Queensland
Government

Department of
Agriculture, Fisheries and Forestry

Reference: **30882/13**

19 DEC 2014

Dr Kim Ritman
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Australian Department of Agriculture
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Dear Dr Ritman

Thank you for your advice of 17 November 2014 in relation to the Department of Agriculture's (DA's) *Commencement of a review of import conditions for fresh ginger from Fiji* and the request for stakeholder comments by 19 December 2014.

The Department of Agriculture, Fisheries and Forestry (DAFF) has prepared the attached technical response to the terms of reference of the review.

DAFF strongly recommends that further research is conducted to (1) investigate the pathogenicity and virulence, and degree of genetic variation, among Fijian and Australian isolates of burrowing nematode (*Radopholus similis*), and (2) determine the efficacy of methyl bromide as a postharvest fumigant against burrowing nematode in fresh ginger.

DAFF is fortunate to have several scientists with expertise in both ginger production and pests, including specific knowledge and experience with burrowing nematode. These experts will be available if required to contribute to the review and to conduct the necessary research. DAFF looks forward to assisting with the review where possible.

Thank you for the opportunity to comment on the review. It is important to Queensland that the import conditions for fresh ginger from Fiji effectively mitigate the pest risk, particularly the risk associated with burrowing nematode, to protect the Australian ginger industry and our favourable plant health status.

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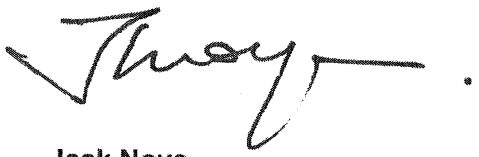
Yours sincerely



Jack Noye
Director-General
Department of Agriculture, Fisheries and Forestry

Att

Department of Agriculture, Fisheries and Forestry

Response to the *Commencement of a Review of Import Conditions for Fresh Ginger from Fiji*

This publication has been compiled by Biosecurity Queensland, Department of Agriculture, Fisheries and Forestry.

RESPONSE TO TERMS OF REFERENCE

Term of reference:

Evaluating the efficacy of the measures applied to manage the biosecurity risks associated with fresh ginger from Fiji by:

- *analysing and evaluating pest interceptions from on-arrival inspections, including evaluating the compliance of on-arrival fumigation,*
- *evaluating information from audits in the exporting country,*
- *gathering, recording and evaluating any information on additional processes in Fiji to ensure compliance with the import requirements, and*
- *evaluating any other relevant additional scientific information that is available.*

Response:

Pests detected in ginger imported from Fiji

Following the recent arrival into Australia of fresh ginger imported from Fiji, ginger has been intercepted at both the Sydney and Melbourne markets by the Australian ginger industry, and tested for the presence of burrowing nematode (*Radopholus similis*), yam scale (*Aspidiella hartii*) and other quarantine pests of concern. The diagnostic testing was conducted at the request of the Australian ginger industry by Queensland Department of Agriculture, Fisheries and Forestry (DAFF) scientists with experience in ginger pests and diseases.

Dead yam scale and several other genera of nematode (*Pratylenchus*, *Rotylenchulus* and *Helicotylenchus*) were detected in the samples, indicating that the methyl bromide treatment had been effective against these pests.

Although no burrowing nematode was detected in the samples tested, live root knot nematode (*Meloidogyne arenaria*) was confirmed in every sample of the imported ginger tested.

The presence of live root knot nematode in the consignments indicates the methyl bromide fumigation was ineffective against this pest. If the methyl bromide fumigation was ineffective against root knot nematode, then almost certainly it would be equally ineffective against burrowing nematode if it was present, especially considering that burrowing nematode has the capacity to burrow even more deeply into the ginger rhizome.

The absence of live *R. similis* in the tested consignments cannot be considered proof that the methyl bromide fumigation was effective. No dead *R. similis* were detected either and it is possible that these particular consignments of ginger were harvested from areas with a very low population density of burrowing nematode or that some other factors may have contributed to the pest not being detected in the samples tested e.g. only a small sample of material from the consignments was tested.

The Import Risk Analysis (IRA) for ginger from Fiji (Australian Government 2013), in determining the probably of entry of *R. similis,* has made the assumption that 'Obviously infested or rotting rhizomes would be discarded at harvest. Rhizomes with lesions or other symptoms of nematode are likely to be culled during pre-export processing/packing, or detected during phytosanitary inspection'.

The ginger in these consignments was of very poor quality and the symptoms of root knot nematode infestation were obvious, indicating severe infestation. The obvious severe infestation of the tested ginger consignments indicates that the inspection processes in both Fiji and on arrival in Australia failed to fulfil the assumption in the IRA and modification of the inspection process should be immediately adopted to improve effectiveness. It is unacceptable that the ginger intercepted at both the Sydney and Melbourne markets has passed through the harvesting, cleaning, grading, curing, packaging, exporting and inspection stages, when it was clearly and obviously symptomatic.

Failure to meet the general requirements for consignments

All IRA reports state that 'Australia has general requirements for all fruit and vegetables, which require that consignments must be free of live insects, disease symptoms, trash, contaminant seeds and other debris on arrival in Australia' (Australian Government, 2011).

Of the ginger that was obtained from the Sydney markets (refer above), four of the five boxes of ginger examined and tested contained soil, weeds and plant debris, in addition to the live root knot nematode detected.

The inspection regime for imported ginger needs to be rigorous enough to detect pests, invasive plants and contaminants upon arrival in Australia.

Although the species of root knot nematode (*M. arenaria*) detected has been recorded in Australia previously, it has never been recorded on ginger in Australia.

It is also not known if this isolate of *M. arenaria* detected in the ginger from Fiji is the same strain as previously recorded in Australia. Introducing a new strain of a plant pest can be as hazardous as introducing a new species.

Consignments of plants or plant products that harbour live plant pests or fail to meet the general requirements should be either destroyed or sent back to the exporting country. They should not be accepted into Australia, due to the risk of introducing new strains or species of plant pests.

Efficacy of methyl bromide treatment against burrowing nematode (and other pests)

Although methyl bromide can be an effective nematicide when used as a soil fumigant, its use as a postharvest treatment, particularly for internally feeding nematodes such as burrowing nematode, has been authorised without any scientific evidence to demonstrate that it is effective.

No trials or studies have been conducted to demonstrate that the recommended methyl bromide fumigation rate (32g/m^3 for 3 hours at 21°C) is effective for burrowing nematodes in vegetative material such as ginger rhizomes.

The effectiveness of the methyl bromide fumigation needs to be assessed in detail to determine if there is an appropriate pressure and temperature regime to destroy burrowing nematode.

Assuming that an appropriate methyl bromide treatment regime can be established for fresh ginger, a compliance monitoring program needs to be in place to regularly monitor that the treatment is being conducted correctly whether carried out in Fiji or on arrival in Australia.

Potential alternative treatments for burrowing nematode (and other pests)

If an effective methyl bromide fumigation regime for burrowing nematode cannot be established, other alternative treatments need to be investigated for fresh ginger e.g. irradiation.

Ginger production in Fiji

There are several crop management practices which should be implemented and monitored in ginger growing areas in Fiji to help reduce the levels of *R. similis* infestation in ginger for export. These practices include ginger seed treatment to ensure clean planting material, crop rotation, and elimination of volunteer ginger and weeds.

Clean planting material

It is imperative that ginger growers in Fiji use clean planting material to establish new crops. It is understood that due to the chronic shortage of planting material, ginger growers in Fiji are not discriminatory in sourcing planting material and will obtain material from a wide range of sources, irrespective of the level of pest and disease infestation of the material. Seed ginger is often sourced from older ginger plants in which nematode populations have built up. Field and glasshouse studies have shown that when nematode-infested seed is planted, *R. similis* can multiply to relatively high population densities within a few months (Smith et al. 2012).

Hot water treatment (51°C for 10 minutes) has been shown to be an effective method for reducing nematode infestation in ginger rhizomes used for planting material. However in Fiji, the hot water treatment is most often carried out incorrectly, and at temperatures that are insufficient to kill nematodes (Australian Government 2007; Smith et al. 2012; Turaganivalu et al. 2013).

If the hot water treatment is performed correctly, it is an effective way to reduce the levels of burrowing nematode in planting material and consequently the spread of pest (Smith et al. 2012; Turaganivalu et al. 2013).

Crop rotation

Ginger is often rotated with taro and cassava, both of which are poor hosts of *R. similis* (Smith et al. 2012; Turaganivalu et al. 2013). Populations decline to either non-detectable or low levels after one year of either taro or cassava (Turaganivalu et al. 2013).

Elimination of volunteer ginger

Roguing out volunteer ginger plants to remove the host during crop rotations and fallow periods is essential to reduce pest nematode populations (Smith et al. 2012; Turaganivalu et al. 2013).

Weed control

Weeds (e.g. crow's foot or *Eleusine indica*) may act as alterative hosts for *R. similis* and therefore need to be controlled or eliminated to control nematode populations (Smith et al. 2012; Turaganivalu et al. 2013).

Other practices

The use of pre-planting applications of poultry manure has been shown to reduce nematode populations (Smith et al. 2012; Turaganivalu et al. 2013).

General issues

It is understood that the government extension service for ginger growers in Fiji is run down and the system does not function effectively. Effective extension is also difficult given the number of ginger growers and their distribution across the commercial farms and the surrounding villages and highlands. Therefore there is very little education and awareness among growers about pest and disease management options. Although the Ministry of Agriculture has provided guidelines for growing ginger, the implementation of proper crop management practices is not mandatory.

Surveillance and monitoring for burrowing nematode needs to be carried out routinely to determine the geographical distribution and monitor the pest population density on affected farms and in ginger growing areas more broadly. It is essential to have a good understanding of the farms and districts infested with burrowing nematode, and the levels of infestation in affected areas. Soil testing should be carried out regularly to monitor the pest population density, distribution and spread in ginger growing areas, and the effectiveness of crop management practices.

This work will need to be properly resourced (appropriate skills and expertise, vehicles, travel and operating funding, equipment and facilities etc.). At present, there is only one nematologist in Fiji, and this person works across all different crops, not just ginger. Specific resourcing is required for the surveillance and monitoring of burrowing nematode in Fiji, as well as assistance for growers to improve their growing practices for ginger e.g. the provision of clean planting material and crop rotations.

In addition, for proper inspection during grading and packing, inspectors need to be trained to inspect for and detect symptoms of pest and disease infestation, including the specific symptoms for burrowing nematode. The small sunken lesions of burrowing nematode can easily go undetected, even amongst inspectors with a reasonable level of training and experience. Highly trained and qualified inspectors and a thorough inspection process are necessary to ensure effective detection of infested ginger.

Term of reference:

Consider and make recommendations of further actions to confirm the quarantine status of Radopholus similis, *including additional scientific information relating to this including on the efficacy of methyl bromide as a phytosanitary measure.*

Response:

The basic taxonomic unit considered in the IRA process

The international guidelines that the Australian Government's IRA procedure is based on, state that:

'The taxonomic unit for the pest is generally species. The use of a higher or lower taxonomic level should be supported by scientifically sound rationale. In the case of levels below the species, this should include evidence demonstrating that factors such as differences in virulence, host range or vector relationships are significant enough to affect phytosanitary status' (FAO 2013).

Many plant pathogens are differentiated at a sub-specific taxonomic level, such as forma specialis, race, pathovar, pathotype or biotype. The IRA process needs to recognise these sub-specific taxa are

entirely valid. As stated above, introducing a new strain of a plant pest can be just as hazardous as introducing a new species.

Virulence of the Fijian isolates of *Radopholus similis*

Recent scientific studies have recognised that the Fijian strain of *R. similis* is more virulent than the Australian strain of *R. similis* (Cobon et al. 2012, Turaganivalu et al. 2013). The Fijian strain of *R. similis* causes serious damage to ginger (Turaganivalu et al. 2013) while in contrast the Australian strain of *R. similis*, is not an aggressive pathogen of ginger (Cobon et al. 2012).

To further clarify the comparative pathogenicity of the Fijian and Australia strains of *R. similis*, a direct comparison of the Fijian and Australian isolates should be conducted under identical experimental conditions (i.e. in the same experiment). This would require acquisition of isolates of *R. similis* from different ginger growing areas in Fiji for comparison to isolates representative of the Australian strain. Analyses required would include pathogenicity testing, as well as molecular diversity studies. All experiments should be replicated (at least duplicated) and the studies published in a peer-reviewed scientific journal.

Genetic variation amongst Fijian isolates of *Radopholus similis*

There is a very limited understanding of the degree of genetic variation amongst Fijian isolates of *R. similis* and this area requires investigation.

A detailed study of the genetic and pathogenic variation amongst Fijian strains of *R. similis* is required. Isolates of *R. similis* should be obtained representative of the different varieties of ginger, growing areas in the main production area and the villages and highlands, and also isolates from native ginger. In addition to pathogenicity testing, genetic diversity should be analysed using molecular techniques, in particular multi-locus DNA sequencing methods.

The limited genetic variation amongst Australian isolates of *Radopholus similis*

Analysis of Australian isolates of *R. similis* has indicated that there is little to no genetic variation amongst Australian isolates occurring on a range of crops i.e. only a single strain is known to occur in Australia (Tan et al. 2010). The geographical distribution of *R. similis* in Australia is also well understood, with the pest occurring mainly in banana production areas from Coffs Harbour through to northern Australia.

Given the lack of genetic diversity amongst Australian isolates of *R. similis*, and the greater genetic diversity amongst overseas isolates of *R. similis*, it would be prudent to prevent the introduction of any new strains in Australia.

If new strains of burrowing nematode were introduced into Australia, in addition to the pest risk and potential impacts on crop production, there are also risks to export markets which rely on area freedom from this pest (e.g. carrots to Taiwan).

Further actions to confirm the quarantine status of *Radopholus similis*

Research into the degree of pathogenic and genetic variation amongst different strains of burrowing nematode, and their impact on Australian and Fijian crops would involve a significant investment of scientific resources, including appropriate quarantine containment facilities. A comprehensive research project to address this issue would likely cost in the order of $500,000 over a period of three years.

However, outcomes from this project would be of benefit to a number of biosecurity stakeholders, including the Australian ginger industry and other Australian plant industries that are likely to be affected by burrowing nematode (e.g. pineapple, banana). Funding for this research could be sought from cross industry initiatives.

Further actions to determine the efficacy of methyl bromide treatment against burrowing nematode (and other pests)

It is critical that further research into the efficacy of methyl bromide as a postharvest fumigant against burrowing nematode in fresh ginger is carried out. This has not been done and there has been little opportunity (to develop research proposals, gain funding, etc.) to conduct this additional work since the release of the final import risk analysis report for fresh ginger from Fiji in 2013.

The decision to use methyl bromide as a postharvest treatment for burrowing nematode in ginger was made without any specific scientific evidence to demonstrate that it would be effective. It is our understanding that responsibility for providing evidence of efficacy would lie with the Federal Department of Agriculture or the importer.

An estimate of the cost of this research, would be in the order of $100,000 to $150,000 over the period of one year.

NOMINATION OF RELEVANT SCIENTIFIC EXPERTS TO ASSIST DURING THE REVIEW

DAFF would nominate the following research scientists who have expertise in nematology and ginger pests and diseases:

- Dr Mike Smith (Principal Horticulturist, DAFF)
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- Jenny Cobon (Senior Experimentalist and Nematologist, DAFF)
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More details of their skills and experience (including curricula vitae) can be provided upon request.

These scientists all have extensive research experience, and to our knowledge, are the only nematologists in Australia with field and laboratory experience with *R. similis*.

References

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Australian Government Department of Agriculture, Fisheries and Forestry (2011). Import risk analysis handbook, Canberra.

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