



REPÚBLICA DE MOÇAMBIQUE
MINISTÉRIO DA AGRICULTURA E DESENVOLVIMENTO RURAL
DIRECÇÃO NACIONAL DE SANIDADE AGROPECUARIA E BIOSSEGURANCA
DEPARTAMENTO DE SANIDADE VEGETAL

Detection and Delimitation Survey for Foc TR4 in Mozambique

IPPC Workshop Series on Fusarium TR4 (Tropical Race 4)



Maputo, April 2022

I. Introdução (1)

National Banana Industry

1. Southern region: 16 large commercial growers farmers - **4000 ha**

Average ~ **250-300 ha** per each farmer

2. Central region: 3 large commercial growers farmers - **200 ha**

Average ~ **50-70 ha** per each farmers

3. Northern region: Three (3) large commercial growers farmers - **750 ha**

Average ~ **250 ha** per each farmers

Total of **75000 ha** (including **small farmers**)

Production/year- 518.000 ton (FAOSTAT, 2019)

Ranking: 3rd most banana producer in Africa



I. Introdução (2)

1. Bananas in Africa and Mozambique in particular is important in the basic diet of families and source of income for small producers in rural areas;
2. Is a source of foreign exchange to the country, through exports to various international and regional markets (USD 70 millions/year);
3. In recent years, the country has made significant investments in the banana industry, ensuring employment for many families;



I. Introduction (3)

4. Of the total production of the banana industry, 80% is exported to several international markets and 20% consumed locally;
5. Banana production in the country has been affected by several biotic and abiotic factors:
 - a) Low level of use of appropriate technologies, culminating in low yields,
 - b) Poor quality of the fruit, especially for the export market, due to the attack of pests and diseases (BBTV, Foc TR4).



Type of farms (Large and small commercial, and smallholder farmers)



- a) In Mozambique we have all the three types of farms (Large and small commercial and smallholder farmers fields (most predominant for subsistence)).
- b) Most of the largest commercial farmers are owned by foreigner

Small commercial-medium size farmers, owned by local/national farmers



Smallholder farmers for
subsistence



II. DETECTION AND STEPS TAKEN

AFTER FOC TR4 CONFIRMATION

II. Detection and Steps Taken after Foc TR4 Confirmation (1)

1. In Mozambique the first communication of the occurrence was in 2013 in Nampula province, northern part of the country;
2. The commercial Matanuska Company detected plants with symptoms of fusarium wilt;
3. Matanuska informed the NPPO and FAEF/UEM about the problem and samples were taken and sent to FAEF/UEM and SU;
 - a) FAEF/UEM confirmed the presence of Foc
 - b) SU confirmed the **presence of Foc TR4**



II. Detection and Steps Taken after Foc TR4 Confirmation (2)

External symptoms



Leaves wilt and progressively buckle at the petiole resulting in a skirt of dead leaves draped around the plant

II. Detection and Steps Taken after Foc TR4 Confirmation (3)

**External
symptoms**



Pseudostem crack

II. Detection and Steps Taken after Foc TR4 Confirmation (4)

Internal symptoms

- a) The most characteristic symptom may be seen by cutting through the pseudostem of an infected plant
- b) Dark-brown to black discoloration of the water conducting tissues is evident



II. Detection and Steps Taken after Foc TR4 Confirmation (5)

Internal symptoms



Rhizomes, when cut, show yellow to brown discoloration of the inner corm, and dark-brown to black flecks/ lines running through the tissues

II. Detection and Steps Taken after Foc TR4 Confirmation (6)

4. NPPO visited the farm to assess the phytosanitary situation and recommend containment measures;
 4. Monitor production fields regularly for early detection of new infected plants
 5. In the infected areas the infected plants were cutting and burning or cutting and bury
5. The NPPO reported the occurrence of the disease to the Ministry of Agriculture Advisory Council (MAAC) and the measures that were underway;
6. Notified IPPC/FAO, IAPSC and SADC;



II. Detection and Steps Taken after Foc TR4 Confirmation (7)

Annoucement of TR4 to the IPPC - <https://www.ippc.int/en/countries/mozambique/pestreports/2013/09/new-banana-disease-found-in-mozambique-fusarium-oxysporum-fspcubense-tropical-race-4/>

Novo separador x Mobile WiFi x Mobile WiFi x Novo separador x Mobile WiFi x Latest Pest Reports

ippc.int/en/countries/mozambique/pestreports/2013/09/new-banana-disease-found-in-mozambique-fusarium-oxysporum-fspcubense-tropical-race-4/

Geographical Distri... North of Mozambique, Nampula province in Monapo distrit

Summary The fungal disease Tropical race 4 (TR4) was discovered on a commercial farm in Monapo distrit,Nampula province, northern Mozambique, early in 2013, and the responsible fungus subsequently identified first by the Eduardo Mondlane University, Mozambique and confirmed by the Stellenbosch University in South Africa. The Ministry of Agriculture, Mozambique, through the National Directorate of Agrarian Services, said that "according to their knowledge, the outbreak is still limited to a few fields on the farm". All sites where the disease was found have now been isolated, the affected plants destroyed, and appropriate phytosanitary measures have been implemented to prevent the disease from spreading.

The Ministry of Agriculture of Mozambique officials have visited the farm, and have introduced in-country measures to contain and prevent spread to other parts of the country. A stakeholder consultation meeting to explain the outbreak was held in Maputo in November 2013, and will be followed by similar meetings in neighboring countries to raise awareness, heighten surveillance and put in place an emergency response plan.

Danger The new form of this fungal disease, Tropical race 4 (TR4) as emerged, and is spreading in Asia where it is decimating production of Cavendish. Tropical' race 4 is a more virulent form of the pathogen and is capable of causing disease in 'Cavendish' growing under any conditions, whereas 'subtropical'race 4 generally only causes

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New banana disease found in Mozambique (Fusarium oxysporum f.sp.cubense Tropical Race 4)

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| | |
|------------------------|---|
| Publication Date | Sun, 01 Sep 2013, 02:00 |
| Last Updated | Dec. 22, 2016, 11:21 a.m. |
| Report Number | MOZ-03/2 |
| Country | Mozambique |
| Pest Id | Fusarium oxysporum f. sp. cubense - (FUSACB) |
| Report Status | Preliminary |
| Hosts | The Tropical Race 4 of this fungus has banana as the specific host |
| Pest Status | <ul style="list-style-type: none">Present: only in some areas |
| Geographical Distri... | North of Mozambique, Nampula province in Monapo distrit |

II. Detection and Steps Taken after Foc TR4 Confirmation (8)

7. After the field visit, the NPPO developed an Project for contain the disease and requested support from FAO;
8. The action plan was approved as an Emergency Project and lasted for 1 year;
9. The MADER/NPPO called different stakeholders and experts of the disease (FAEF/UEM, SU/RSA, Australia, Barnes, Bioversity International e IITA) to assist in the elaboration of technical recommendations for disease containment;
10. A task force was create to monitor the implementation of biosecurity measures



Task Force

II. Detection and Steps Taken after Foc TR4 Confirmation (9)

The recommendations consisted of:

Enabling policy Environment

- Ensure effective coordination and synergy among relevant institutions and stakeholders, including public-private partnerships;
- Advocacy to ensure commitments of governments and Regional Economic Communities;
- Develop and implement appropriate strategies and contingency plans for prevention, emergency, preparedness and mitigation;
- Enhance awareness of policy makers, technical institutions and general public on the impacts and prevention of the disease;

On-farm Measures

- Improvements in drainage systems, border controls, gate controls and vehicle movements;
- Improved planning is critical while establishing new plantations in terms of phytosanitary measures as well as drainage requirements, location of packing houses and flooding threats;
- Improved sustainable crop management and application of best practices;
- Provide appropriate and adequate training to workers and raise awareness of neighbouring communities on importance of containment and impact of the disease.

II. Detection and Steps Taken after Foc TR4 Confirmation (10)

Establishment and training of the National Surveillance Team



National surveillance team during theoretical training at IIAM, Nampula



Theoretical basis was supported by field training (identification of symptoms and sample collection)

II. Detection and Steps Taken after Foc TR4 Confirmation (11)

Training of NPPO technicians, Extensionists, was carried out by SU on the identification of disease in the field and management;



II. Detection and Steps Taken after Foc TR4 Confirmation (12)

Train NPPO technicians, extension officers, quarantine officials, research institutions and private sector technicians in detection, identification and control of Fusarium wilt disease



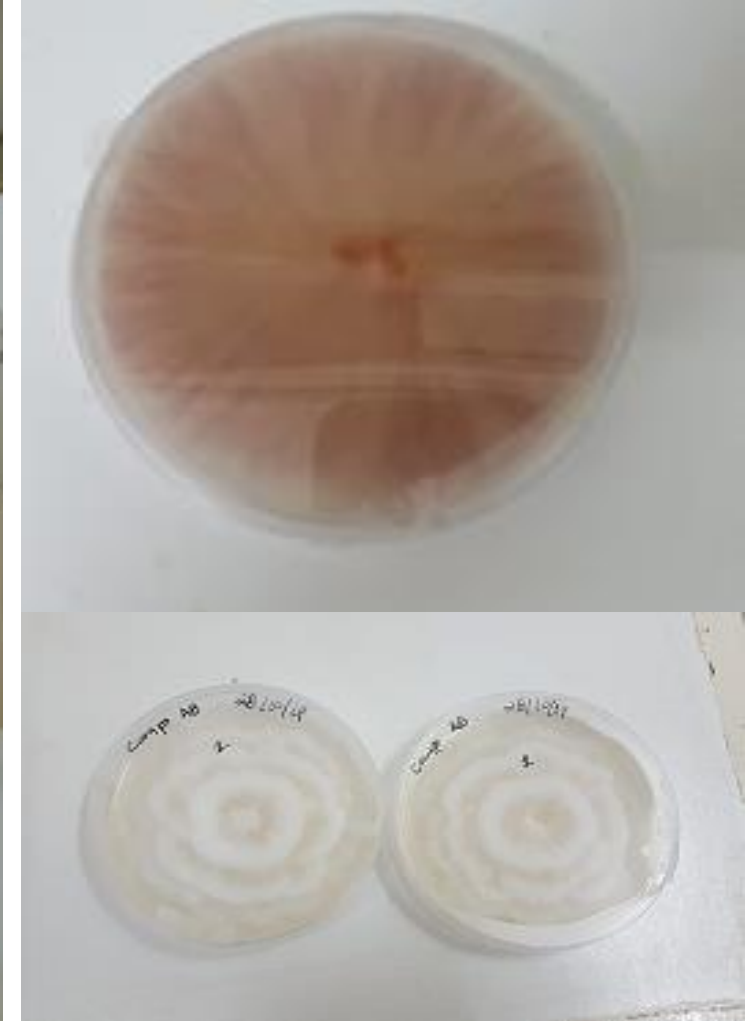
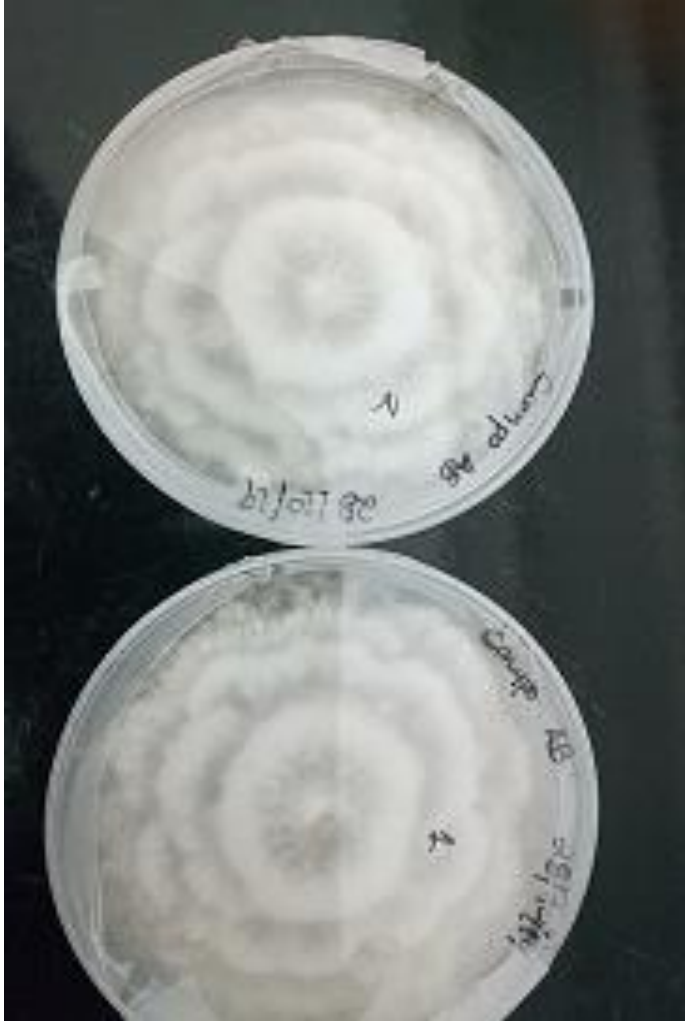
II. Detection and Steps Taken after Foc TR4 Confirmation (13)

Train laboratory diagnostic at SU/RSA

Two delegates from University and research Institute attended the training on Banana Fusarium wilt Diagnostics and Characterization at Stellenbosch University.



II. Detection and Steps Taken after Foc TR4 Confirmation (14)



Training on National Capacity for Laboratory diagnostic of Foc TR4 in IIAM

II. Detection and Steps Taken after Foc TR4 Confirmation (15)

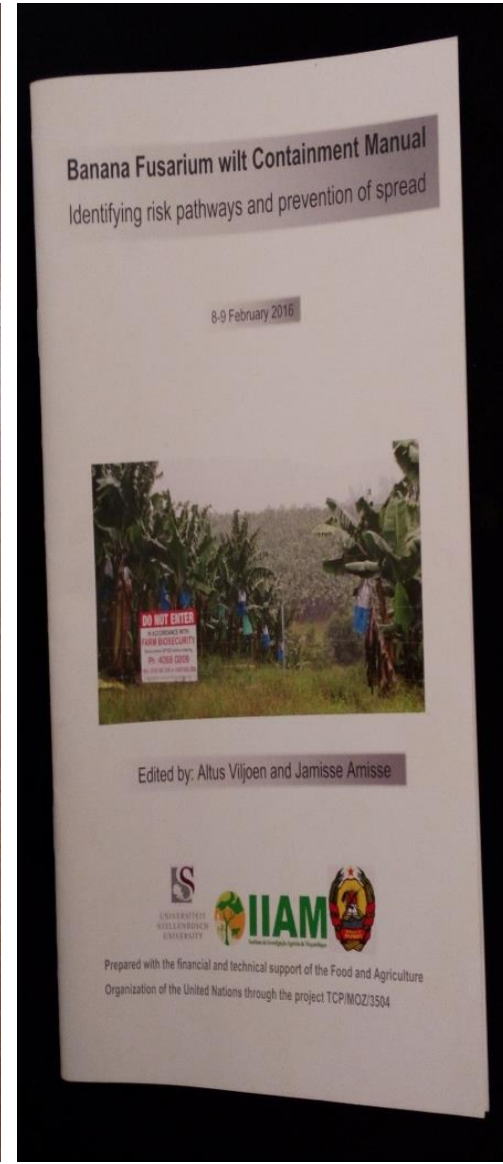
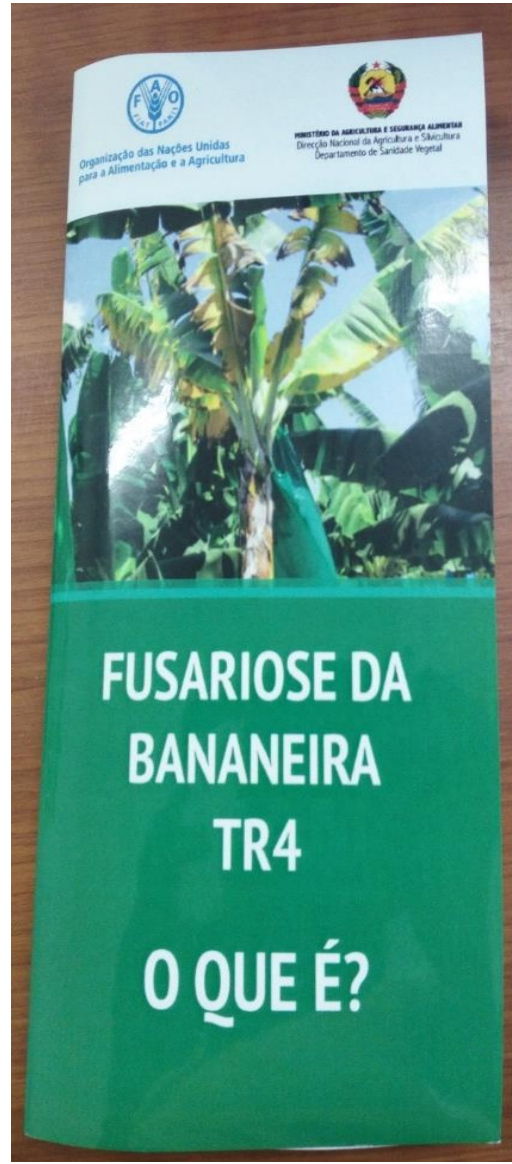


Training of small-scale banana growers in the vicinity of the infected farms and in the Nampula region in disease diagnosis, management and phytosanitary measures.

II. Detection and Steps Taken after Foc TR4 Confirmation (16)

Different awareness materials on disease identification, prevention and management were produced and distributed to farmers and all stakeholders in the banana production chain;

- Radio
- jornal
- TV
- Street signs
- Workshops
- Leaflets, brochures, posters



Poster

MAL DO PANAMÁ: A AMEAÇA GLOBAL DA BANANA

• • • A doença • • •

O Mal do Panamá também conhecida por Fusariose é uma das doenças mais destrutivas da banana em todo o mundo. É causada por um fungo denominado *Fusarium oxysporum f.sp. cubense* (Foc). O fungo infecta as plantas através das raízes colonizando de seguida o pseudocaule, onde causa obstrução no transporte da água, resultando no murchamento das folhas e a morte das plantas. Uma vez estabelecida numa plantação, pode facilmente **dispersar-se** e devastar plantações de banana. A erradicação efectiva da **doença é quase impossível** com os meios actualmente existentes.

Nas últimas duas décadas, a raça tropical 4 (Tropical Race - TR4), do fungo *Fusarium* tem vindo a afectar severamente a banana no sudeste da Ásia. Contudo, foi recentemente descoberta no Médio Oriente e numa plantação de Cavendish em Nampula, Moçambique, indicando que de facto, é uma ameaça para a banana de todo o mundo.



Um campo infestado

Como reconhecer o Mal do Panamá (Foc TR4)?

TR4 produz sintomas característicos **de ataque do fungo Fusarium**. O primeiro sintoma visível é normalmente o amarelecimento das folhas mais velhas. A medida que a doença progride, as folhas entram em colapso, formando uma saia de folhas mortas em torno da parte inferior da planta. O fraccionamento da base do pseudocaule é outro sintoma comum, **assim como o**

enrrugamento e deformação das folhas emergentes. O principal sintoma interno é a descoloração do rizoma e do pseudocaule, que varia entre o amarelo pálido na fase inicial até vermelho escuro **acastanhado** ou quase negro na fase mais tardia. Os frutos não apresentam nenhum sintoma específico.

O que é TR4?

Raça **tropical 4** (Tropical race 4 - TR4) é o nome dado às estirpes do fungo que afectam particularmente as bananas Cavendish nos trópicos. O termo TR4 é utilizado para distinguir estas estirpes da raça 1 e 2 e a raça 4 subtropical (STR 4), que afecta as bananas Cavendish na presença de factores **predispostos** de stress abiótico como as baixas temperaturas.

O que significa a TR4 para a banana Africana?

As estirpes Foc 1 e 2 são comuns em África onde afectam plantações de banana de mesa como as Gros Michel (Bogoya) e Pisang Awak (Kayanja) mas não as Cavendish. O TR4 também causa doença em plantações susceptíveis a estas duas estirpes (Foc 1 e 2), mas também na Cavendish, tendo ainda potencial para afectar as espécies usadas na cozinha com as plantaines (platanos) e a East African highland bananas (bananas das montanhas da África Oriental). A principal incógnita é a reacção das plantaines e East African highland bananas. Embora ensaios preliminares de campo realizados na Ásia sugiram que as espécies usadas na cozinha possam ser resistentes ao Foc TR4, é necessário mais investigação.

Sintomas do Mal do Panamá na banana



Murchamento das folhas (G. Blomme, Bioversity)



Fraccionamento do pseudocaule (M. Dita, Bioversity)



Surgimento de sintomas foliares (M.Dita, Bioversity)



Descoloração do pseudocaule (A.Javellana)

Com que se pode confundir?

• • •
Os sintomas iniciais de murchamento podem ser confundidos com deficiência nutricional ou stress hídrico. Os sintomas nas folhas também podem ser confundidos com os de murcha da bananeira (*Xanthomonas wilt* - BXW). Em plantas **infectadas** pelo Mal do Panamá, o amarelecimento e murchamento das folhas normalmente progride das folhas mais velhas para as folhas mais novas. As folhas murchas também se agarram ao pecíolo e, podem pender do pseudocaule. Em plantas **infectadas** pela murcha da bananeira, o murchamento pode começar com qualquer folha e as folhas infectadas tendem a agarrar-se ao longo do limbo foliar.



Quebra da folha numa planta infectada por (A. Vezina, Bioversity)

Como confirmar TR4

• • •
A infecção por Foc em plantações de banana Cavendish nos trópicos **implica** a presença de TR4, mas a confirmação em outras plantações é mais difícil. A forma mais rápida para confirmar uma suspeita de infecção por TR4 é através da análise de amostras de tecido **de bananeira** usando o teste molecular específico TR4-PCR. Isolados de fungos podem também ser analisados para determinar o seu Grupo de Compatibilidade Vegetativa (GCV), um processo que pode levar um mês ou mais.

Como se propaga

• • •

A doença pode-se propagar através de materiais de plantas infectadas e movimento físico de partículas do solo infectados, através de quaisquer meios, tais como equipamentos agrícolas, calçados, veículos, irrigação, drenagem e águas superficiais. O fungo pode persistir no solo por décadas e **difícilmente** pode ser erradicado.

O que fazer para prevenir a propagação do TR4?

• • •
A implementação de medidas fitossanitárias e procedimentos de quarentena é essencial para prevenir a propagação da doença. Acções específicas para minimizar a propagação da doença inclui o uso de material de plantio limpo, como plântulas de cultura de tecidos, evitando a partilha de equipamentos agrícolas, **abate e queima imediata** de plantas suspeitas, **cercar as áreas infectadas, construir canais de drenagem** para impedir que a água escorra para fora da área **infectada**, desinfectação de botas e veículos na entrada das plantações e, **semear** plantas de cob

Adaptado de www.promusa.org/Tropical4+race+4+-+TR4; www.musarama.org & www.fao.org/news/story/en/item/223409/icode/ (ProMusa é uma rede de partilha de conhecimento gerido peao Bioversity Internacional, como parte do Programa de Pesquisa CGIAR sobre raízes, tubérculos e bananas; FAO é a Organização para a Alimentação e Agricultura das Nações Unidas)

COMO PREVENIR E CONTER A DOENÇA?

- 1 Não transportar socas de zonas infectadas para áreas livres de doença.
- 2 Desinfectar calçados (botas) e equipamentos usados nos campos.
- 3 Usar variedades de bananas tolerantes à doença.
- 4 Remover e queimar plantas infectadas incluindo socas da geração seguinte mesmo que estas não apresentem sintomas.

! Solicitar uma licença de importação fitossanitária ao Departamento de Sanidade Vegetal antes de importar mudas ou socas de outros países.

! Entrar em contacto com as Autoridades Agrícolas locais assim que os sintomas da doença forem encontrados.

FOLHETO INFORMATIVO

Fevereiro 2019

DOENÇA DO PANAMA RAÇA TROPICAL 4

O QUE É?

Departamento de Sanidade Vegetal - MASA
Dep.Sanidade.Masa@gmail.com

Apoiado por



República de Moçambique
Ministério da Agricultura e Segurança Alimentar

Procedimentos ao sair da farma

- 1 Lavar as mãos e a cara com água e sabão.
- 2 Passar pelo pedilúvio para pedestres para desinfectar as botas, removendo todo solo restante.
- 3 Dirigi-se a uma sala apropriada ou a um vestiário para retirar as botas e se trocar no geral.
- 4 Colocar as botas usadas dentro da farma (suja) em silos designados para garantir que são lavadas e desinfectadas.
- 5 Colocar as roupas usadas na visita à farma dentro de um recipiente devidamente rotulado.

Folheto Informativo

Fevereiro 2019



República de Moçambique
Ministério da Agricultura e Segurança Alimentar

Doença do Panamá Raça Tropical 4

Departamento de Sanidade Vegetal - MASA
Email: Dep.Sanidade.Masa@gmail.com

Regulamentos e
Procedimentos de
Contenção

- 6 Colocar os seus próprios sapatos.
- 7 Assinar confirmando a saída o livro de registos.

8 Sair da farma. É proibido levar consigo amostras de solo ou material de planta da farma.

9 Tomar banho e lavar suas roupas com detergente e água quente.

Apoiado por



Produced leaflets on biosecurity procedures to entry and exit of the farms.

O QUE É?

A fusariose da banana (conhecido com o mal-do-panamá), é uma doença que tem afectado a produção de banana nas últimas décadas. A doença é causada por um fungo que impede a planta de receber nutrientes e água, sem os quais a planta murcha e eventualmente morre. Em 2013 confirmou-se a presença da estirpe raça tropical 4 do mal-do-panamá em Moçambique, o que tem vindo a ameaçar a produção de banana no país.

QUAIS SÃO OS SINTOMAS?



COMO SE PROPAGA?

O fungo propaga-se através de solo contaminado, ou seja, o fungo pode ser transportado pela planta mas também através de veículos, vestuário ou qualquer material que tenha estado em contacto com o solo.

Regulamentos de Contenção

Todas as farmas infectadas pela Raça Tropical 4 devem ter:



Sinais claros em volta da farma indicando que a quarentena está em vigor.



Manter um livro de registo de todos os visitantes. Apenas os visitantes que formalmente solicitaram acesso à farma ao Departamento de Sanidade ou ao proprietário da farma devem ter acesso.



Um parqueamento de viaturas fora da farma (nenhum veículo deve entrar na farma).



Sinais claros indicando que é proibido a entrada de veículos dentro da farma.



Um vestiário designado para funcionários e visitantes na entrada da farma.



Botas desinfectadas para qualquer indivíduo entrar na farma incluindo os visitantes.



Máquinas disponíveis para o pessoal interno da farma que são lavados e secos na farma.



Máscaras descartáveis disponíveis para todos os visitantes.



Recipientes de lixo visíveis para depositar roupa ou materiais contaminados.



Pedilúvios para pedestres na entrada e saída da farma assim como na entrada dos viveiros dentro da farma.



Mecanismo para lavagem das viaturas na entrada e saída da farma.

Entrada na Farma e Procedimentos de Movimento

1

Registrar na entrada da farma.

2

Vestir os designados macacões e botas.

3

Passar pelo pedilúvio para garantir que as botas sejam desinfectadas.

4

Não deixar nenhum pertence no chão.

5

Usar sempre equipamentos e materiais desinfectados.

6

Descartar soluções de tratamento usadas na área infectada.

7

Colocar amostras em saco plástico duplicado, desinfectado o segundo plástico.

8

Remover o solo das botas e roupas.

II. Detection and Steps Taken after Foc TR4 Confirmation (17)



Street signs

III. DELIMITATION AREA OF FOC TR4 IN MOZAMBIQUE

III. Delimitation Area of Foc TR4 (1)

1. The beginning of the survey, collection of samples and delimitation of areas with Foc TR4 started in 2014;
2. The official survey aimed to establish the phytosanitary status of Foc TR4 in an area;
 - a) Isolation of the area, not allowing the movement of people in the area or vehicles, since the fungus can survive in the soil for more than 30 years.
 - b) Quarantined area has been declared
 - c) Sample collection by the producer is prohibited, being restricted only to agricultural authorities for testing/research purposes;
 - d) Mandatory disinfection with sodium hypochlorite, all tools and utensils used in cultural treatments and during the slaughter of plants suspected of symptoms.
 - e) Mandatory use of seedlings produced in vitro, or of proven origin, to reduce the risk of introducing diseases in the production area.

III. Delimitation Area of Foc TR4 (2)

3. Fencing of the infected area not allowing the movement of people or vehicles in the area, since the fungus can survive in the soil for more than 30 years.



III. Delimitation Area of Foc TR4 (3)

4. Declaration the infected area as the **Quarantine Area**;
5. The NPPO issued a statement in the newspapers about the occurrence of the new disease in the country and the ongoing biosecurity measures;



III. Delimitation Area of Foc TR4 (4)



REPÚBLICA DE MOÇAMBIQUE

MINISTERIO DA AGRICULTURA E SEGURANÇA ALIMENTAR
DIRECÇÃO NACIONAL AGRICULTURA E SILVICULTURA

Mozambique affected by the destructive Panama disease of banana

Panama disease, caused by the fungus *Fusarium oxysporum* f. sp. cubense (Foc) tropical race 4 (TR4), is a devastating banana disease that causes losses up to 100% if not contained. This disease occurs in countries such as Australia, China, Taiwan, Philippines, Indonesia, Malaysia, Oman, Jordan, Pakistan and now Mozambique. In Mozambique the disease was identified near Monapo in the Nampula province in September 2013, and in the Chiure district in the Cabo Delgado province in 2014. Containment measures are being implemented by the affected companies in cooperation with the Ministry of Agriculture and Food Security and its partners. Mozambique is the first country in Africa that reported Foc TR4. Without intervention, it is feared that the fungus can decimate bananas in Africa, and in particular in Mozambique. The Panama disease fungus is soil-borne and spread with propagation material such as suckers and seedlings, soil from infested fields, irrigation water, the movement of people and vehicles inside infected fields, and agricultural implements used during land preparation. To contain Foc TR4 at the affected farms and prevent its introduction into disease-free areas the Ministry of Agriculture and Food Security announces that it:

- It is forbidden to move plants and seedlings from affected banana farms in the Monapo and Chiure districts of the Nampula and Cabo Delgado provinces, respectively, to unaffected areas; to ensure Foc TR4 containment in the affected areas and prevent its dissemination to disease-free areas,
- It is forbidden to move banana plants and seedlings from the Nampula and Cabo Delgado provinces to the rest of the country to protect the banana industry and ensure food security of families who depend on this crop in the country,
- It is forbidden to move soil and other substrate used to grow seedlings from infected to disease-free areas of the country. This statement comes into force immediately.

Anyone who visits the areas infected by the disease must ensure the disinfection of shoes, boots or other materials that you used in the field and should not visit then any banana production field to avoid possible introduction of the disease with soil particles.

Any additional information may be requested to the nearest Agricultural Services.

O Director Nacional
Maputo, Outubro de 2015



III. Delimitation Area of Foc TR4 (5)

6. Surveys carried out in 6 districts (Erati, Monapo, Muecate, Murrupula, Rapale and Ribaué) potential banana producers in the province of Nampula for data collection and mapping to show disease distribution;
7. Field Diagnostic and Surveillance Manual was produced - Develop methodology for surveillance for Fusarium wilt;



III. Delimitation Area of Foc TR4 (6)

8. Conduct targeted surveillance of disease bananas, particularly those growing in small groups in the vicinity of the farms of Matanuska and Jacaranda and in other areas in the Nampula region



Members of the surveillance team in Nampula during the sample collection in the farmers field

III. Delimitation Area of Foc TR4 (7)



Looking for aerial/foliar symptoms (**A**) and pseudostem split symptoms (**B**)

III. Delimitation Area of Foc TR4 (8)

Mecuburi district



Murrupula district



During surveillance owners/producers provided information on the history of the plantation and production practices to surveillance team

III. Delimitation Area of Foc TR4 (9)



Fusarium wilt symptoms observed and sampled in the farmer's field during survey in Erati District

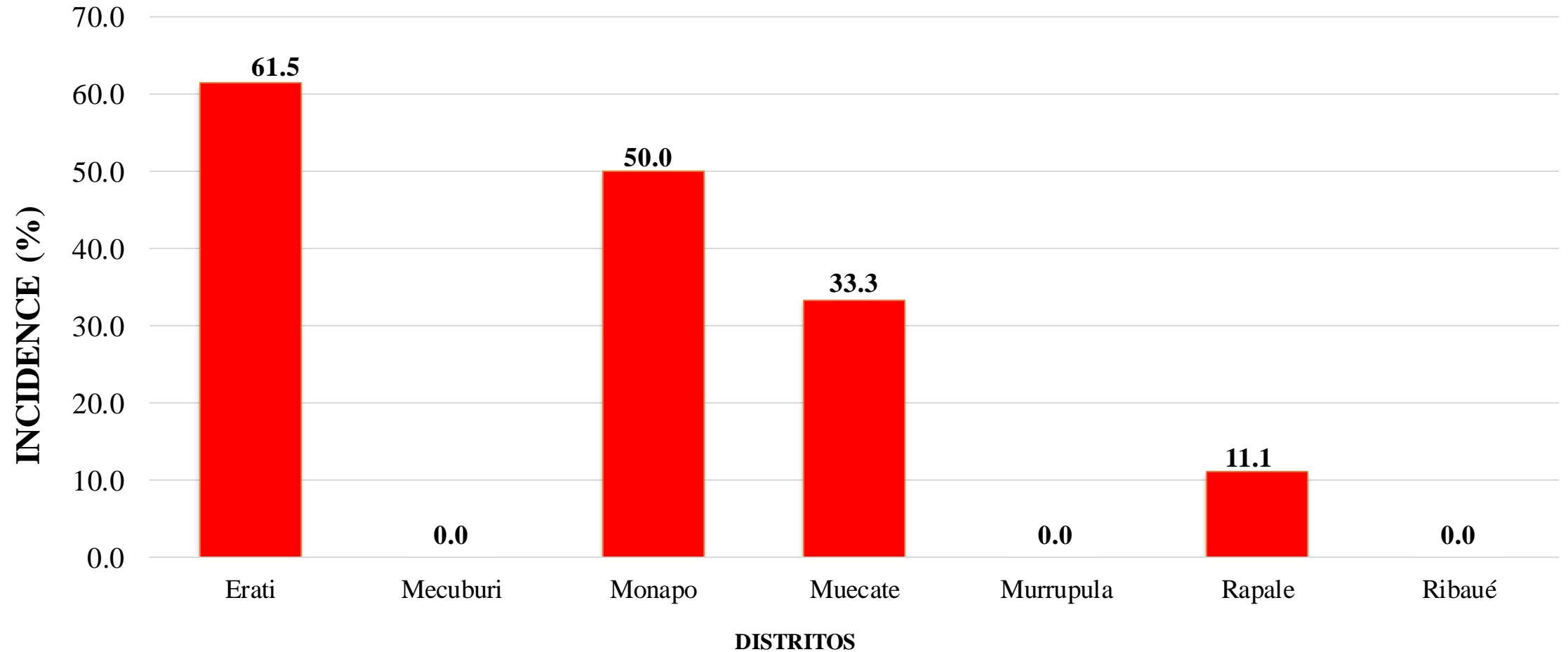
III. Delimitation Area of Foc TR4 (10)

9. Results

- a) Total of **15 districts** and **87 fields** surveyed in the three provinces;
- b) Nampula (7 districts, 56 farmer's field and some commercial farms);
- c) Manica (3 districts, 16 farmer's field and some commercial farms);
- d) Maputo (5 districts, 15 farmer's field and some commercial farms);
- e) **15** of 56 fields showed Fusarium wilt symptoms : **26.8 %** of incidence in Nampula province.

III. Delimitation Area of Foc TR4 (11)

Incidence based on Fusarium wilt symptoms



III. Delimitation Area of Foc TR4 (12)

9. Results

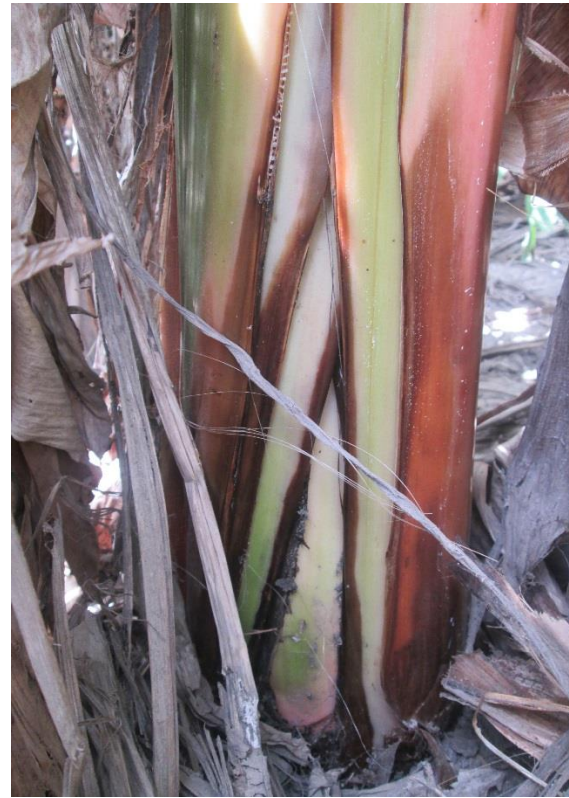
Banana Fusarium wilt symptoms were observed in the farmers field of some districts



Yellowing of leaves



Leaves collapsing and hang down



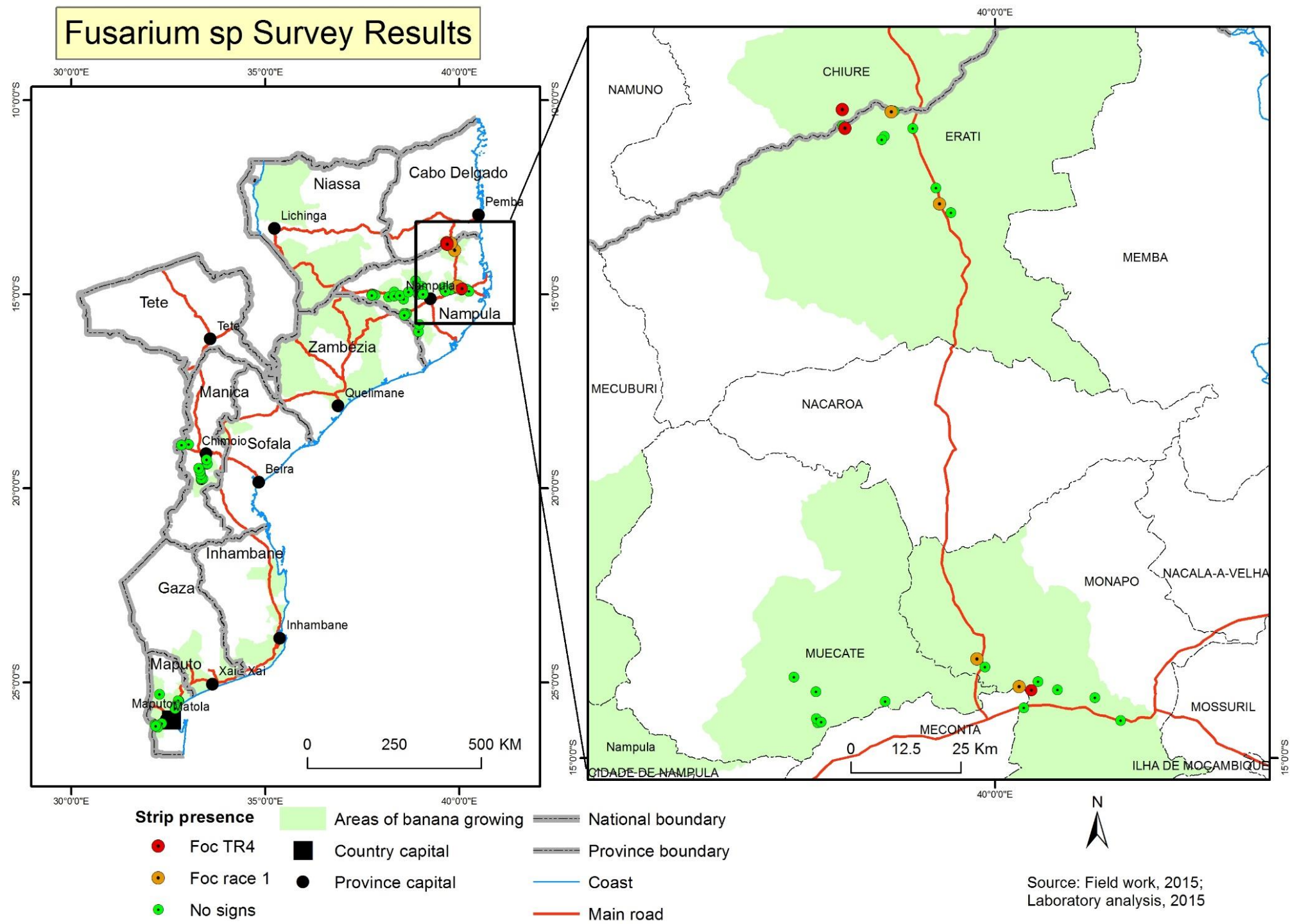
Pseudo stem split

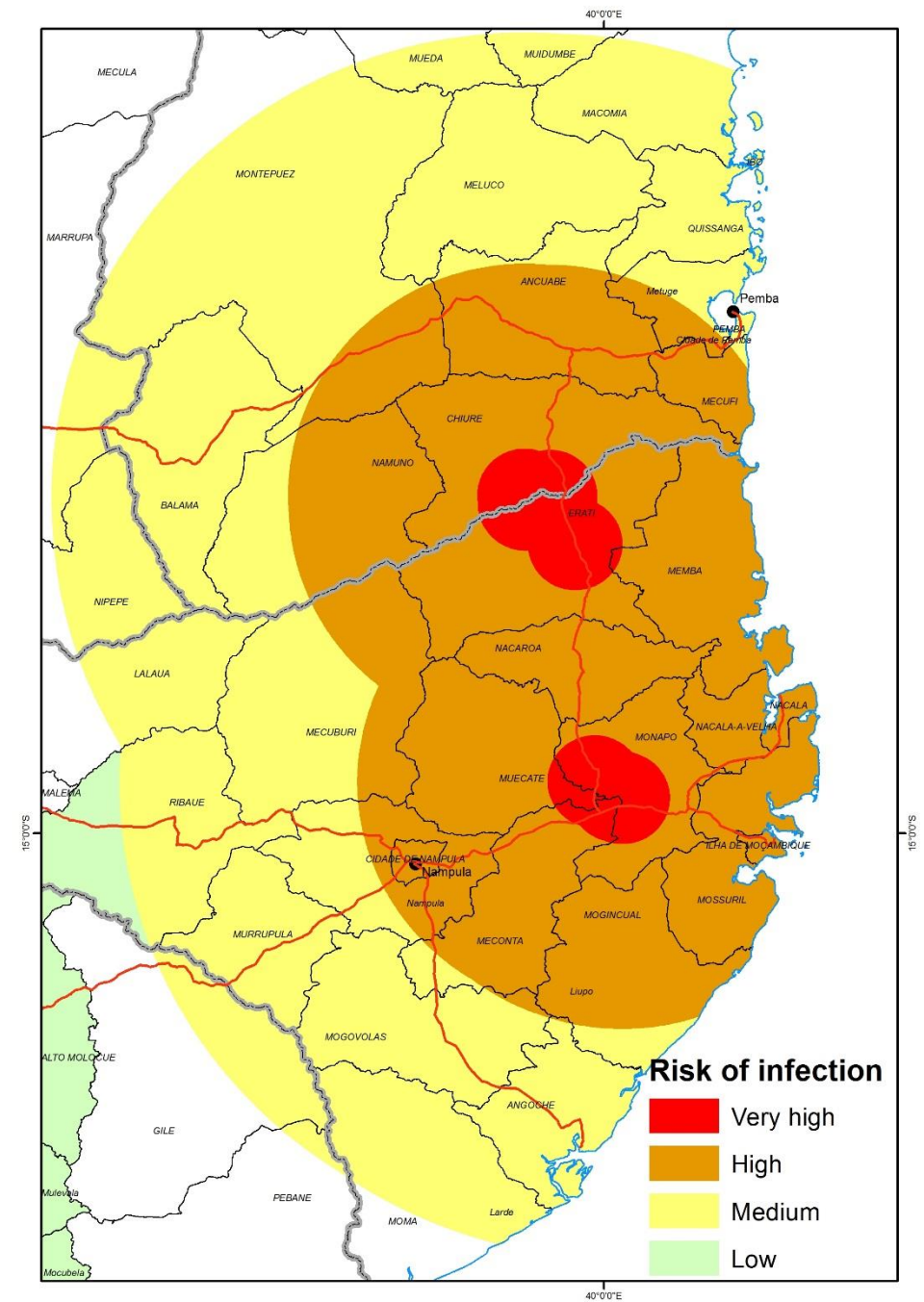
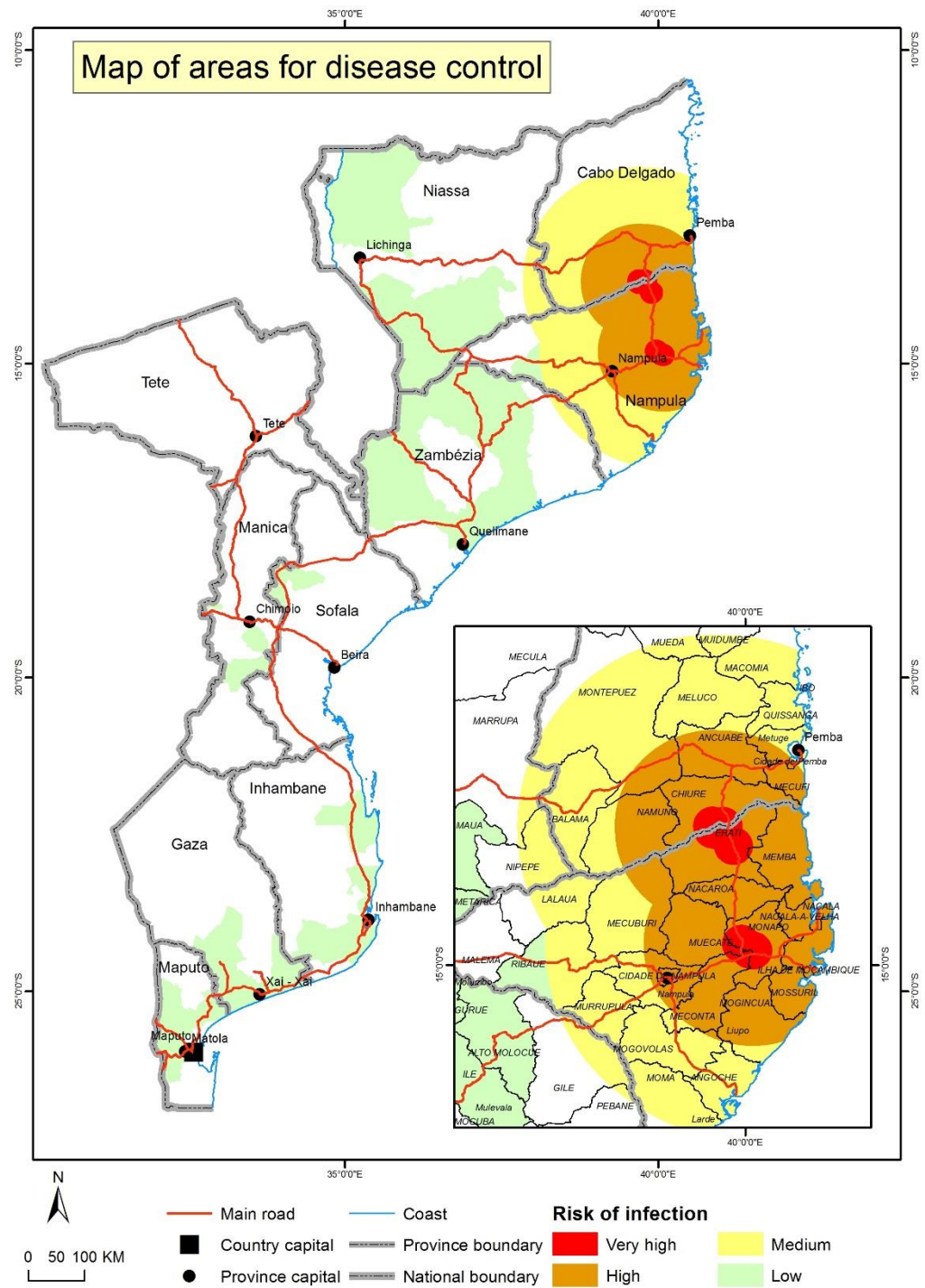


Discolored of xylem tissue

9. Results:

Map disease
developed
based on
Foc races





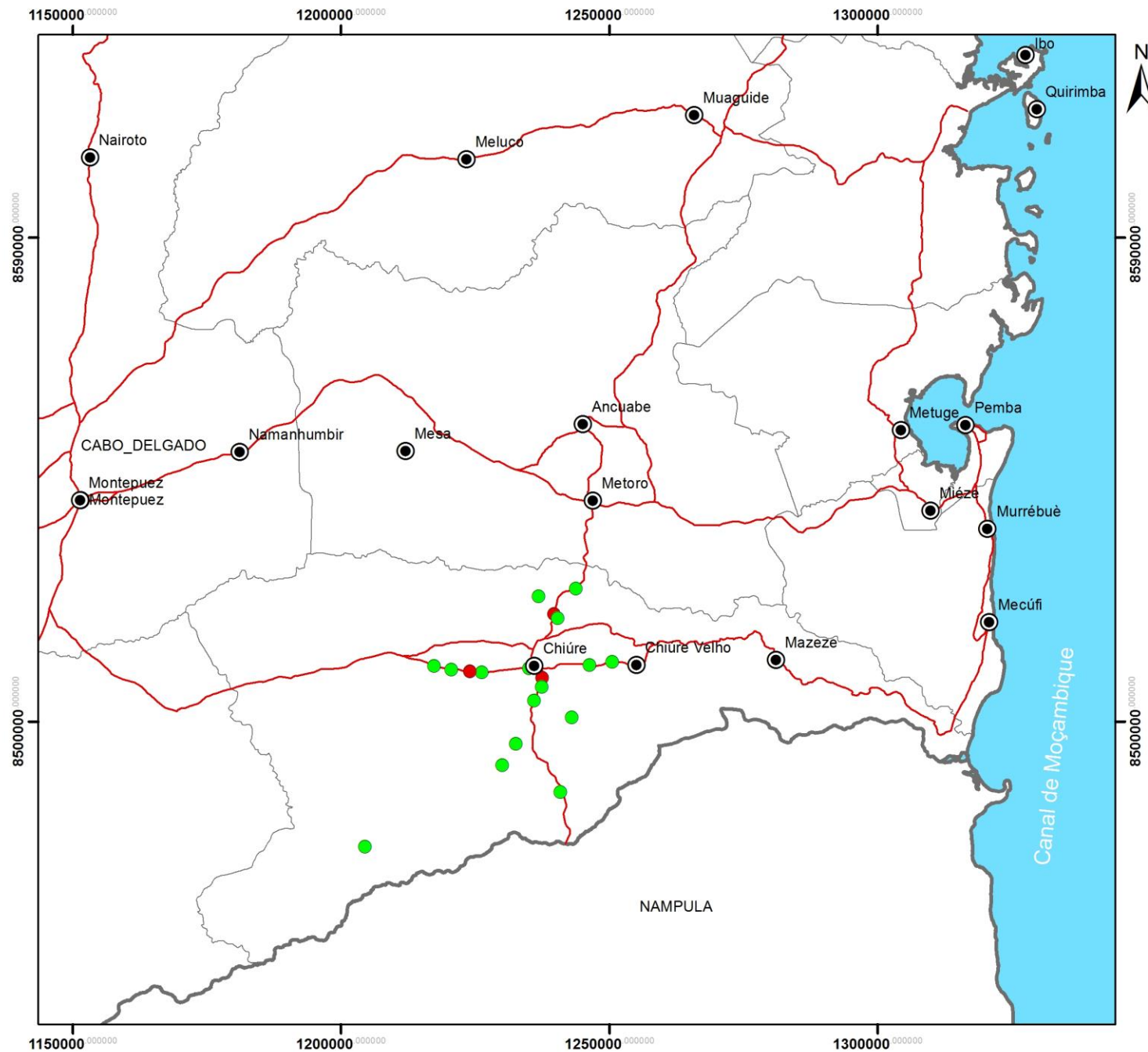
III. Delimitation Area of Foc TR4 (13)

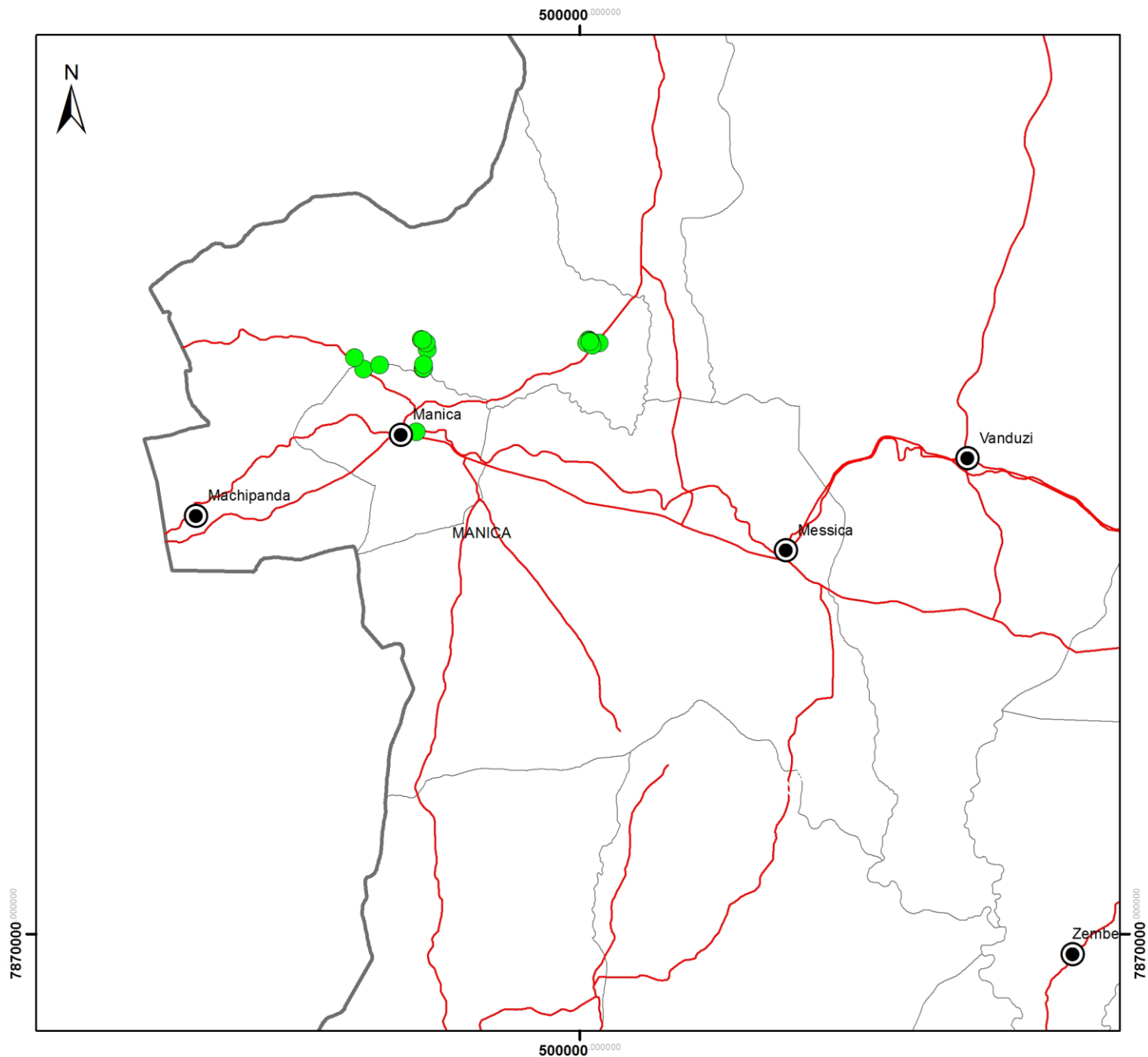
10. Regular monitoring in affected areas to ensure prevention of the spread of the disease to new areas



III. Delimitation Area of Foc TR4 (14)







Ministério da Agricultura e Desenvolvimento Rural
Direção Nacional de Agricultura e Silvicultura
Departamento de Sanidade Vegetal

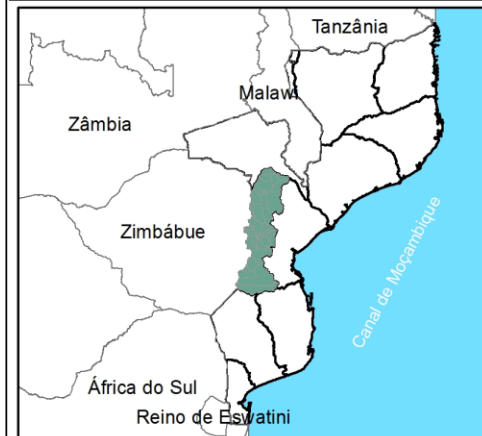
Áreas de monitoria de Foc TR4 na Província da Manica

CONVENÇÕES CARTOGRÁFICAS & LEGENDAS

Pontos Monitorados

- Plantas suspeitas Foc TR4
- Cidades e Vilas
- Vias_de_Comunicacao

localização da área de estudo



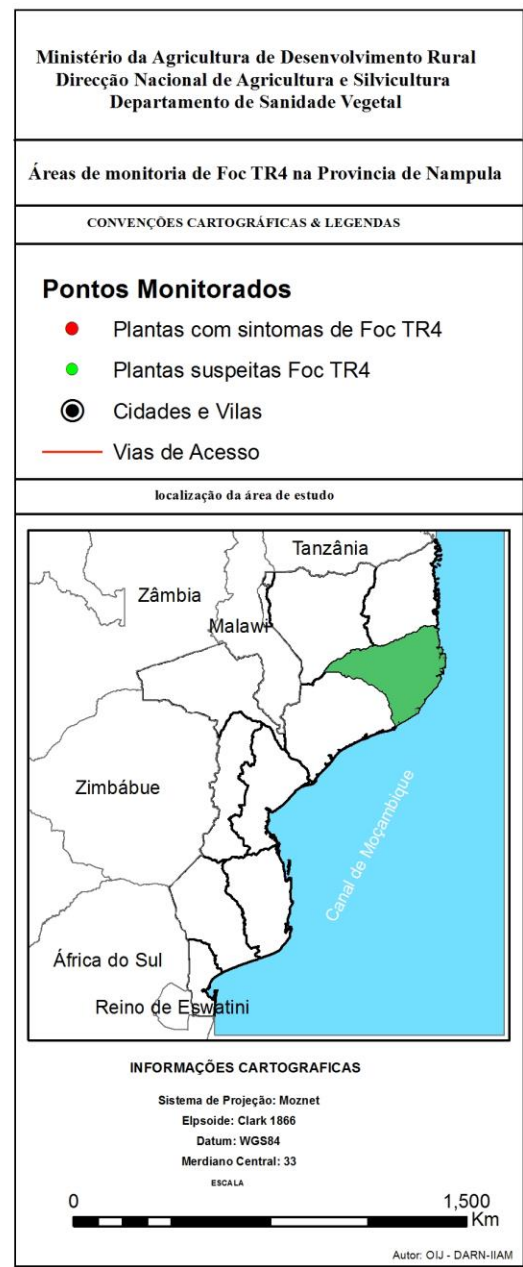
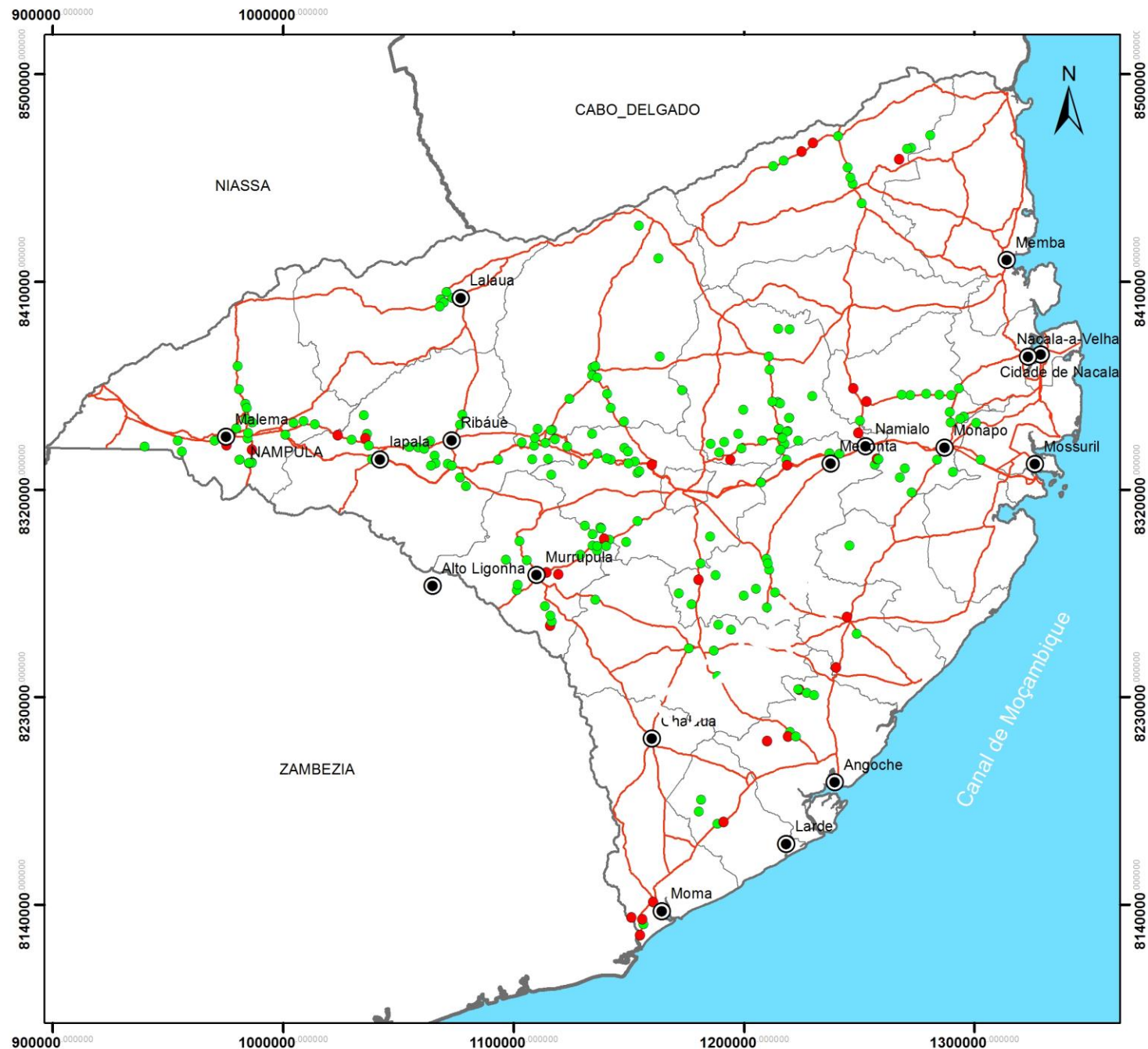
INFORMAÇÕES CARTOGRÁFICAS

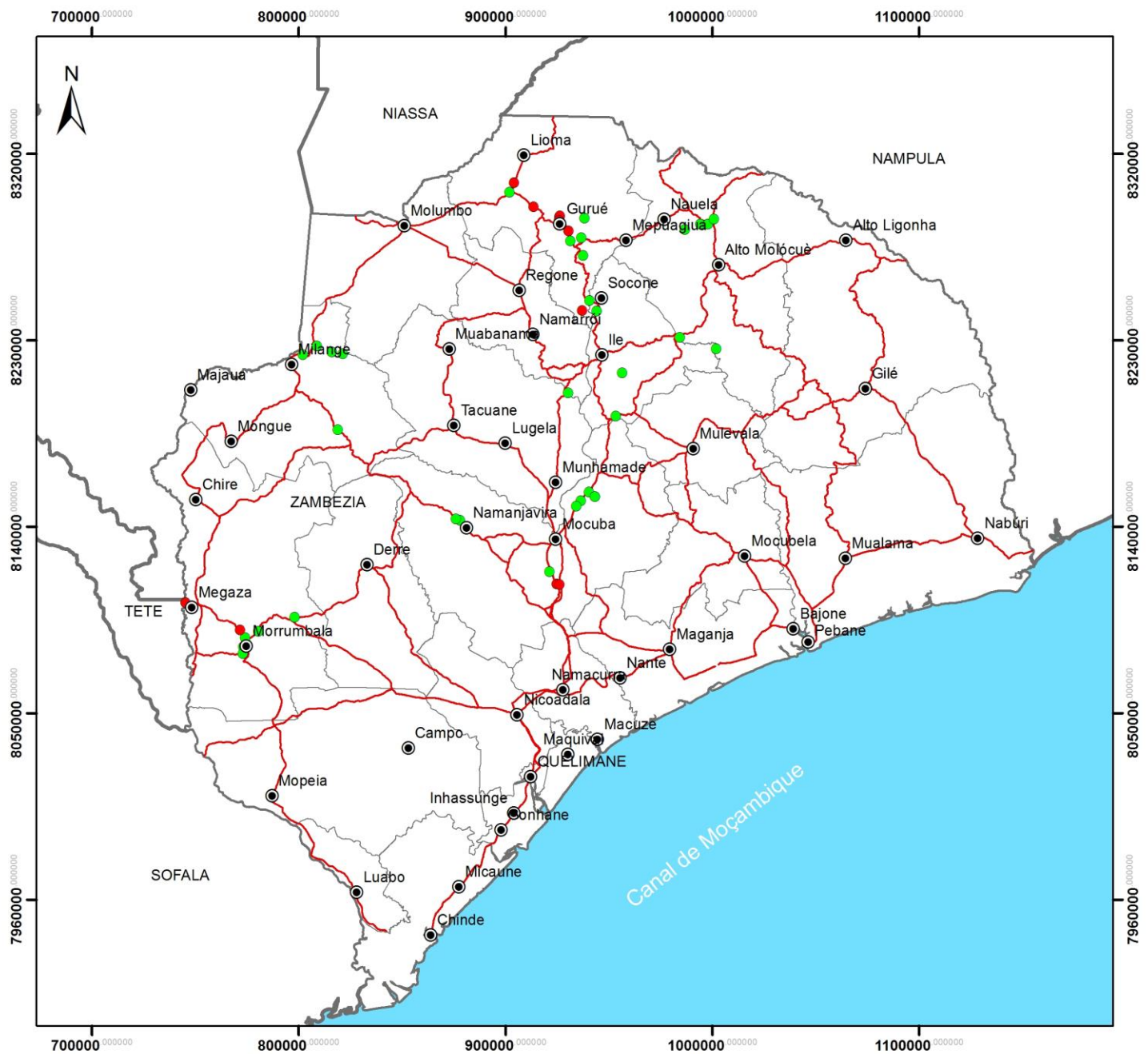
Sistema de Projeção: Moznet
Elipsoide: Clark 1866
Datum: WGS84
Meridiano Central: 33

ESCALA

0 1,500 Km

Autor: OJ - DARN-IIAM





Ministério da Agricultura de Desenvolvimento Rural
Direção Nacional de Agricultura e Silvicultura
Departamento de Sanidade Vegetal

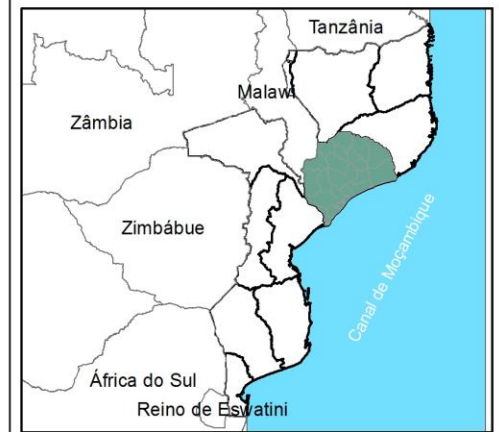
Áreas de monitoria de Foc TR4 na Província da Zambézia

CONVENÇÕES CARTOGRÁFICAS & LEGENDAS

Pontos Monitorados

- Plantas com sintomas de Foc TR4
- Plantas suspeitas Foc TR4
- Cidades e Vilas
- Vias de Acesso

localização da área de estudo



INFORMAÇÕES CARTOGRÁFICAS

Sistema de Projeção: Moznert
Elipsoide: Clark 1866
Datum: WGS84
Meridiano Central: 33

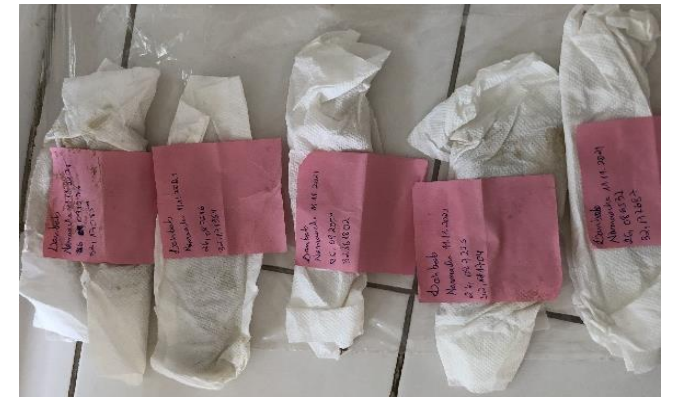


Autor: OIJ - DARN-IIAM

III. Delimitation Area of Foc TR4 (15)

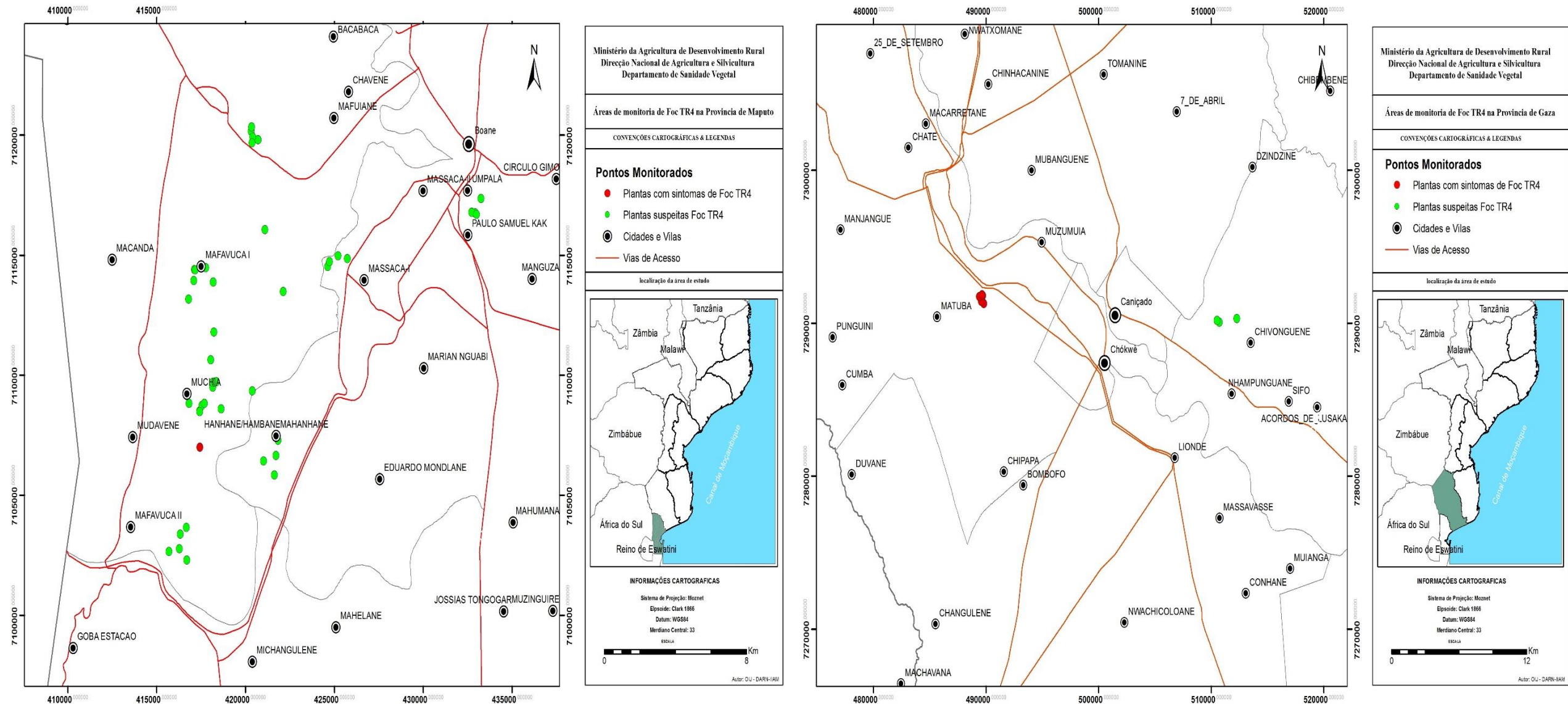
11. Conduct surveillance to collect of samples of banana trees to screen for Panama disease in the Southern of the country, still free from the disease (ISPM 4);

12. The samples is in CB/UEM for laboratorial diagnostic and later mapping;



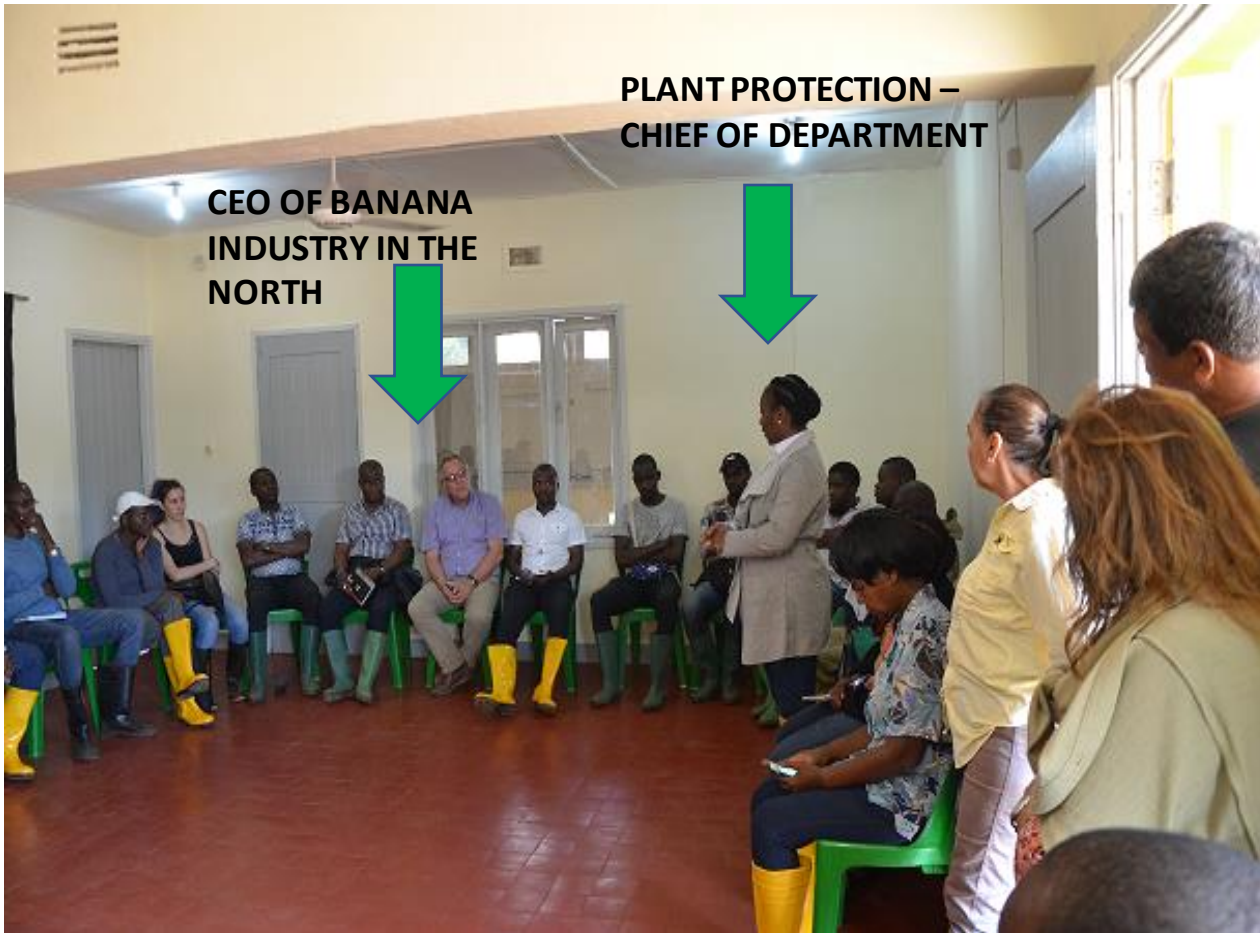
III. Delimitation Area of Foc TR4 (16)

Mapping of the sites where the samples were taken in the southern of Moz and the results of the laboratory diagnosis are awaited



IV. POLICY MAKERS

IV. Policy Makers of Foc TR4 (1)



IV. Policy Makers of Foc TR4 (2)

Conferences/meetings with Industry and other stakeholders



Industry WEBSITES

4G 99% 22:03

<https://www.bananamoz.org> 27




BANANAMOZ
Banana Producer Association
Mozambique

BANANAMOZ represents commercial banana producers across Mozambique.

The main objective of the association, registered in 2019, is to unite and represent banana producers in political and economic discussions, promote the qualitative and quantitative production of bananas in Mozambique and to increase the appreciation and consumption of the nationally produced bananas within the country.

Currently we are also combining our efforts

4G 99% 22:04



Profile

Post

All News

Dec 19, 2019 • 5 min

Leading the Fight to Control Banana Diseases in Mozambique and Beyond

V. ACTUAL SITUATION OF FOC

TR4

V. Actual Situation of Foc TR4

1. Foc TR4 is still confined to the provinces of Nampula and Cabo-Delgado in the northern part of the country;
2. Biosecurity measures are underway in the infected areas to prevent the spread of the disease into new areas;
3. The Integrated Management of Foc TR4 is being implemented using organic material (*Bokashi*), *efficient Microorganisms*, *Trichoderma* and *resistant Varieties* to improve productivity;
4. Production and exports increased - from 1 container/week in 2018 when it was declared financial insolvency for 19 containers/week currently;
5. Percentage of infected plants in the field is below 3%.



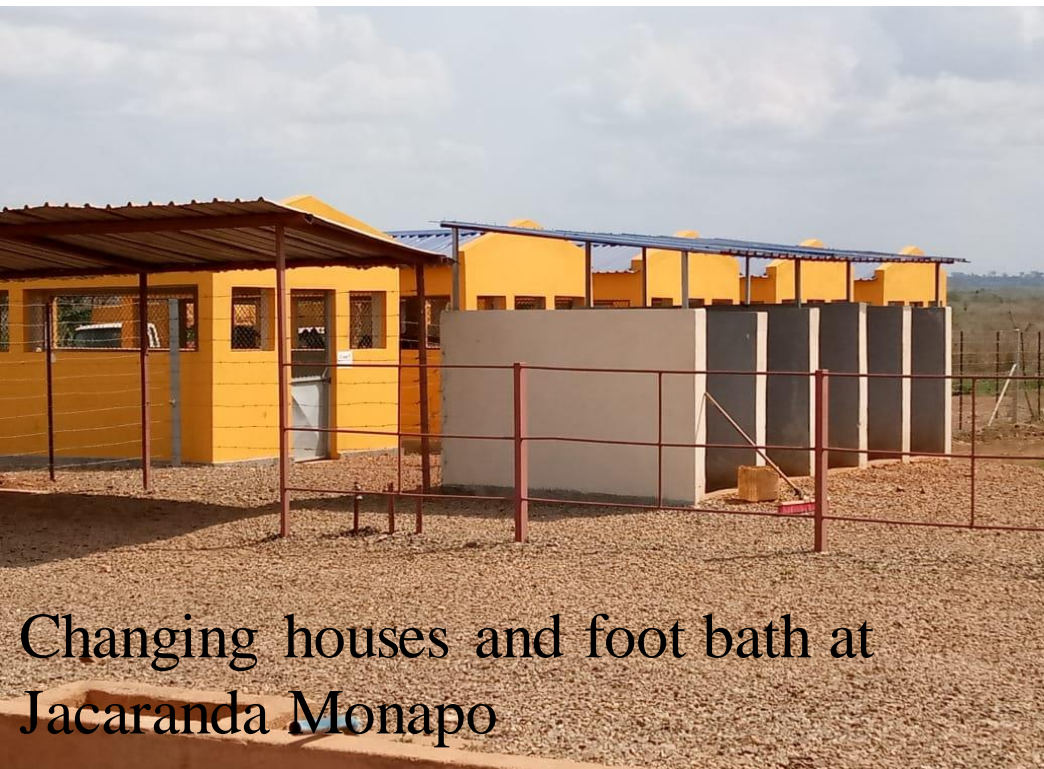
One entrance - 27 km of
perimeter fence

Foot Baths for
disinfection
boots





Packing for Exportation



Changing houses and foot bath at
Jacaranda Monapo



VI. RESEARCH CONTRIBUTION

VI. Research contribution to Management Foc TR4

14. The Research paper published:

- Viljoen, A., Mostert, D., Chiconela, T., Beukes, I., Fraser, C., Dwyer, J., Murray, H., Amisse, J., Matabuana, E., Tazan, G., Amugoli, O.M., Mondjana, A., Vaz, A., Pretorius, A., Bothma, S., Beed, F., Dusunceli, F., Chao, C.-H. and Molina, A.B. 2020.
Occurrence and spread of the banana fungus *Fusarium oxysporum* f. sp. cubense TR4 in Mozambique. South African Journal of Science (In Press);

Other Research

- Socioeconomic impact of Panama Disease Foc TR4 in Mozambique;
- Assessment of Panama Disease occurrence in banana production areas considered at risk of infestation
- Effect of controlled Flooding combined with the incorporation of corn residues in the Foc TR4 population
- Disinfection strategies for agricultural equipment contaminated by Foc TR4

VII. FINAL CONSIDERATIONS

VII. Final Consideration

1. Regular surveillance is crucial to monitoring the disease and prevent the spread to new areas;
2. The coordination of different stakeholders is the key to ensure joint efforts to containment of Foc TR4;
3. The awareness campaigns at different levels is also a key communication strategy to ensure the knowledge about the symptoms and management of Foc TR4;
4. Is very important the farmers to report immediately the Agriculture Authorities for any similar symptoms like Foc to enable to take early decision and prevent the spread;

A photograph of a lush, green banana plantation. The plants are tall and dense, filling the frame. In the background, there are some trees and a hazy horizon. Overlaid on the center of the image is the text "THANK YOU" and "OBRIGADA" in a white, serif font.

THANK YOU
OBRIGADA