ultimately lead to a loss in crop yield and quality. Subsequently, a TRIAD assessment consisting of ecological, physico-chemical and ecotoxicological lines of evidence was undertaken to evaluate the potential threat posed to selected irrigated farmlands. The physico-chemical line of evidence included an assessment of historical water quality data on nutrient and salt levels, which clearly indicated lower water quality associated with the study sites if compared to the reference system (Marico-Bosveld irrigation scheme). This line of evidence also determined metal, nutrient and salt content in water, sediment (from irrigation dams) and soil (from farmlands) samples. However, nematode specific analyses (ecological line of evidence) indicated that while the Hartbeespoort Dam farmlands were more structured, the reference farmlands were enriched. Most soil samples were dominated by herbivores and bacterivores. On-going physico-chemical and ecotoxicological analyses will provide further information on the threat posed to soil health from using low quality irrigation water.

CHARACTERISTICS OF SOIL NEMATODE COMMUNITIES AS AFFECTED BY ORGANIC AND CONVENTIONAL FARMING SYSTEMS UNDER VARIOUS CROPPING SYSTEMS

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To evaluate the effects of organic and conventional farming systems on the population densities and diversity of soil nematode communities, a study was conducted in Tharaka Nithi County, Kenya. The study was carried out on farmer fields and a research site in plots measuring 5 x 5 m and replicated four times. Three farming systems were evaluated; farmer practice; organic; conventional and a non-amended control. Intercrop of maize and beans were planted in the first season (April 2015) while bean as a sole crop was planted in the second season (November 2015). Thirty-one genera belonging to bacterivores, fungivores, omnivores, predators and plant parasitic nematodes (PPN) were recovered. Nematode populations were significantly higher in the organic system (2039) in both seasons and between sites. Organic system had significantly higher numbers of bacterivores (826) and the lowest number of PPN (398.5). We suggest that the organic amendments applied in the organic system may have suppressed the number of PPNs due to increased nematode diversity (competition) and nematotoxic compounds. The study demonstrates that the organic system has potential for managing plant parasitic nematodes and improvement of free living nematodes as it appeared to directly or indirectly suppress PPNs whilst boosting free living nematodes.

RING NEMATODE, *CRICONEMOIDES XENOPLAX*, WITH SPECIAL REFERENCE TO GRAPEVINE AND STONE FRUIT

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Ring nematodes, *Criconemoides xenoplax,* are migratory ectoparasites that feed mostly on the roots of woody plants. Worldwide, they are regarded as a key pest in stone fruit orchards and vineyards. In South Africa *C. xenoplax* is regarded as being the most common plant-parasitic nematode species in vineyards and stone fruit orchards, with increasing numbers being found, thus leading to a growing need for its control. The control of the ring nematode has proven to be a challenging task, which has been exacerbated by industries undergoing a mandatory shift from a chemical-dominated to a more integrated pest management approach with the focus on soil health. Information on the morphology and molecular characterisation of ring nematode is lacking. The overall focus of this study will be to obtain basic information on *C. xenoplax*. A survey will be conducted, aimed at collecting soil samples from different stone fruit and grapevine production areas, and determining the morphological and molecular differences between ring nematode populations. The analysis of information obtained from commercial samples, regarding *C. xenoplax* recovery, in association with stone fruit and grapevine will be discussed. Lastly, five different commercial grapevine rootstocks were evaluated for their susceptibility against ring nematode in a glasshouse experiment.

A CYST NEMATODE FROM A UNIQUE HABITAT IN SOUTH AFRICA

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The Nematology Unit of the Biosystematics Division, ARC-PPRI, received a soil sample for nematode analysis from a swamp forest in KwaZulu-Natal in July 2015. The second stage juveniles and cysts of an unknown *Heterodera* cyst nematode were found in this acidic soil (pH of 3 – 4.5). The juveniles were characterised by the presence of a well-developed stylet of 27 - 28 µm long, a dorsal oesophageal gland outlet to the stylet knobs of 10 µm long and a tail of 64 µm long, The hyaline terminal was 39 µm and there were four lateral lines in the lateral field. The length and width of the cysts was about 530 µm X 395 µm, the vulval slit 32 µm long and the length and width of the fenestrae were 37 µm X 25 µm. The ITS-rDNA sequence of the KwaZulu-Natal heteroderid showed a 99% similarity with that of *Heterodera fici* and phylogenetic relationships, inferred by using the Maximum Parsimony method, shows that *H. fici* and the KwaZulu-Natal heteroderid are genetically near each other but perhaps not conspecific. This poster presents the phylogenetic tree, SEM photomicrographs of the heteroderid nematode and *H. fici*, and a morphometric study of this heteroderid species.

GLOBODERA AGULHASENSIS, A NEW CYST NEMATODE FROM SOUTH AFRICA

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A new cyst nematode, *Globodera agulhasensis*, was found parasitizing *Senecio burchelli* in the Western Cape Province, South Africa. Second-stage juveniles are characterised by a well-developed stylet of 22.5-24.8 µm with rounded to anteriorly flattened knobs. The dorsal pharyngeal gland outlet is 3.5-6.5 µm posterior to the stylet knobs. The cysts are characterised by their ovate to spherical shape, short neck and the absence of bullae or vulval bodies. Six to 12 cuticular ridges/lines are present on the outer surface of the cyst between the anus and vulval basin. Granek's ratio ranges from 1.0-3.0, the vulval basin diameter 11.7-26.1 µm and the distance between vulval basin and anus 19.1-47.0 µm. Males have a stylet length of 24.4-27.7 µm and spicule length of 27.2-33.8 µm with a rounded tip. Females have a stylet length of 19.0-24.4 µm, a large median bulb, almost filling the body diameter and a short vulval slit 3.2-6.6 µm long. Phylogenetic relationships with other species of the genus, inferred from ITS-rRNA sequences indicate that *G. agulhasensis* is included in the clade of *Globodera* spp. that parasitize non-solanaceous plants, and closely related to *G. millefolii* and *G. artemisiae*.

RESISTANCE IN MAIZE TO SOUTH AFRICAN ROOT-KNOT NEMATODE SPECIES

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The Root-knot nematode is an economically important pest on maize, causing losses of 12% and higher. Currently most producers are highly reliant on the use of the few nematicides registered on maize. These products are expensive and its efficacy is inconsistent under unpredictable environmental conditions. It is therefore important to exploit alternative and sustainable management tools such as host-plant resistance to improve existing nematode management strategies. The main objective of this study was to identify 38 commercially available maize cultivars for resistance to *Meloidogyne incognita* and *M. javanica*, respectively, under greenhouse conditions. Trails were planted in randomized complete block design with five replicates per entry. A susceptible tomato (cv. Floradade) was included as the susceptible standard. Each plant was inoculated with 5 000 *M. incognita* and 4 000 *M. javanica* eggs and juveniles, respectively. Nematode data was collected 56 days after inoculation. Ten cultivars were confirmed to show resistance to *M. javanica* and 10 to *M. incognita*, respectively. Of these, only eight showed resistance against both *M. javanica* and *M. incognita*. The eight cultivars resistant to both species can be safely recommended to farmers with a mixed *M. javanica* and *M. incognita* population above damage threshold levels.

NEMATODE BIODIVERSITY IN SOYBEAN-BASED CROPPING SYSTEMS IN SOUTH AFRICA

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Information on nematode-soybean associations exists in South Africa for conventional soybean crops but not for Round-up® Ready cultivars, which constitute more than 85% of soybean production. Thus nematode surveys were conducted during 2011/12 and 2012/13 seasons whereby both soil and root samples were collected at six localities where conventional and Round-up® Ready soybean were grown. The grasses in natural areas adjacent to soybean fields were sampled concurrently to assess nematode assemblages in such ecosystems. Results from this study indicated that *M. incognita* and *M. javanica* were predominant nematode pests. Root-knot nematode populations ranged from 59 383 eggs and J2/50g roots of Round-up® Ready to 1 225 eggs and J2/50g roots of conventional soybean cultivars during 2011/12 and from 23 000 eggs and J2/50g roots of Round-up® Ready to 175 000 eggs and J2/50g roots of conventional soybean cultivars during 2012/13. Interestingly, natural grass hosted up to 1 800 and 1 462 *Meloidogyne* spp. eggs and J2/50g roots during 2011/12 and 2012/13, respectively. Other plant-parasitic nematodes genera were *Pratylenchus*, *Helicotylenchus*, *Rotylenchus*, *Scutellonema*, *Criconemoides*, *Criconema* and *Tylenchorhynchus*. In terms of non-parasitic nematodes a variety of fungivores, bacterivores, omnivores, predators were identified. No significant differences could be detected in nematode assemblages where conventional and Round-up® Ready soybean cultivars were cultivated.

EVALUATING NEMATODE AND YIELD DATA – WHAT INFORMATION DO WE NEED TO COLLECT?

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When conducting nematode trials, nematode and yield data are collected, and after statistical analysis significant differences for nematodes and yield between the different treatments are determined. However, other factors can play a significant role in yield and are often not taken into account. A 4-year trial was conducted to determine the effect of conservation agriculture (CA) on yield of maize as the main crop in the North West Province of South Africa. The trial included 4 replicates of 12 treatments, consisting of monoculture maize produced under conventional practices (CT) compared with monoculture maize and maize rotated with cowpea/sunflower only or cowpea/sunflower and pearl millet sequence under CA practices. Together with yield, nematodes assemblages and soil chemistry were determined annually. When yield was plotted against the XY coordinates, it was obvious that yield in the first replicate was significantly lower from the other replicates and this was caused by higher Aluminium (Al) and Potassium (Na) concentrations in this replicate. Multi-table analysis was performed to determine the effect of plant-parasitic nematodes (PPN), soil chemistry and treatments on yield over the 4-year period. Fortunately, since all treatments were represented in the 1st replicate, this discrepancy did not seem to have a significant effect on the overall results obtained.

NEMATODE DIVERSITY OF THE TELPERION NATURE RESERVE, SOUTH AFRICA

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The Nematology Unit of the ARC-PPRI Biosystematics founded the South African Plant-Parasitic Nematode Survey (SAPPNS) in 1987, with a comprehensive assessment of the nematode biodiversity resources of South Africa as its aim. Since the start of the SAPPNS, various surveys have been undertaken to record the biodiversity of the nematode fauna. During a survey of the Telperion Nature Reserve in Mpumalanga, various samples including soil, root, water substrate and grass seeds, were collected over four consecutive seasons (winter 2015 to autumn 2016). The nematode diversity found during this survey was remarkable, with 93 genera recorded. The seed samples yielded four new records for South Africa, namely *Aphelenchoides lichenicola, Aphelenchoides rutgersi, Aphelenchoides spicomucronatus* and *Panagrolaimus leperisini.* Two species, *Paraphanolaimus behningi* and *Tridentulus* sp., found in water are also new records for South Africa.

CAN FUNGICIDES HELP IN THE BATTLE AGAINST *MELOIDOGYNE*? PRELIMINARY *IN VITRO* ASSESSMENTS

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Previous studies have shown that insecticide efficacy could be improved in combination treatments with conazole fungicides. This study aimed to establish whether the same positive interaction existed between fungicides and nematicides. The active ingredients from four formulated products were assessed using *Meloidogyne in vitro* motility assays. Active ingredients in the nematicides used were oxamyl and a combination of abamectin and thiamethoxam. Fungicidal active ingredients included difenoconazole and carbendazim. All actives were first tested on their own to determine their individual effect on nematode motility. Thereafter, various nematicidal-fungicidal combinations were tested by first exposing the nematodes to the fungicidal actives followed by the nematicidal actives. Oxamyl and abamectin significantly reduced nematode motility compared to the control. In contrast, no significant effect on nematode motility was noted for the fungicidal actives when tested on their own. The insecticide thiamethoxam also significantly reduced nematode motility with no significant difference to the results with oxamyl and abamectin. A positive interaction was noted between oxamyl and difenoconazole but this was not significant ($p = 0.078$). In contrast, a negative interaction between abamectin and difenoconazole was detected, but was also not significant ($p = 0.052$). This negative interaction was unexpected and thus requires further investigation. Additional studies to optimize the bioassay methods and to test newer nematicides and fungicides will continue.

MOBILITY OF PHYTONEMATICIDES IN DIFFERENT SOIL TYPES USING BIOINDICATORS

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The response of *Meloidogyne* species to Nemarioc-AL and Nemafric-BL phytonematicides had been established under diverse environments. However, there is limited information on the mobility of the two phytonematicides in different soil types. The objective of the study was to determine the mobility of Nemarioc-AL and Nemafric-BL phytonematicides in different soil types using *Meloidogyne incognita* as bioindicators. A split-split plot experiment was carried-out in 15 cm diameter plastic cylinders of 100 cm length with soil type (S), phytonematicides and depth (D) as factors. Uniform tomato cv. Floradade seedlings were transplanted into each medium column before being inoculated with 5 000 *M. incognita* eggs and second-stage juveniles (J2). Fifty-six days after inoculation, second order interaction of soil type ^{x} phytonematicide ^{x} depth had significant effects on J2. The first order interaction, S ^{x} D and D alone had highly significant effects on nematode eggs in the roots. This is possibly the first report of the interactions of soil type, phytonematicides and depth and how they influenced nematode population densities. Most empirical reports focussed on efficacy and phytotoxicity of phytonematicides, without any consideration on soil type or depth. *Meloidogyne incognita* served as a strong bioindicator of the movement of active ingredients of phytonematicides under different soil types.

SCREENING TWELVE SWEET POTATO CULTIVARS AGAINST *MELOIDOGYNE* SPECIES IN SOUTH AFRICA

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Sweet potato (*Ipomoea batatas*) cultivars Letlhabula, Monate, Blesblok, Ndou, W119, 199062.1, Ribbok, Bophelo, Bosbok, Mvuvhelo, Impilo and Beauregard were screened for resistance to the root-knot nematode, *Meloidogyne javanica, M. incognita* race 2 and *M. incognita* race 4 under greenhouse conditions. In separate experiments for each nematode species or race, the treatments were arranged in a randomised complete block design, with six replications. Pots were placed on the benches at 30 cm intra-row and 25 cm inter-row spacing. Two weeks after planting, each cutting was inoculated with 6000 eggs and second-stage-juveniles (J2). Pots were irrigated with 250 ml water/plant every other day. At 56 days after inoculation, the reproductive potential (RP) values of *Meloidogyne* species/races were greater than one in all cultivars except for Bosbok and Mvuvhelo, where RP values were equal to zero. Zero RP values suggested non-host status, whereas RP values above one suggested good host status. In conclusion, cultivars Bosbok and Mvuvhelo were non-hosts to *Meloidogyne* species or races whereas all other tested cultivars were hosts.

MECHANISM OF NEMATODE RESISTANCE IN SWEET POTATO CULTIVAR MVUVHELO TO *MELOIDOGYNE INCOGNITA*

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A previous host-status and host-sensitivity study suggested that cv. Mvuvhelo has resistance to *Meloidogyne incognita*. The aim of this study was to determine whether nematode resistance in cv. Mvuvhelo to *M. incognita* had a pre- or post-infectional mechanism of resistance. Cuttings were transplanted into 250 ml polystyrene cups containing 200 ml steam-pasteurised fine sand. A week after transplanting, established cuttings were each infested with 100 *M. incognita* second-stage juveniles. Seedlings were fertilised once with 2 g Multifeed and irrigated every other day with 40 ml water. Starting from two days after inoculation, four seedlings were removed every second day for a month and their roots severed, cleaned, stained and then destained. The sampling time was highly significant on necrotic spots, giant cells, rootlet interference and root mass. In conclusion, the results suggested that cv. Mvuvhelo has post-infectional nematode resistance to *M. incognita*.

RESEARCH OF ALTERNATIVE METHODS OF SUGAR BEET PROTECTION AGAINST SUGAR BEET CYST NEMATODE *HETERODERA SCHACHTII* (SCHMIDT, 1871)

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The negative environmental effect and cost of nematicides necessitate refocusing on biological methods to control *Heterodera schachtii* in sugar beet. The use of nematophagous fungi and botanical pesticides are two promising biological strategies for control of this nematode species. In small plot trials on two sites in Central Bohemia and Silesia, the effects of four nematophagous fungi: *Arthrobotrys oligospora, Pleurotus ostreatus, Stropharia rugosoannulata* and *Clonostachys rosea*, four essential oils from plants: *Thymus vulgaris, Rosmarinus officinalis, Pelargonium graveolens* and *Litsea cubeba* and two products promoting plant growth: Albite and Lignohumate were tested against *H. schachtii*. The nematophagous fungi were cultivated on solid (straw) and liquid medium. The essential oils were formulated with the detergent Tween 20 and adsorbed on Granin and Sorbin. Results showed no statistically significant differences in any of the observed characteristics, however, some interesting trends were clearly evident. In at least one locality, both the nematophagous fungus *C. rosea* and essential oil from *P. graveolens* treatments supported plant growth and had the same number of cysts as in case where the tolerant sugar beet variety was sown. These treatment options seem to be alternatives to previously conventional methods used. Increased sugar content was found in variants treated with the nematophagous fungi and in all variants treated with essential oils and Albite. Qualitative parameters (contents of Na, K, and α amino N) were mostly better in alternatively treated variants than in the variant sown with a tolerant variety. The regression analysis confirmed the dependence of bulb yield on the number of nematode cysts.

MECHANISM OF RESISTANCE IN SWEET POTATO CULTIVAR BOPHELO TO *MELOIDOGYNE JAVANICA*

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The two forms of nematode resistance in plant-parasitic nematodes are pre- and post-infectional mechanisms. The objective of this study was to investigate the form of nematode resistance in the sweet potato cv. Bophelo to *Meloidogyne javanica*. Uniform sweet potato cuttings were propagated in 250 ml polystyrene containers filled with steam-pasteurised fine sand. A week after transplanting, vines were each infested with 100 second stage-juveniles (J2) of *M. javanica*. Two days after inoculation, four vines were harvested every second day for 30 days, with roots being prepared, stained and destained. Harvest interval was highly significant on necrotic spot, giant cell and rootlet inference. The existence of necrotic spots suggested that J2 penetrated the root system, while rootlet interference indicated that the plant resisted the establishment of feeding sites. The preliminary results suggested that cv. Bophelo had post-infectional nematode resistance to *M. javanica*.

GLASSHOUSE SCREENING AND FIELD EVALUATIONS OF COMMONLY OCCURRING WEEDS AND LEAFY VEGETABLES TO *MELOIDOGYNE INCOGNITA* AND *M. JAVANICA*

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Weeds do not only compete with crops for light, nutrients and water, but they may serve as alternative hosts for nematode pests. Twenty weed species that commonly occur in fields of developing farmers were evaluated to determine their host status to *Meloidogyne incognita* and *Meloidogyne javanica*. Glasshouse studies showed that seven weed spp. had Rf values >1 for both nematode species indicating susceptibility, while 13 had Rf values ≤ 1 indicating resistance. *Hibiscus trionum* and *Amaranthus tricolor* were identified as the most susceptible and *Chenopodium carinatum* and *Datura ferox* the poorest hosts for *M. incognita* and *M. javanica*. In a field site at Kuruman, *Solanum retroflexum* was the most susceptible weed to the prevailing *M. javanica* population. *Hibiscus trionum* was the most susceptible weed spp. at Mbombela, where a mixed population of *M. incognita* and *M. javanica* occurred and at Potchefstroom, where a population of *M. incognita* was present. Results from this study indicated that certain weed spp. are highly susceptible to root-knot nematodes. Hence, such weeds should be removed timely and effectively to prevent population density increases of root-knot nematodes in farmers fields.

CONCENTRATION-RESPONSES OF *STEINERNEMA FELTIAE* TO CUCURBITACIN A: PRELIMINARY FINDINGS

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Pure cucurbitacin A was previously shown to inhibit root-knot (*Meloidogyne* spp.) nematodes. However, its compatibility with biocontrol agent *Steinernema feltiae* had not been investigated. Therefore, *S. feltiae* infective juveniles were exposed to cucurbitacin A at concentrations of 1, 2, 3, 4 and 5 µg/mL. *Meloidogyne incognita* eggs were first added to petri dishes to activate *S. feltiae* juveniles. Samples were set in an incubator at 25 ± 2 ˚C for 12, 24 and 48 h exposure periods. Data on the number of life and dead *S. feltiae* juveniles were recorded after each exposure period. There were no significant effects of cucurbitacin A concentrations on *S. feltiae*. In conclusion, cucurbitacin A had no detrimental effect on *S. feltiae* at concentrations used under field conditions to manage populations of *Meloidogyne* species.

NEW TECHNIQUES FOR CONTROL OF NORTHERN ROOT-KNOT NEMATODE *MELOIDOGYNE HAPLA* IN THE CZECH REPUBLIC

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Root-knot nematodes are the most harmful plant-parasitic nematodes worldwide. The most important species for the Czech growers is *Meloidogyne hapla*, which causes yield losses ranging between 50–90%. The importance of the northern root-not nematode has considerably increased in the Czech Republic within the last ten years. The damages caused by this nematode were reported for the first time in 1999 on 12-ha carrot fields in the typical vegetable growing area near Semice (the Central Bohemian Region). In the summer of 2009, vegetable growers asked a lot of our questions regarding root-knot nematodes. More than 300 ha were infested with *M. hapla,* which caused 100% yield losses. In the Czech Republic, no effective and environmentally friendly nematicides are available in the list of registered pesticides. The future of the Czech vegetable growers is uncertain. Small farmers that cultivate infested fields had to discontinue growing host plants for several years. Subsequently alternative methods of plant protection were tested. Pre-plant soil treatments with nematophagous fungi and pre-plant soil treatments with essential oils were tested under natural field conditions on highly infested fields near the village of Semice. The obtained data were evaluated with the statistical program Statistica 12.0. The results of field plot trials confirmed the scientific hypothesis, that essential oils and nematophagous fungi are possible tools for the control of *M. hapla*.

PHYLOGENETIC RELATIONSHIPS OF THE DOMINANT FAMILIES OF THE SUBORDER MONONCHINA BASED ON SMALL SUBUNIT RIBOSOMAL DNA

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Mononchida is an order of predatory nematodes including the two suborders Bathyodontina and Mononchina. In this survey, sequences of the 18S rDNA were amplified and used to reconstruct the phylogeny of the suborder Mononchina. Phylogenetic analyses using neighbour joining (NJ) and maximum likelihood (ML) were employed with five outgroup taxa and 79 mononch sequences. Both analyses indicated that the genus *Anatonchus* is monophyletic. The genus *Actus* was placed as the sister group of *Mylonchulus* with weak and strong support, respectively, from the ML and NJ analyses. In both phylogenetic analyses, trees obtained from SSU rDNA alignments were subdivided into five highly- or moderately-supported clades, designated Clade I: *Mylonchulus* spp., Clade II: *Actus salvadoricus*, Clade III: *Anatonchus* spp., a group comprising the genera *Clarkus*, *Coomansus*, *Miconchus* and *Prionchulus*, Clade IV: *Mononchus* spp., and Clade V: *Granonchulus* sp. The 18S rDNA analysis demonstrated that this region of the nuclear genome can be used to resolve the relationships of members of this suborder.

PERMACULTURE – IS THIS A PRACTICAL SOLUTION FOR COMMERCIAL FARMING?

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Permaculture is a concept that consist of digging a 60 cm deep hole, filling it with waste material including brown, green waste, manure and fruit and covering it with topsoil. On top of this, vegetables are grown. Trials conducted at the ARC-TSC with a variety of crops over several seasons have shown excellent results in growth enhancement, yield improvement and nematode control. Additionally a long-term effect was present as these results were observed for three consecutive crops. In a small scale farming setup this technique should be included in the management strategies to secure better food production. But what was the feasibility of this technique on a commercial scale? During our study about 40-cm deep furrows were made using a plough and ripper as per normal farming practice. The furrows were than filled with different types of waste material and covered with the topsoil as would be done when planting. Five treatments and 6 replicates were applied in a randomized block design. After 12 weeks, tomatoes (cv. Monica) were planted on the rows. Fruits were harvested over time and at termination of the trail nematode samples and plant data were collected. The permaculture treatments performed considerably better than the untreated and treated control for all the parameters measured.

MORPHOLOGICAL AND MOLECULAR CHARACTERIZATION OF BURROWING AND ROOT LESION NEMATODES ASSOCIATED WITH *Musa* SPECIES IN TANZANIA

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The burrowing (*Radopholus similis)* and root-lesion nematodes (*Pratylenchus goodeyi* and *Pratylenchus coffeae)* are serious banana yield-reducing nematodes worldwide. In this study, the morphological and morphometric characteristics were used to identify *R. similis, P. goodeyi* and *P. coffeae* extracted from banana roots in Tanzania. Additionally, molecular characterization using PCR and sequence analysis of the ITS1-5.8S rDNA region were performed to confirm morphological identification. From the morphological identification, 20 burrowing nematodes, and 40 root lesion nematodes, were identified. Morphometric analysis showed that all the nematodes fell in the correct measurement standards for all parameters used. Molecular characterization of each nematode population confirmed the presence of *R. similis*, *P. goodeyi* and *P. coffeae* in banana roots collected from the different agro-ecological zones of Tanzania. Sequence and phylogenetic analysis showed high relationship to other burrowing and root lesion nematode sequences available in GenBank. These results provide an insight on the presence of plant parasitic nematodes in banana that contributes to low banana yield in Tanzania. The information may be useful for nematode studies necessary for the development of an efficient nematode management strategy, that may improve banana production in Tanzania and other banana growing countries in Africa.

NEMATODE INFESTATION OF QUEEN PINEAPPLE VARIETIES, CLONES AND SELECTIONS IN HLUHLUWE, SOUTH AFRICA

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Four Queen pineapple varieties, GU044, GU076, SI087 and TA039, and 2 Queen like clones, BR338 and BR316c, were introduced to South Africa, Hluhluwe, KwaZulu-Natal from a gene bank of CIRAD-PHLOR, Martinique, to increase the gene pool for breeding and the expansion of varieties with possible resistance to pests and diseases. The Natal Queen, one local selection and the VC Queen clone were also included in the study. Nematode counts were done at regular intervals after planting in 5 planting cycles (2009, 2010, 2013, 2015 and 2016). The standard nematode control program was 80 l/ha EDB pre-plant and 4.5 l/ha Vydate at 3 months post-plant. Three plant parasitic genera were identified, namely *Pratylenchus, Meloidogyne* and *Helicotylenchus*. *Pratylenchus* infestation was the lowest in the Natal Queen and SI087 variety. SI087 was the only variety infested with low *Meloidogyne* numbers in only one of the five planting cycles. Low populations of *Helicotylenchus* occurred in the 2013 and 2016 planting cycle. The SI087 variety is less susceptible to nematode infestation than all the other varieties, clones and selections. A pot trial is conducted to confirm the results obtained in the field.

OCCURRENCE AND DISTRIBUTION OF PLANT PARASITIC NEMATODES ASSOCIATED WITH SUGARCANE IN TANZANIA

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Sugarcane is one of the commercial crops grown in Tanzania by estates and small scale farmers. Currently production ranges between 80-100 tons/ha which is lower compared to potential yield of 120 tons/ha. The low production is attributed to different factors of which plant parasitic nematodes is one. A preliminary study was done in two sugarcane estates; Kilombero Sugar Company and Kagera Sugar Limited to identify nematode genera in sugarcane fields. Soil and root samples from both estates were collected randomly. Nematodes were extracted, identified and counted using compound microscopes. Among the genera identified were *Meloidogyne, Pratylenchus, Paratylenchus, Helicotylenchus and Tylenchus* on both the roots and in the soil. The nematode counts from the two estates showed a higher number of *Meloidgyne* compared to the other nematodes genera. A high infestation of *Meloidogyne* and *Pratylenchus* was found at the Kagera estate compared to Kilombero. These results highlight the status of nematode infestation in sugarcane fields which need to be extended to other estates and outgrowers fields while planning a nematode management strategy.

SCREENING OF PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) FOR BIOLOGICAL CONTROL OF *MELOIDOGYNE INCOGNITA* (TYLENCHIDA) ON CARROTS (*DAUCUS CAROTA* L.) BY MEANS OF A SEEDLING BIOASSAY

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Plant growth promoting rhizobacteria (PGPR) have previously been reported as potential biological control agents for *Meloidogyne incognita* (Kofoid & White) Chitwood. The current study was conducted to select PGPR isolates with biocontrol potential against *M. incognita* on carrots (*Daucus carota* L.). A seedling bioassay was conducted on 6 week old carrots under glasshouse conditions using 27 PGPR isolates obtained from the University of Pretoria's PGPR collection. Seedlings were first inoculated with the isolates, and after 5 days inoculated with J2 of *M. incognita*. The reduction of root-knot nematode galls was determined 10 days after J2 inoculation. Five isolates showed significant reduction in gall numbers, viz. T11, A08, A10, T30 and N10w being 86.03%, 85.32%, 84.61%, 81.46% and 82.05% respectively. The isolates were identified as A10 *Paenibacillus barcinonensis*, A08 *Bacillus aryabhattai*, T30 *Paenibacillus alvei*, T11 *Bacillus firmus* and N10w *Bacillus cereus*.

POPULATION OF *SCUTELLONEMA* FROM SOUTH AFRICA

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A species of *Scutellonema* was isolated from grass in the Potchefstroom city area which was identified morphologically and molecularly. Morphologically, this population is similar to *Scutellonema brachyurus* reported to occur in South Africa in association with a wide range of plant species. Moreover, Nblast analyses showed a close relationship with a *Scutellonema brachyurus* population from Greece (KU059494; 94% identity) and an US population (KX959259 95% identity). Although phylogenetic analysis revealed that the 'new' population can be grouped together with *S. brachuyurus,* it is separated from other similar species. Genetic pairwise distance showed the highest genetic distance of 0.099 between the 'new' population and two known *S. brachyurus* populations from South Africa (JX472050; JX472051). Morphometrical data and phylogenetic relationships with the other related species are also provided.

A STUDY OF *TYLENCHULUS SEMIPENETRANS* ISOLATED FROM CITRUS ORCHARDS IN SOUTH AFRICA USING 28S RDNA

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Parasitism by citrus nematodes, *Tylenchulus semipenetrans*, results in substantial yield losses in local orchards. Although ample research has been done on this specific nematode pest, molecular studies regarding the phylogeny of local populations have not been done. During a nematode survey, eight isolates of *Tylenchulus semipenetrans* were recovered and studied using D2-D3 segments of 28S rDNA. Molecular analyses of these South African populations showed a close relationship with Iranian populations of *T. semipenetrans*. Phylogenetic analysis also placed two populations of *T. semipenetrans* from South Africa close to two US populations (JN112249, JN112250). The South African *T. semipenetrans* populations formed a monophyletic group. Genetic pairwise distance showed that two out of the eight populations differed (0.002). However, the mean GC content of the studied populations is 53.7 %, indicating that genetic variation exists among the South African populations and need to be studied further.

POTENTIAL OF SOUTH AFRICAN ENTOMOPATHOGENIC NEMATODE ISOLATES FOR CONTROL OF THE BLACK CUTWORM (*AGROTIS IPSILON*)

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Among the many agricultural crop pests, cutworm species (Lepidoptera: Noctuidae) are cosmopolitan insects, threatening a number of agricultural crops globally. Larval stages feed on many important grain crops and nearly all vegetables. Entomopathogenic nematodes (Nematoda: Rhabditida) are naturally occurring round worms, which live in a symbiotic relationship with highly specialized bacteria, capable of causing mortality in an insect host within 48 hours. They are exploited globally as safe and environmentally friendly biological control agents of insect pests. Hence, they have been successfully commercialized in developed countries, which underscore their effectiveness. Several species of EPNs were tested for control of the black cutworm, *Agrotis ipsilon*, using the laboratory Sandwell bioassay system. The results indicated that two locally collected species from the ARC-SGI EPN collection, SGI 245 (*Heterorhabditis* sp.) and ROOI 352 (*Steinernema tophus*), hold significant potential for control of the black cutworm, causing 80 and 77% mortality, respectively. These two species were mass-produced *in vitro* followed by field application to determine persistence under natural environmental conditions. The *Heterorhabditis* strain showed superior persistence (maximum 93% vs. 33%) at two localities at least one-month post application. Efficacy of the two species will be tested under field conditions in the next growing season.

CITRUS FRUIT AMENDMENTS – CAN THEY BE USED FOR NEMATODE CONTROL?

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Citrus amendments in the form of oils and juices were tested in the glass house for nematode control and growth enhancement. Previous trials seemed to indicate that citrus fruit amendments enhanced yield and in some instances could reduce nematode numbers. The aim of this study was to confirm previous results and determine the most effective citrus amendments. Lime, lemon and orange oils, orange powder as well as lemon, orange, naartjie and grape fruit juices were tested. Furthermore, a range of orange juice concentrations were tested to determine the most effective concentration. Results showed that orange powder provided the lowest nematode numbers followed by lime oil. Among the different juices, grape fruit juice was the most effective for nematode control. This was in contrast to previous trials where lemon juice gave good nematode control. Juices used were prepared last season and it might be worthwhile to determine the effect of aging/fermenting on the efficacy of the juice. While the different concentrations of orange juice were positively correlated with growth enhancement, this was not seen in nematode control, with lower concentrations giving better nematode control. Results necessitate further studies including field trials. It will also be helpful to determine the active molecules in the amendments.

THE REPRODUCTION POTENTIAL OF *ROTYLENCHULUS PARVUS* AND *MELOIDOGYNE INCOGNITA* IN ROOTS OF MAIZE

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The use of the adapted NaOCl method lead to novel information being generated for *Rotylenchulus parvus* infections in roots of maize and other grain crops, and explains why high population levels of this genus might have eluded researchers in the past. Relatively low population densities of this species have been reported in the past and its pathogenicity to maize crops listed as unknown. However, the concurrent occurrence of eggs of this species together with those of *Meloidogyne* has been recorded since 2011 and has been confirmed using molecular and morphometric identification in 2016. A glasshouse study was conducted during which i) 10 000 eggs of *R. parvus*, ii) 10 000 eggs of *M. incognita* and iii) 5 000 eggs of *R. parvus* and 5 000 eggs of *M. incognita* were inoculated per maize seed (cultivar DKC 78-79 BR) at planting in Telone II fumigated soil. The trial layout consisted of a randomized complete, split plot block design. Nematode eggs and J2 of the two sedentary nematode genera were extracted using the adapted NaOCl method 56 days after planting and inoculation. Inoculation with *M. incognita* only as well as that with the mixed *M. incognita* and *R. parvus* population resulted in significantly higher eggs and J2 at termination of the experiment compared to that with *R. parvus* only. The *R. parvus* only treatment had a very low Rf value of 0.004, indicating that this species did not increase in numbers during the duration of the experiment. This experiment represented the first to study the impact of *R. parvus* in local maize production areas, but have to be repeated to indicate whether this nematode should be of concern to producers or not.

NEMATODES ASSOCIATED WITH WHEAT CROPS IN SOUTH AFRICA: A REVISION AND THE WAY FORWARD

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Cereal cyst (*Heterodera avenae*), root-knot (*Meloidogyne* spp.), root-lesion (*Pratylenchus* spp.) and ear-cockle (*Anguina tritici*) nematodes are the most economically important nematodes of wheat. The most abundant endoparasites identified in South African wheat crops were *Pratylenchus neglectus* and *Pratylenchus thornei* from an extensive survey in 1992. A *Heterodera* species that closely resembled *Heterodera avenae* was also identified. The South African Plant Parasitic Nematode Survey database also listed *Meloidogyne arenaria*, *Meloidogyne chitwoodi*, *Meloidogyne incognita* and *Meloidogyne javanica*. Nonetheless, 26 years after the first wheat nematode survey was conducted a need exist to determine which nematode pests are predominantly parasitizing wheat crops. This is crucial since recent reports i) listed the presence of new or unexpected plant-parasitic nematodes in local crop production areas, ii) improved extraction methods (e.g. adapted NaOCl method) which was not used in the 1992 survey and may produce new/interesting results about sedentary, endoparasitic nematode species parasitizing wheat and iii) state-of-the-art molecular techniques have the potential to produce accurate and quick identification of nematodes. Updated information is crucial to inform commercial and developing producers about the risks nematode pests pose and control options to minimise their damage. The current study is aimed at identifying the nematode assemblages that occur in local wheat producing areas with emphasis on the morphological and molecular identification of *Heterodera*, *Meloidogyne* and *Pratylenchus* species.

THE ABUNDANCE AND DISTRIBUTION OF ROOT-KNOT NEMATODES IN SUNFLOWER PRODUCTION AREAS OF SOUTH AFRICA

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High population densities of *Meloidogyne* spp. are recorded from roots of sunflower plants obtained for diagnostic analyses and research purposes. A survey that listed the most abundant nematode pests of this crop for local production areas was conducted nearly 32 years ago and did not allow for use of the adapted NaOCl method. This method is specifically aimed at extracting eggs of sedentary nematode pests such as *Meloidogyne* spp. and has only been used routinely in some laboratories in South Africa since the early 1990s. This implies that realistic data on the abundance and occurrence of *Meloidogyne* spp. (and most probably other sedentary nematode genera) have not been generated. Therefore, a survey has been conducted during the 2017 growing season in five areas (Petrus Steyn, Bothaville, Bultfontein, Wesselsbron and Potchefstroom) where sunflower is produced. Twenty rhizosphere soil and root subsamples were obtained from each of the 10 sunflower fields sampled for nematode analyses. The mean population density (MPD) and frequency of occurrence of *Meloidogyne* spp. for each field was used to calculate prominence values (PV) for this genus per locality. Mean population densities ranged from a low 12 to 143 648/50g roots. Data pooled across localities showed that *Meloidogyne* occurred in 92% of the samples, with a high mean population density of 25 897/50g roots and a high PV of 24 834. Results showed that these nematode pests can reach high population levels in sunflower fields, which will adversely impact the sustainable production of crops.

EVALUATION OF A NOVEL, ANTINEMATODAL PRODUCT FOR ITS EFFECT IN REDUCING *MELOIDOGYNE INCOGNITA* POPULATION DENSITIES IN ROOTS OF SIX SUNFLOWER CULTIVARS

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The search for alternative, environmentally-friendly products with anti-nematodal characteristics has gained momentum during the past few decades. This is mainly due to the discontinuation and withdrawal of extremely toxic, Class 1 red-band nematicides from world markets. Recently, a highly cost-effective and safe product with fertiliser attributes has been developed by a researcher at the North-West University. Different derivates and concentrations of this product were evaluated for its effect against a mixed *Meloidogyne* spp. population *in vitro* and significantly imotilise and killed second-stage juveniles compared to those suspended in clear tap water. *In vivo* evaluation of the effect of one of these product derivates (Ferticide^{TM}) and concentrations on the reproduction potential of *Meloidogyne incognita* in roots of six cultivars followed. Sunflower was chosen as the target crop since it is highly susceptible to *Meloiodgyne*, with no nematicide being registered for use on the crop in South Africa. Ten thousand eggs and second-stage juveniles of *M. incognita* were inoculated per seed during planting of sunflower in 10-l capacity pots. Soil used was fumigated with Telone II three weeks prior to planting and nematode inoculation. The trial consisted of a randomised complete split-block block design, with six replicates for each cultivar. Half of the plants were treated with Ferticide^{TM}, while the other half were left untreated. Substantial variation existed regarding the host status of the six sunflower cultivars with regard to *M. incognita*, with Rf values ranging from 24 for PAN7102CLP to 57 for PAN7080. Egg and J2 numbers per g root did not differ between the untreated control and Ferticide^{TM} treatments for the six cultivars, indicating that the product was nog successful in reducing population densities of this nematode pest.

LIFE-STAGE DEVELOPMENT OF *MELOIDOGYNE ENTEROLOBII* AND *MELOIDOGYNE INCOGNITA* IN ROOTS OF A SUSCEPTIBLE TOMATO CULTIVAR: A COMPARATIVE STUDY

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Meloidogyne enterolobii has been identified from fruit, grain and vegetable production areas in South Africa. However, no information is available about the aggressiveness and life cycle of South African populations of this species compared to those ofr other economically termophylic species, *viz. Meloidogyne incognita* and *Meloidogyne javanica*. Therefore, 48-h old second-stage juveniles of local single-species populations of *M. enterolobii* and *M. incognita*, respectively, were inoculated on roots of susceptible tomato seedlings (cultivar Moneymaker) that were kept in a glasshouse. An ambient temperature range of 14 – 24 °C and a 14L:10D photoperiod were maintained during the duration of the experiment. The development of different life stages of each of the species was determined at sampling intervals of 2, 5, 10, 15, 20 and 25 days after inoculation. Differences in the life-stage development of the two species are discussed, which did not seem to differ substantially at this specific temperature range. Follow-up experiments will be done by higher temperature ranges to elucidate the life stage of *M. enterolobii* under local climatic conditions. This information represents the first on the life-cycle of a local *M. enterolobii* population and can contribute towards employing optimal management strategies to combat this threat root-knot nematode species. The species has been identified in both subtropical and temperate agricultural production areas of South Africa.

IDENTIFICATION AND DISTRIBUTION OF NEMATODE ASSEMBLAGES IN AN IRRIGATED MAIZE FIELD AND ASSOCIATIONS WITH SOIL PHYSICAL PROPERTIES

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Various abiotic and biotic factors affect the distribution, population densities and dynamics of nematodes in soils. Soil texture, for example, influences both the horizontal and vertical distribution of soil nematodes and can be useful to predict the abundance and distribution of both economically important nematode pests and non-parasitic, beneficial nematodes. Using precision application of nematicides in highly infested areas of a field only can, for example, benefit producers economically and limit broad application to minimise pollution. Limited studies have been conducted in local agricultural cropping systems to investigate and promote the use of the global positioning and geographical information systems. This study hence entailed sampling of both soil and roots of irrigated maize cultivated on a 50-hectare field at 48 designated GPS points. Soil physical properties (particle size) as well as pH and EC were determined for soils sampled at each of the GPS points sampled. Such data were analysed together with nematode abundance and diversity data to determine whether associations existed for soil properties and economically important nematode pests as well as non-parasitic beneficial nematodes. A wide range of both beneficial and plant-parasitic nematodes were identified. Distinct differences in nematode trophic groups existed between field and veld and between clayey and sandy soils. The study forms a baseline for determining whether the approach followed can be used to benefit producers in limiting the application of harmful nematicides and stimulate the presence of beneficial nematodes to minimise nematode damage to crops.

SOIL MICROBIAL COMMUNITY DYNAMICS AND NEMATODE SUCCESSION IN MEDIC-WHEAT ROTATIONAL SEQUENCES UNDER VARYING SOIL DISTURBANCE DURING A FOUR-YEAR CROPPING CYCLE

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Terrestrial nematode and soil microbial communities are sensitive indicators of sustainable crop production as influenced by cropping sequence and tillage. Soil samples were aseptically collected over four consecutive years from two cropping systems: wheat monoculture (WWWW) and wheat-medic (WMc) rotations under conventional (CT) and zero tillage (ZT). Nematode functional groups from soil and root samples, and soil microbial activity and functional diversity were determined. Cropping sequences and tillage changed temporal shifts in terrestrial nematode and soil microbial functioning and activity. Cropping sequences influenced microbial functioning more than microbial activity. The ratio of free-living to plant-parasitic nematodes was similar under WWWW, but was much higher with medics as the initial crop, compared with wheat as the initial crop. Soil microbial functioning and activity increased more under ZT compared with CT, whereas the percentage of free-living nematodes present in the soils under ZT was similar but varied greatly under CT. This study suggests that agricultural management practices could be adjusted to enhance soil biodiversity and soil fertility.

THE IDENTITY OF SOUTH AFRICAN *MELOIDOGYNE* SPECIES THAT PARASITISE FRUIT, VEGETABLE AND GRAIN CROPS

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Identification of *Meloidogyne* spp. from 28 populations (isolated for diagnostic and/or research purposes) was pursued using morphological and molecular approaches. DNA was extracted from 20 mature, egg-laying females per population and subjected to SCAR-PCR, followed by phylogenetic analysis. DNA from *Meloidogyne arenaria*, *M. chitwoodi*, *M. enterolobii*, *M. fallax*, *M. hapla*, *M. incognita* and *M. javanica* species standards was included. Perineal patterns, shape of the lumen of the oesophagus, shape of stylet knobs, distinct phasmids near tail terminus and length of the vulval slits of 18 mature females per population were recorded during morphological identification. Three (*M. arenaria*, *M. incognita* and *M. javanica*) of the four economically most important *Meloidogyne* spp. as well as the emerging *M. enterolobii* (= *M. mayaguensis*) were identified, either as single- or mixed species populations. Comparison of molecular and morphological data yielded an 82% similarity. *Meloidogyne incognita* dominated (guava, maize, potato, soybean and sunflower), followed by *M. javanica* (guava, green pepper, maize, potato and sunflower), *M. enterolobii* (guava, green pepper and potato) and *M. arenaria* (maize). Phylogenetic analysis yielded a cluster containing *M. enterolobii* and *M. javanica* (as well as mixed populations of these two species and *M. incognita*) and one containing single species populations of *M. arenaria* and *M. incognita*, and complexes of these two species.

DISTRIBUTION OF PLANT PARASITIC NEMATODES ASSOCIATED WITH BANANA CROPS IN TANZANIA

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In Tanzania, the main staple food for around 30% of the population is bananas; however, national production is low compared to potential yields under good management. Plant parasitic nematodes can cause a yield reduction of over 40% in African banana crops, but the extent of this damage has not been studied in Tanzania. Ten banana-growing areas situated in the four agro-ecological zones of Northern, Lake, Southern, and the Zanzibar archipelago were surveyed. Soil and root samples were analyzed for percentage incidence and number of nematodes present. Geographical information were also recorded and later used to develop nematode distribution maps. It was found that the common banana nematodes viz. the burrowing nematode (*Radopholus similis*) and the lesion nematode (*Pratylenchus goodeyi*) were present in all 10 areas, with the latter being most common. Furthermore, lesion nematodes, which are known to be common in cooler areas, were also found in the warm Zanzibar area. Finally, *Pratylenchus coffeae,* which has not been previously reported in banana growing areas of mainland Tanzania, was present in all four zones. These results will help to identify nematode hotspots and contribute to sustainable nematode management in the banana growing areas of Tanzania.

PLANT-PARASITIC NEMATODE ASSEMBLAGES ASSOCIATED WITH *AMARANTHUS CRUENTUS* (ACCESSION ARUSHA) IN FOUR PROVINCES OF SOUTH AFRICA

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Various weed species (e.g. *Amaranthus* spp.) are consumed by locals as important leafy vegetable food supplements. Plant-parasitic nematodes particularly root-knot nematodes (*Meloidogyne* spp.) hamper production of these crops. The objective of this study was to conduct a survey and identify the plant-parasitic nematode assemblages associated with the popularly cultivated *Amaranthus cruentus* (Arusha). The survey was conducted at 10 localities situated in four provinces of South Africa where *Amaranthus* are produced. Nematode species were identified by means of morphology, while verification of *Meloidogyne* spp. was done using molecular techniques. Twelve plant-parasitic nematode species and 11 genera were identified from rhizosphere soil and roots of Arusha with *Meloidogyne* spp. (*M. incognita* and *M. javanica*) being the predominant, followed by *Helicotylenchus dihystera* and *Pratylenchus zeae*. High prominence values for *Meloidogyne* spp. per 50g roots, ranging between 70 and 35,216, were recorded. Principal component analyses of data indicated that *Meloidogyne* spp. were positively related to sandy soils, while a strong positive correlation existed between the % silt and the mean population density of *Helicotylenchus dihystera*, *Pratylenchus zeae* and *Scutellonema* spp. *Criconema corbetti* were more abundant in soils with high clay and organic matter contents. Information generated during this study is the first of its kind for South Africa.

NEMATODE ASSEMBLAGES ASSOCIATED WITH THREE OIL-BEARING CROPS IN THE GIYANI REGION (LIMPOPO PROVINCE)

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Meloidogyne spp. are a major constraint especially in subsistence farming communities. Alternative nematode management strategies therefore need to be developed. The aims of this study are to i) identify plant-parasitic and non-parasitic nematode assemblages associated with *Pelargonium capitatum x radens* (Rose geranium)**,** *Lippia javanica* (Fever tea) and *Siphonochilus aethiopicus* (Wild ginger) growing on Hi-Hanyile farm in Giyani using morphological and molecular techniques. Nematode samples were obtained during February 2016 and January 2017 for each of the three crops and *Meloidogyne* spp. eggs and J2 were extracted from 50g roots/tubers using an adapted NaOCl method. Other plant-parasitic nematodes were also extracted from 5g roots/tubers using an adapted sugar floatation method. The latter method followed the decanting and sieving method to extract a wide range of nematodes from 200g soil samples. Counting and identification of nematodes were pursued and prominence values (PV) calculated. *Meloidogyne* spp. occurred at all the sites where the three oil-bearing crops were grown. The highest population density and PV for *Meloidogyne* spp. eggs and J2/50g roots were recorded for *L. javanica* (22 208), followed by *P. capitatum x radens* (6 930) and *S. aethiopicus* (5 438). The six plant-parasitic nematode genera identified in 5g root samples were *Meloidogyne*, *Scutellonema*, *Pratylenchus*, *Ditylenchus*, *Helicotylenchus* and *Tylenchorhynchus*. Population densities and PV data were low, with *Meloidogyne* spp. being the predominant genus and *Tylenchorhynchus* spp. the least dominant.

PREVALENCE AND IMPLICATIONS OF POTATO CYST NEMATODES IN KENYA

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The occurrence of the golden potato cyst nematode, PCN (*Globodera rostochiensis*) in Kenya was first reported in 2015. This triggered the need to establish the status of the pest in the main potato-growing areas of Kenya, with a view to developing a road map for comprehensive and holistic interventions towards its management in the country. Field surveys were undertaken through structured interviews with farmers in various counties, geo-referencing and collection of soil samples for subsequent extraction and identification of nematodes. The sampling was conducted in 20 potato-producing counties: Nyandarua, Nakuru, Narok, Bomet, Kericho, Meru, Nyeri, Laikipia, Elgeyo Marakwet, Bungoma, Trans Nzoia, West Pokot, Uasin Gishu, Nandi, Baringo, Kiambu, Murang'a, Kirinyaga, Embu and Taita-Taveta in September and October 2016. PCN cysts were detected in all 20 counties, and their identity confirmed through morphological and molecular analyses. The pest, with cysts were recovered from 904 soil samples (73% of the analyzed samples). The widespread occurrence of PCN based on this study potentially decreases the availability of good quality seed potato and greatly widens the existing yield gap; consequently threatening the potato sub-sector in Kenya.

NEMATODE SURVEY FROM ONE OF AFRICA'S LAST UNSPOILED WILDERNESSES

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The Okavango Delta, situated in the northern reaches of Botswana may be recognised by its clear waterways, lush green papyrus and fertile floodplains, surrounded on all sides by arid semi-desert and Kalahari sandveld. A field trip was undertaken to the Leseding Research Camp near Shakawe, Botswana in December 2016 to sample the nematofauna of this region. Before the 2016 survey, the only other reports of non-parasitic nematodes from Botswana were in the early 1990's by Heyns, Coomans and De Bruin; their studies were mostly carried out in the Moremi Wildlife Reserve and Chobe National Park. Soil samples for the present survey were collected in replicate from three localities near the research camp and either kept in a refrigerator, or processed using the modified Baermann funnel or tray method. The remaining samples were transported to Bloemfontein where they were processed using standard techniques. Extracted nematodes were mounted on Cobb slides and are currently still being identified. To date, nematodes from the following families have been identified: Dorylaimidae, Qudsianematidae, Aporcelaimidae, Mononchidae, Tobrilidae and Chronogasteridae. Preliminary results also revealed that the families Dorylaimidae and Qudsianematidae were dominant in many of the processed samples. Nematode community data will also be used to determine the ecological status of the upper Okavango Delta.

ANOTHER NEMATODE PEST OF GROUNDNUT IN THE VAALHARTS IRRIGATION SCHEME (SOUTH AFRICA)

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Ditylenchus africanus is the most economically important nematode pest of groundnut in South Africa and is present in all production areas. *Aphelenchoides arachidis* also damages local groundnut, but has to date only been reported from a few localities. A third plant-parasitic nematode genus that damages local groundnut crops involves several *Meloidogyne* species. Severe damage to groundnut pods, sampled in the Vaalharts Irrigation Scheme (Northern Cape Province) during May 2016, revealed the presence of large numbers of *Robustodorus* juveniles. Mature males and females were obtained from rhizosphere soil samples. Population densities of this nematode ranged from 2 – 1 531 specimens/5g seed and 10 – 22 750 specimens/5g hulls. Parasitism of this nematode resulted in pronounced, blackish discoloration of hulls and discoloured and shrunken seeds. Morphological and molecular identifications of this nematode are currently in progress, suggesting that it belongs to a new species. This is the first report of this nematode's association with groundnut worldwide. Future research necessitates a survey to determine whether *Robustodorus* is distributed in other local groundnut production areas, while knowledge on its reproduction potential and aggressiveness to groundnut and other rotation crops should also be attained.

A STUDY OF THE CARROT CYST NEMATODE, *HETERODERA CAROTAE*, IN SOUTH AFRICA

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Carrot (*Daucas carotae* L) is one of the four major root and tuber vegetables consumed in South Africa. The carrot crop therefore contributes much to the gross value of agricultural production in the country. In 2008 *Heterodera carotae* Jones, 1950 (carrot cyst nematode) was first reported from the Tarlton area, with concomitant crop damage. This nematode is generally considered a European species and no previous studies had been conducted on *H. carotae* under South African conditions. This presentation deals with a morphological, morphometrical and molecular study of populations of *H. carotae* in the Tarlton area, and results from this study are compared with those of European populations. To determine the number of generations that can be completed by *H. carotae* during a carrot-growing season in South Africa, the life cycle was investigated under field conditions. This involved weekly collections of root and soil samples, from seedling emergence to harvesting (about 22 weeks), extraction of all nematode life stages, and calculation of the abundance of each developmental stage. The soil temperature was recorded throughout the experiment. The time-periods and accumulated day-degrees above the developmental temperature (10°C) required by *H. carotae* to reach different life cycle stages are graphically presented.