

REPORT

**Strengthening the ginger export pathway for Australia-
Ministry of Agriculture**

10 March, 2015

Introduction

This report presents the recent work carried out by the Ministry of Agriculture, in its efforts to strengthen the ginger export pathway for the Australian market. The main objective is to ensure that growers and other stakeholders are meeting the import requirements of the Department of Agriculture, Australia.

Recent work undertaken by the Ministry that is additional to the import requirements, includes the collection of soil samples taken for the purposes of analysis of nematode presence and using the results of these tests as a 'qualifier/disqualifier' for registration of farms for export of ginger to Australia. Data collected includes information on ginger farm survey, nematode prevalence, activities organized by respective division of the Ministry of Agriculture and Marketing data (export of fresh ginger from Fiji to Australia).

For nematode prevalence, this report presents the genera encountered during the survey and the most dominant genera. This report also analyzed the nematode prevalence by locality where most ginger farms are located.

1. Ginger farm Survey

Cropping system - Crop rotation

Ginger is currently planted in rotation with other non-host crops of *Radophulus similis*. Most farmers rotated their ginger farms with crops such as cassava and dalo. Sweet potato and Fijian asparagus (duruka) have been also noted as a rotational crop. In addition to the crop rotation, a fallow period of about 6 months is being observed by few farmers. Growth of *Mucuna pruriens* on fallow land was noticed in one of the farms in Navua.

Seed treatment

Data shows that most farmers (Naboro, Navua and Veikoba) practice a standard treatment procedure of treating ginger planting material rhizomes with hot water at 51°C for 10 minutes, while most farmers in Waibau and Lomaivuna area treated their seed using procedure "sun drying". In addition one of the farms (from Navua) also treated the rhizomes by dipping in Tricho shield- a fungicide to protect rhizomes from fungal infections.

The government has also provided gas facilities for hot water treatment of planting material. A small (1.2 m³) gas-fired vat is issued by the Ministry of Agriculture for the purposes of hot-water treating ginger seed for the Ministry's recommended treatment of 51°C for 10 min period.

Ginger field size and type of land

All ginger fields were noted for their field size. The size of the ginger fields of a commercial farm in Navua ranged from 0.27 acre to 1.58 acre. In Waibau, most commercial field size ranged from 2.5 acre to 5 acre, while semi commercial fields size ranged from 0.1 acre to 0.3 acre. In Lomaivuna, where most farmers grow ginger at semi commercial scale, their field sizes ranged from 0.1 acre to 0.3 acre. In Waidina, there is only one farm investigated, with the field size of 0.5 acre. At Munaweni, one farm is recorded with 4 different field size ranging from 0.2 acre to 0.5 acre.

Use of poultry manure

Farm survey data shows that most farms are using poultry manure with few farms using NPK, urea in addition to poultry manure.

Years of ginger farming.

Farmers in Waibau area have been cultivating ginger for past 50 years, while some farms have been noted for ~20 years. Farmers in Veikoba and Muaniweni have been practicing ginger farming for more than 20 years. Farmers in Navua and Naboro are the only two farms, which have started with ginger farming in year 2013.

Soil Chemistry and soil type

Soil pH data was recorded from Naboro area only; the soil pH was 4.5-5.5, mostly acidic. Naboro had very high numbers of *Helicotylenchus* in their samples. There is no association of nematodes with soil pH in this survey however the soil pH.. Soil pH data for other areas could not be retrieved. Soil Type was noted only from a farm in Navua with most blocks having either loam or sandy loam soils.

Other Data:

Land preparation in most fields were performed/carried by means of man power (manual), while very few farms used digger to prepare their land. This practice is to avoid minimum tillage during land preparation. For most of the ginger farms, GPS coordinates have been noted to map the distribution pattern of nematodes.

2.0 Nematode Survey Data

Fields from Waibau, Veikoba, Lomaivuna and Naboro were surveyed in the month of September 2014, during the land preparation phase. Fields from Muaniweni and Navua were sampled in June and July 2014 respectively. A total of 55 ginger soil samples and 6 ginger rhizome samples were collected from 55 ginger fields. In addition soil samples were also collected from other hosts such as banana and eggplant.

GPS coordinates for most of the sites have been compiled and documented. GPS coordinates have been used to map the distribution pattern of the nematodes. Nematode sampling and identification was done by Research Division, Ministry of Agriculture.

Soil sampling, extraction and identification

Samples were taken with a shovel at a depth of 0–20 cm from about ten plants in each field. A total of 10 sub-samples were taken and mixed to represent composite sample.

To extract nematodes from soil samples, soil (200 mL) was spread on a standard nematode extraction tray and nematodes were recovered after 2 days by sieving twice on a 38- μ m sieve. For extracting nematode from rhizome sample, rhizomes were cut into 70g sections, placed in 200 mL of water, macerated in a blender for 10 s, and then placing the macerate on an extraction tray for 24 h to extract nematodes.

Nematodes were identified using morphological technique. The identification was done by nematologist at Koronivia Research, Plant Pathology laboratory.

Analysis

Nematode prevalence, density and distribution.

From the fifty-five soil samples, four nematode genera namely *Rotylenchulus reniformis*, *Helicotylenchus* sp, *Criconea* sp and *Meloidogyne* sp were encountered. The most widespread genera in the ginger soil samples were *Rotylenchulus reniformis* and *Helicotylenchus*, occurring in 76 and 42% of the ginger fields respectively while genera *Criconea* and *Meloidogyne* occurred in 26 and 11 % of the fields respectively. *R. reniformis* was also noted to be widely distributed in most of the ginger fields in different locations as in Table 1.0. There were no records of *Radopholus* sp.

The population densities of nematodes in the soil samples was also investigated. We found that *R. reniformis* was most dominant in 51% of the soil samples, while *Helicotylenchus* was dominant in 28% of the soil samples. *Criconema* and *Meloidogyne* were dominant in 13 and 10% of the samples respectively.

From the six (6) rhizome samples collected in four different ginger sites, only Root Knot nematode (*Meloidogyne sp*) was encountered.

Table 1.0: The occurrence and distribution of plant parasitic nematodes in 7 localities of ginger growing areas in Fiji.

Locality	Nematode Prevalence
Lomaivuna	10 out of 12 fields had <i>R. reniformis</i> , few records of <i>Criconema</i> and one record of <i>Helicotylenchus</i> and <i>Meloidogyne</i> each. No other genera recorded.
Muaniweni	1 out of 3 fields had <i>R. reniformis</i> , <i>Helicotylenchus</i> and <i>Criconema</i> . No other genera recorded.
Navua	6 out of 8 fields had <i>R. reniformis</i> , 3 fields had records of <i>Criconema</i> and <i>Helicotylenchus</i> each while 4 fields with records of <i>Meloidogyne</i> . No other genera recorded. A farm from Navua had records of <i>Meloidogyne</i> in ginger rhizome.
Naboro	Very high no. of fields (13/16) were infested with <i>Helicotylenchus</i> . In addition 50% of the fields were also noted for <i>R. reniformis</i> . There were no records of <i>Meloidogyne sp.</i> and other genera.
Waibau	This area had all 11 fields showing records of <i>R. reniformis</i> . Very few records of <i>Helicotylenchus</i> and <i>Meloidogyne</i> and <i>Criconema</i> .
Waidina	Only one farm surveyed and it had only records of <i>R. reniformis</i> .
Veikoba	All four farms were infested with <i>R. reniformis</i> . There were no records of <i>Helicotylenchus</i> , <i>Meloidogyne</i> and <i>Criconema</i> . No records of other genera.

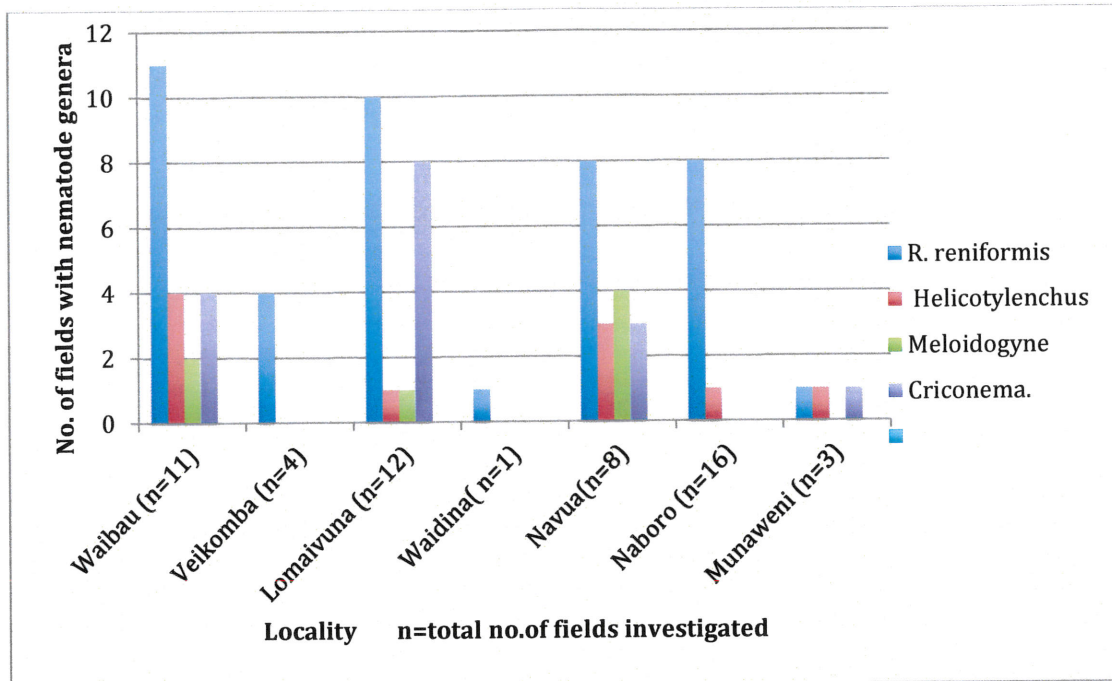


Figure 1.0 Graphical presentation of plant parasitic nematodes occurrence in 7 different localities of ginger growing areas. Nematodes were extracted from soil (200 mL), which was spread on a standard nematode extraction tray. Highest densities > 1000 of *R. Reniformis* was noted from Waibau and Naboro area.

Soil samples collected from crops such as banana, eggplant and fallow land also showed prevalence of genera *Rotylenchulus reniformis*, *Helicotylenchus*, *Criconema* and *Meloidogyne*. There were no records of *Radopholus* in other hosts sampled.

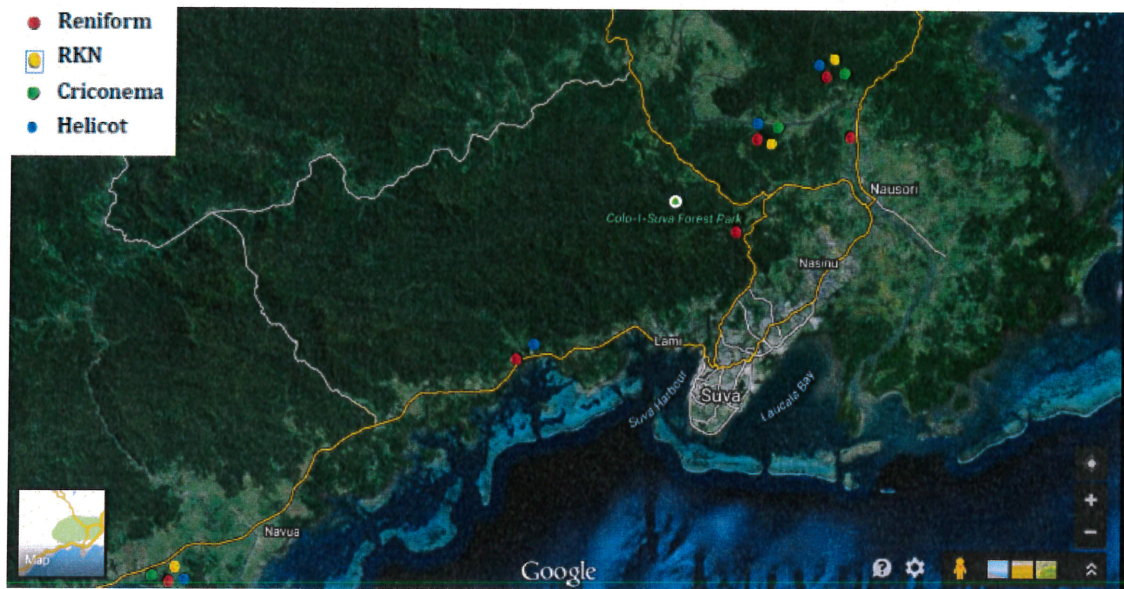


Fig 2.0 Distribution of plant parasitic nematodes in ginger growing areas (Central division) of Fiji. Coloured circles represent respective nematodes as in the key. This figure combines information from the same year.

Presence and absence of *R similis*

Nematode surveys on ginger farms in 2007 revealed that *R. similis* was dominant in ginger farms in Veikoba and Muaniweni areas. *R. similis* was found to be present on planting material, on volunteer ginger in fields of taro and cassava which are common rotation crops and poor hosts of *R. similis*, and on weeds such as crowsfoot (*Eleusine indica*).

These farmers have been practicing ginger farming for more than 20 years. Nematode sampling carried out in September 2014, after 7 years in Veikoba and Muaniweni from the same ginger fields, did not show any records of *R. similis*.

Volunteer ginger and weeds- crowsfoot (*Eleusine indica*) were also sampled in February 2015 to investigate presence of *R. similis*. Data showed absence of *R. similis* from the same field.

We also investigated if there was uniformity in the techniques used back in 2007 and 2014. The technique was robust. The sampling, extraction and identification of nematodes was carried out by same personnel Ms. Turaganivalu.

3.0 Activities organized by Ministry's Research and Extension division.

There have been various activities organized by Ministry of Agriculture, Extension and Research division, such as:

An overview of training, awareness and various programme organized by Extension

Training sessions specifically for growing ginger for export have been organized by the Extension Division. Training has been provided on the recommended package of practices by the Ministry as outlined in the Technical Bulletin for Ginger. A total of 16 training sessions have been organized for 560 farmers in the Central division. Extension staff ensured that all registered farmer's were assisted in strengthening their compliance with Australia's requirements.

4.0 Export Data

In addition to the Australian market, Fiji currently exports fresh mature ginger to New Zealand, Canada and USA for direct retail in supermarkets.

Table 2.0- The table below summarizes the export of fresh ginger to Australia.

No.	EXPORTER	WEIGHT(kg)	MONTH OF EXPORT
1.	Sai Yee Foods	494.12	September
2	Turners & Growers Ltd	1577.5	September
3.	Turners & Growers Ltd	1150	October
4.	Turners & Growers Ltd	2300	November
5.	Baby Pink Ginger	290.5	January, 2015
	TOTAL	5812.12	

Conclusion

R similis is not considered an important plant-parasitic nematode in farms growing ginger as the survey did not encounter any presence records of *R. similis* from ginger growing areas.

The data documented shows that farms are routinely following the additional inputs such as soil sampling test, treating the seeds with hot water at recommended time and temperature, use of poultry manure, rotating ginger with non-host and other management practices.

Additional Information

Key management practices	Benefits	References/ links
Crop rotation	Crop rotation practices with certain crops suppress nematode population.	Turaganivalu et al., 2013 http://link.springer.com/article/10.1007/s13313-013-0206-2 <i>R. similis</i> did not multiply on either taro or cassava in pots. The nematode was not detected following taro, and although it was recovered from pots which had grown cassava, the final population density (379±168 <i>R. similis</i> /pot) was lower than the number of nematodes inoculated.
Planting material Source and treatment with hot water.	Sourcing own planting material restricts PPN distribution esp nematode of a concern. seeds treated in hot water at recommended temp at at certain time kills the nematode	Turaganivalu et al., 2013
Use of organic fertilizers	Increase the population of free living nematodes and lowers the population of PPN	Turaganivalu et al., 2013.

