

**MINISTRY OF
AGRICULTURE**



**DEMOCRATIC REPUBLIC OF
CONGO**

JUSTICE – PEACE – WORK

NATIONAL CASSAVA VIRAL DISEASES RESPONSE PLAN FOR THE DEMOCRATIC REPUBLIC OF CONGO

WEST AFRICAN VIRUS EPIDEMIOLOGY FOR FOOD SECURITY - “WAVE”



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LIST OF ABBREVIATIONS

AAA: Agro Action Allemande [Welthungerhilfe]

ACOMMER: Atelier de Construction Mécanique, Métallique, Electricité-Radio (Workshop manufacturing agricultural, mechanical and rural engineering equipment)

ADEVS: Association de Défense de l'Environnement de Vains-Saint-Léonard [Vains-Saint-Léonard Environmental Association, France] (NGO)

AGRIMAC: Agri Machinery Specialists

APTМ: Association des Producteurs et Transformateurs de Manioc [Association of Cassava Producers and Processors]

ADB: African Development Bank

WB: World Bank

BMGF: Bill & Melinda Gates Foundation

CADIM: Centre d'Appui du Développement Intégral de Mbankana [Mbankana Center for Integrated Development Support]

CBSD: Cassava Brown Streak Disease

CBSV: Cassava Brown Streak Virus

FFS: Farmer Field School

CIAT: Centre International d'Agriculture Tropicale [International Center for Tropical Agriculture]

ICRC: International Committee of the Red Cross

IPPC: International Plant Protection Convention

CMD: Cassava Mosaic Disease

CODIS: Compagnie de Distribution (Distribution Company, a farming micro-business)

EOC: Emergency Operations Center

CPK: Clinique des plantes de Kinshasa [Kinshasa Plant Clinic]

CRAFOD: Le Centre Régional d'Appui et de Formation pour le Développement [Regional Development Support and Training Center]

CREN-K: Centre de Recherche d'Etudes Nucléaires de Kinshasa [Kinshasa Nuclear Studies Research Center]

CRS: Catholic Relief Services

DFID: Department for International Development

DPV: Direction de Protection des Végétaux [Plant Protection Directorate]

ENABEL: Belgian Development Agency

FAMEWS: System for surveillance and early warning of armyworm. A free application for Android mobile phones, made by FAO, for global real-time surveillance of the fall armyworm

FAO: Food and Agricultural Organization

FEC: Fédération des Entreprises du Congo [Congo Business Federation]

IFAD: International Fund for Agricultural Development

IFAD: International Fund for Agricultural Development

GIZ: Gesellschaft für Internationale Zusammenarbeit [German international cooperation agency]

GPS: Global Positioning System

IFA: Institut Facultaire des Sciences Agronomiques de Yangambi [Yangambi Institute for Higher Study of Agronomic Sciences]

IITA: International Institute of Tropical Agriculture

IKYA: IITA Kisangani Youth Agripreneurs

INERA: Institut National pour l'Etude et la Recherche Agronomiques [National Institute for Agronomic Studies and Research]

IPAPPEL: Provincial Inspector of Agriculture, Fishing and Livestock

ITAPPEL: Inspecteur Territorial de l'Agriculture, Pêche et Elevage [local inspector of agriculture, fishing and livestock]

JICA: Japan International Cooperation Agency

KOICA: Korea International Cooperation Agency

LAYUKA: the Spanish word for cassava

MINAGRI: Ministry of Agriculture

NICT: New Information and Communication Technologies

ODK: Open Data Kit (for collecting, managing and using data in resource-limited environments)

UNIDO: United Nations Industrial Development Organization

WFP: World Food Programme

PIDR: Programme Intégré de Développement Rural [Integrated Rural Development Program]

UNDP: United Nations Development Programme

DRC: Democratic Republic of Congo

SECID: South East Consortium International for Development

SENAFIC: Service National des Fertilisants et Intrants Connexes [national service for fertilizer and related inputs]

SENAMA: Service National de Mécanisation Agricole [national agricultural mechanization service]

SENASEM: Service National des Semences [national seed service]

SNV: Service National de Vulgarisation [national extension service]

SOCOTRAM: Société Coopérative de Transformation de Manioc [Cooperative Cassava Processing Company]

UCBSV: Ugandan Cassava Brown Streak Virus

EU: European Union

UNIKIN: University of Kinshasa

UNIKIS: University of Kisangani

UNILU: University of Lubumbashi

USAID: United States Agency for International Development

VAMED: VANGU MBAMBI EDMOND (Agricultural micro-business)

WAVE: West African Virus Epidemiology for Food Security

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FOREWORD BY THE MINISTER OF AGRICULTURE

The Democratic Republic of Congo (DRC) is the largest consumer and the second largest producer of cassava in Africa. This important subsistence crop is subject to several viral diseases, particularly cassava mosaic disease (CMD) cassava brown streak disease (CBSD) and a disease that is related to brown streak, known as CBSD-like. Given the severity of the situation, it is urgent that a national response and prevention plan be put in place, via an Emergency Operations Center (EOC). This will enable us to tackle outbreaks of cassava viral diseases which threaten our country's food security.

This center will be under the supervision of the Ministry of Agriculture, attached to the Plant Protection Directorate. Creation of the EOC is based on phytosanitary regulations and laws relating to the underlying principles of agriculture in the DRC. Regionally and internationally, the EOC is part of the strategic framework for plant protection set up by the African Union (AU) and the International Plant Protection Convention (IPPC).

The plan to respond to cassava viral diseases is part of the national phytosanitary strategy, which aims to build phytosanitary capacity. It is connected to the national plan for response to the fall armyworm (*Spodoptera frugiperda*) and bacterial wilt (*Xanthomonas campestris* pv. *musacearum*).

The EOC was developed and implemented in line with the following principles:

1. Rapid action: the urgency of establishing an effective response and prevention system, requiring rapid decision-making. Immediate and coordinated action by all stakeholders is essential in both the development and implementation phases
2. National coordination and collaboration: if the response and prevention strategy is to be successful, this requires coordination of stakeholders nationally
3. Availability of technical capacity and appropriate technology: scientific research will be at the heart of this prevention and response strategy. It is essential that the EOC have the necessary financial resources and appropriate techniques and technologies at its disposal
4. Those involved in the cassava value chain must be made aware of the threat that cassava viral diseases pose

For this reason, I attach great importance to implementation of this strategic plan, and I want it to receive technical and financial support from all those involved in the national agricultural system, and all our technical and financial partners.

The Minister of Agriculture,

Georges Kazadi Kabongo

EXECUTIVE SUMMARY

This strategic plan concerning the response to cassava viral diseases in the Democratic Republic of Congo (DRC) aims to strengthen and improve subsistence farming methods for vulnerable farming households. This five-year plan involves effective interventions, the aim of which are to protect cassava growing and guarantee food security.

Its vision is as follows: “By 2023, cassava yields will be improved, via effective control of the spread of viral diseases in the Democratic Republic of Congo”.

This plan will consist of strategic interventions, with the aim of limiting the spread of cassava viral diseases toward West Africa, reducing the harmful social and economic effects in the DRC and throughout Africa. Success will be achieved by containing these diseases and prevent them from spreading to currently unaffected areas.

To achieve this primary goal, this response plan contains the following five strategic objectives:

1. Monitoring of cassava viral diseases
2. Management of viral outbreaks
3. Communication and raising awareness in communities
4. Evaluation of the impact of cassava viral diseases on food security and household economies
5. National coordination of activities via an emergency operations center

National coordination by an Emergency Operations Center, under the supervision of the Ministry of Agriculture, will provide major support to this response plan. National experts will be consulted, who have the key skills to carry out the planned activities.

The present response plan will be supported by funders (BMGF, DFID), the DRC's technical and financial partners and, and bilateral and multilateral cooperation partners. Sustained advocacy and awareness-raising among donors is an essential strategy for mobilizing the material and financial resources required to achieve these objectives.

I. I. CONTEXT

Current national situation in relation to cassava viral threats

Economic and Social Importance

Cassava is grown throughout the Democratic Republic of Congo (DRC). It is sown over an area of 1,984,622.3 hectares, meaning that it is the largest root crop by area (other such crops cover around 289,985 hectares in total). For many households in the DRC, cassava is a potential source of income, as its leaves, tubers and derivative products can be sold. A cassava field is a source of food, and functions as a bank for the impoverished. Cassava fields are harvested gradually, according to need. The roots can remain in the ground for up to 4 years after maturity. The cassava crop is very hardy, and in insecure times, and when it is abandoned in the field without weeding, it still has some potential for growing. This is beneficial for displaced populations, who can return and harvest enough cassava to survive while awaiting the next growing season. Because it is so important, cassava has been adopted as a subsistence crop or for kitchen gardens by people in all social categories. Cassava is a strategic crop not just for rural populations, but also for the DRC's major towns.

In the DRC, cassava crop is subject to two viral diseases, which are the main biotic constraints on production. These are the Cassava Mosaic Disease (CMD) and Cassava Brown Streak Disease (CBSD). These two viral diseases are currently a disaster, and the negative effects on the cassava crop risk causing a food catastrophe, if nothing is done. By way of illustration, in Nigeria, where 80% of the population is dependent on cassava growing, spread of a disease such as CBSD would affect the food security of around 180 million people. In the DRC, where over 70% of the populations is dependent on cassava every day, this would affect around 56 million people.

In addition to these two diseases, there are currently reports from western parts of the DRC of a disease known as "CBSD-like", which has similar symptoms to CBSD. This disease is causing dangerous levels of destruction to the cassava crop, particularly in Kongo Central Province, where it is estimated that losses in the field will be 90-100%.

It should be noted that cassava viral diseases have a serious impact on the food security of the Congolese populations who are largely dependent on this subsistence crop. The negative impact of diseases on cassava have a clear effect on household incomes in the DRC, particularly for farming women, which risks resulting in the development of famine that would affect over 70% of the Congolese population, in a country that has faced decades of civil war.

Summary of Current Situation

In the Democratic Republic of Congo (DRC), an obstacle to increasing cassava yields is two viral diseases which cross geographical borders and threaten the cassava crop, causing losses ranging from 37 to 49% (SECAL Bulletin, 2018).

One disease is the African cassava mosaic virus (Ugandan variant EACMV-Ug), which caused a large reduction in cassava production, which fell from 20 million metric tons in 1992 to 15.5 million in 2000 (a fall of 22.5%). The prevalence of this virus varies between provinces, depending on the ecological conditions in the area, how it emerges and expands and how severe it is. The other disease is cassava brown streak virus disease, which was introduced to the DRC via the east.

African cassava mosaic virus (causing CMD) is present throughout the country, and is characterized by alternating green and light green/yellow areas on the leaves, depending on the variety of cassava, the strain of virus involved and the prevailing conditions in the area. In the advanced stage, the leaves become twisted and there is a significant reduction in leaf area. When the disease is in acute form, the plants remain dwarf and/or stunted.

Cassava Brown Streak Disease (CBSD) is more devastating than the Ugandan variety of the African cassava mosaic virus (James *et al.*, 2015). CBSD comes from countries in coastal East Africa, where it was contained in 1935-1946; it was detected in 1936 in Tanzania, 1946 in Kenya, 2003 in Uganda, 2008 in Angola, 2009 in Rwanda and 2011 in Burundi. CBSD causes monetary losses estimated at 75-100 million dollars per year in severely affected countries. It results in necrosis that can affect as many as 100% of the tubers. Spread of the disease is promoted by use, transportation, distribution or introduction, into a site or country, of infected planting material.

National surveys showed that CBSD was present in Kongo Central in 2003, in North and South Kivu in 2012, in Ituri and Haut-Uele (2016) and Tanganyika (in 2015) and Haut-Katanga (in 2018), and showed that all local and improved varieties that were widely available in the DRC, for example Liyayi (MM96/0287), Sawasawa (MM96/3920), Mayombe (MM96/8353) in the east of the country and Disanka (I96/0211), Mvuazi (I95/0528), Zizila, Obama (TME419), Mvuama and RAV in the western parts of the country are all sensitive to this viral disease.

Cassava brown streak virus disease is currently continuing to spread to the other provinces. This is the case for Kinshasa (on the Bateke plateau), Bandundu and Equateur, in which it is causing unprecedented damage (report, 2018). Because cassava cuttings circulate so freely in the DRC, spread to other provinces will happen in a matter of months, with severe consequences.

In addition to these two viral diseases that are well known in the Democratic Republic of Congo (DRC), another cassava disease has been observed, which is related to cassava brown streak virus disease. As its causative agent has not yet been identified with any certainty, its

agreed name is currently CBSD-like (Mahungu *et al.*, 2003). CBSD-Like is only present in the western parts of the DRC, with significant yield loss, while CBSD is very widespread and severe in eastern parts of the Democratic Republic of Congo.

Mapping of major stakeholders

Along the cassava value chain

	Research	Inputs	Production	Storage and Transport	Transformation	Marketing and Promotion
Public	<ul style="list-style-type: none"> - INERA - Universities (faculties of agronomy) - Institutes for higher agricultural study - WAVE - CREN-K - Kinshasa Plant Clinic 	<ul style="list-style-type: none"> - SENAEM - SENAFIC - SENAMA 	<ul style="list-style-type: none"> - Bukanga Lonzo Farm 	<ul style="list-style-type: none"> - Bukanga Lonzo Farm - MINAGRI 	<ul style="list-style-type: none"> - Bukanga Lonzo Farm - MINAGRI 	<ul style="list-style-type: none"> - Bukanga Lonzo Farm
Private	<ul style="list-style-type: none"> - IITA - Catholic Relief Service - ISTACHA 	<ul style="list-style-type: none"> - UNIDO - AGRIMAC - ACOMER - IFAD - ADEVS - Seed operators 	<ul style="list-style-type: none"> - CADI - APAFED - UPLCI - CODIS - Agrifarm-Congo - SNV 	<ul style="list-style-type: none"> - IFAD - FEC - NGOs - SOCOTRAM 	<ul style="list-style-type: none"> - IITA - IKYA - APTM - LAYUKA - CADIM - BeniFood - CRAFOD - SOCOTRAM - VAMED - UPLCI - APAFED 	<ul style="list-style-type: none"> - IFAD - SNV - Netherlands Development Organisation - FEC

Other key stakeholders

Government	Private Sector	Civil society organizations/NGOs	Bi- and multilateral partners	Others
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- MINAGRI - Ministry of Scientific Research - Ministry of Higher and University Education - Ministry of Foreign Trade - Ministry of Rural Development - Ministry of the Environment and Sustainable Development - Ministry of Industry - Republic Social Fund	-	- Caritas International - CRS - AAA - CRAFOD - PIDR	- DFID - KOICA - USAID - Enabel - ADB - SECID - European Union - World Bank - Chinese cooperation - GIZ - IFAD - JICA - FAO - WFP	- Bill & Melinda Gates Foundation - IITA - ICRC - CIAT-HarvestPlus
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Risk assessment

Main threats	Level of risk (Low / Moderate / High)	Current consequences for crops	Probability of outbreak (Low / Moderate / High)	Further consequences if nothing is done
Fungal threats				
Rot	High	Loss of yield	Moderate	Food insecurity
Cassava anthracnose disease	High	Poor quality of propagation material	Moderate	Food insecurity
Cercospora leaf spot	High	Low impact on yield	Moderate	Food insecurity
Bacterial threats				
Cassava Bacterial Blight	High	Loss of yield	High	Food insecurity
Bacterial necrosis	High	Loss of yield	High	Food insecurity
Bacterial wilt	High	Loss of yield	High	Food insecurity
Viral threats				
African cassava mosaic virus	High	Loss of yield	High	- Food insecurity - Increased risk of poverty and famine - Destruction of economic fabric of farming households.
Cassava brown streak virus disease	High	- Loss of yield - Destruction of planting materials - Spreads very rapidly	High	- Food insecurity - Increased risk of poverty and famine - Destruction of economic fabric of farming households.
Others				

1.CBSD-Like	High	<ul style="list-style-type: none"> - Loss of yield - Destruction of planting materials - Spreads very rapidly 	High	<ul style="list-style-type: none"> - Food insecurity - Increased risk of poverty and famine - Destruction of economic fabric of farming households.
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Current outbreak management process

Action currently taken (*)

Risk type	Prevention, mitigation and strategic planning	Detection and intervention	Monitoring and evaluation
Rot	Promotion of good agricultural practices (optimal site choice, land preparation techniques, residue management, etc.)	<ul style="list-style-type: none"> - Identification of causative agent and evaluation of methods of seeking and managing resistant varieties - Capacity building for technicians in identification of pests 	<ul style="list-style-type: none"> - Phytosanitary survey - Setting up demonstration fields - Reporting from Plant Protection services
Cassava anthracnose disease	Promotion of good agricultural practices (optimal site choice, use of certified materials, sanitizing area around fields, land preparation techniques, residue management, etc.)	<ul style="list-style-type: none"> - Creation of intervention guide - Symptoms of this disease - Choice of planting materials before cutting - Capacity building for technicians in identification of anthracnose in the field 	<ul style="list-style-type: none"> - Phytosanitary surveys (incidence and severity) - Reporting
<i>Cercospora</i> leaf spot	Promotion of good agricultural practices (site choice, use of certified materials, sanitizing area around fields, preparation techniques, residue management, etc.)	Capacity building for technicians in identification of <i>Cercospora</i> leaf spot	<ul style="list-style-type: none"> - Phytosanitary surveys (incidence and severity) - Reporting
Cassava Bacterial Blight	Promotion of good agricultural practices (site choice, use of certified materials, sanitizing area around fields, preparation techniques, residue management, etc.)	<ul style="list-style-type: none"> - Creation of intervention guide - Symptoms of this disease - Choice of planting materials before cutting - Capacity building for technicians in identification of pests 	<ul style="list-style-type: none"> - Phytosanitary surveys (incidence and severity) - Reporting
Bacterial necrosis	Prevention and strategic planning	<ul style="list-style-type: none"> - Creation of intervention guide - Choice of planting materials before cutting - Capacity building for technicians in identification of disease 	<ul style="list-style-type: none"> - Phytosanitary surveys (incidence and severity) - Reporting
Bacterial wilt	Promotion of good agricultural practices (site choice, use of certified materials, sanitizing area	<ul style="list-style-type: none"> - Propagation and distribution of resistant materials - Variety selection 	<ul style="list-style-type: none"> - Phytosanitary surveys (incidence and severity) - Reporting

	around fields, preparation techniques, residue management, etc.)	- Capacity building for technicians in identification of pests	
African cassava mosaic virus	<ul style="list-style-type: none"> - Promotion of good agricultural practices (choice of planting period, use of certification materials, sanitizing area around fields, preparation techniques, residue management, etc.) - Introduction, creation, distribution, certification and registration of several resistant varieties in the national catalog - Community phytosanitation - Varietal propagation and maintenance - Study of population dynamics of whitefly 	<ul style="list-style-type: none"> - Determination of the genetic diversity of strains of the African cassava mosaic virus - Laboratory diagnosis - Propagation and distribution of virus-resistant materials - Variety selection 	<ul style="list-style-type: none"> - Phytosanitary surveys (incidence and severity) - Reporting - Distribution of information - Certification, recording and updating in the national catalog
Cassava brown streak virus disease	<ul style="list-style-type: none"> - Promotion of good agricultural practices (site choice, use of healthy materials, sanitizing areas around fields, preparation techniques, residue management, etc.) - Introduction of the varieties that are tolerant/resistant to cassava brown streak virus disease - Phytosanitary surveys (incidence and severity) - Screening of some varieties from GTIL-Nairobi that are reputed to be resistant 	<ul style="list-style-type: none"> - Laboratory diagnosis - Propagation and distribution of healthy materials - Variety selection - Epidemiological monitoring - Raising public awareness and implementing an alert system 	<ul style="list-style-type: none"> - Phytosanitary surveys (incidence and severity) - Reporting - Development of a national response plan, being written
CBSD-Like	<ul style="list-style-type: none"> - Phytosanitary surveys and awareness - Promotion of good agricultural practices (use of healthy planting material, cleaning cuttings, etc.) 	<ul style="list-style-type: none"> - Causative agent not yet identified - Propagation and distribution of healthy materials 	<ul style="list-style-type: none"> - Phytosanitary surveys - Reporting

(*) For each of the threats classified as high or moderate above

Gap assessment

Strengths

From an analysis of how cassava viral diseases are managed in the DRC, the following strengths emerged:

1. Existence of a Directorate of Plant Protection within the Ministry of Agriculture
2. Existence of broad-based expertise in plant protection nationally

3. Existence of laboratories for virus diagnosis (WAVE-INERA/Mvuazi, WAVE-IFA/Yangambi, Kinshasa Plant Clinic, SENASEM, IITA-Bukavu, UNILU Faculty of Agricultural Sciences, UNIKIS Faculty of Sciences)
4. Existence of phytosanitary regulation and quarantine facilities
5. Commitment from the Government's Technical and Financial Partners
6. Farmers are receptive to innovation (Guide to cassava pest management)
7. Availability of catalogued propagation materials that are resistant to African cassava mosaic virus
8. Research is already being carried out in universities and research centers into outbreaks of cassava viral disease

Weaknesses

There are some weaknesses in the management of cassava viral disease outbreaks, including:

1. Lack of budgetary support for operation of existing facilities within the Directorate for Plant Protection
2. Laboratories that diagnose cassava viral diseases are insufficient number and underequipped
3. Lack of strategy and lack of national cassava viral diseases response plan
4. Poor coordination of activities to respond to cassava viral diseases
5. Lack of joint efforts between stakeholders in the cassava sector
6. No permanent monitoring and alert system
7. Shortage of qualified technical personnel
8. Poor level of distribution of cassava virus research outcomes

Key takeaways

Arising from the situational analysis of outbreaks of cassava viral disease in DRC, the following are the needed:

1. Develop a national response plan, to achieve coordination of interventions and contingency planning for viral diseases
2. Effective coordination of work to collect and distribute data related to this
3. Build capacity in the management of viral diseases and increase technical expertise among staff
4. Advocate for the provision of a sufficient budget to support a national response plan
5. Intensify research and expedite publications to achieve effective communication of changing patterns of these two cassava viral diseases
6. Establish a strategic and functional alert system
7. Apply phytosanitary regulations concerning the movement of planting materials
8. Update laboratory and field technicians about management of cassava viral diseases in the DRC

II. STRATEGIC OBJECTIVES AND NATIONAL ACTION PLAN VISION

Vision

Vision: By 2023, cassava productivity will be improved, via effective control of the spread of viral diseases in the Democratic Republic of Congo.

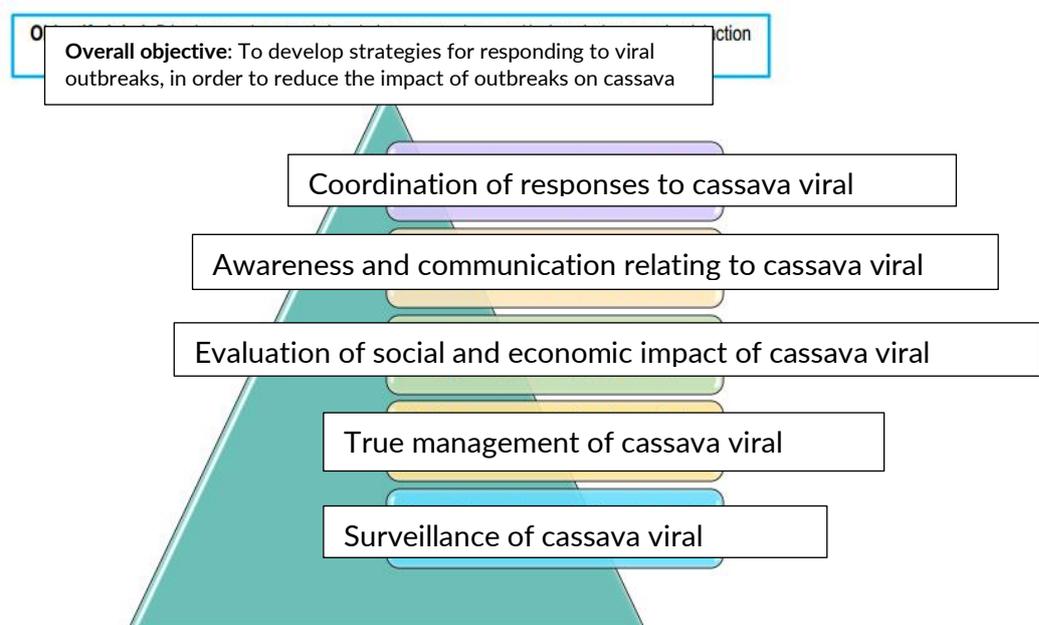
Primary objective: Respond to cassava viral disease outbreaks in order to increase cassava productivity.

This plan will involve limiting the spread of cassava viral diseases toward West Africa, reducing the harmful social and economic effects in the DRC and throughout Africa. Success will be achieved via a contingency plan that aims to contain these diseases and prevent them from spreading to currently unaffected areas.

Strategic objectives

This strategic plan for response to cassava viral diseases in DRC is based on 5 strategic objectives, as follows:

Figure 1: Diagram showing the main strategic objectives of the cassava viral diseases response plan in DRC



Strategic Objective 1.: Establish a Monitoring System for Cassava Viral Diseases in DRC

Outcome 1.1: Monitoring system is operational in DRC

Activity 1: Procure and distribute rapid diagnostic kits for cassava viral diseases for use at entry points

Activity 2: Train phytosanitary inspectors to work in the country's 240 entry points

Activity 3: Identify and Monitor production sites of disease-free planting materials

Activity 4: Establish an alert system

Activity 5: Set up a free telephone number for communication between farmers and researchers

Activity 6: Use rapid detection kits (LAMP, serology test strip, MinION) for detecting cassava virus in the field

Activity 7: Use software to collect data about the impact of viruses on cassava growing

Activity 8: Carry out frequent phytosanitary controls

Activity 9: Build work-related infrastructure

Strategic Objective 2.: Manage Cassava Viral Diseases

Outcome 2.1: Scientific knowledge about viral diseases in DRC is increased

Activity 1: Genetic and molecular characterization of viral strains and vector

Activity 2: Study spatial and temporal dynamics of vector populations in various agro-ecological zones

Activity 3: One-off survey to map the presence and distribution of viruses and vectors

Activity 4: Select for genetic resistance

Activity 5: Vector control using biological methods: promote the vector's natural enemies, evaluate local parasitoids

Activity 6: Maintain and conserve plant genetics resources

Activity 7: Develop a national collection of cassava germplasm (varieties)

Activity 8: Develop growing practices that respond to cassava viral diseases

Activity 9: Study the impact of climate change on viral diseases

Activity 10: Evaluate the breakpoints of varieties that are resistant to cassava viruses

Outcome 2.2: Resistant varieties are propagated and distributed

Activity 1: List, propagate and distribute varieties that are resistant to cassava viral diseases

Activity 2: Clean planting materials that are preferred by farmers but affected by viruses

Activity 3: Evaluate levels of adoption of new resistant varieties

Outcome 2.3: Increased scientific and infrastructure capacity of reference laboratories for management of cassava viral diseases

Activity 1: Build human resources capacity in the specialist services in MINAGRI, specifically in monitoring and diagnosis of cassava viral diseases and implementation of phytosanitary standards

Activity 2: Equip and operationalize reference laboratories for management of cassava viral diseases

Activity 3: Build scientific capacity among laboratory technicians

Outcome 2.4: Farmers' and local technicians' capacity to manage cassava viral diseases is increased

Activity 1: Train the trainers about cassava viral diseases using an FFS approach (farmer field school): recognizing symptoms of cassava viral diseases and ways to respond to them

Activity 2: Train farmers using FFS (farmer field school) approach to cassava viral diseases

Activity 3: Technician training using the Plantwise approach

Activity 4: Train extension workers and CAID workers in cassava viral diseases

Activity 5: Provide training leading to diplomas and placements, to establish a national hub of cassava disease experts (placement, MSc, PhD and post-doc)

Activity 6: Train technicians in the use of impact evaluation tools (software: ODK, DashBoard, FAMEWS, iForm; Kits)

Activity 7: Identify and boost technical capacity among propagation workers

Strategic Objective 3.: Evaluation of Impact of Cassava Viruses

Outcome 3.1: Data acquisition technology contributes to a better understanding of the impact of cassava viruses

Activity 1: Procure and adapt tools for evaluating impact of cassava viruses (software: ODK, DashBoard, FAMEWS, iForm; Kits)

Activity 2: Use evaluation tools (software: ODK, DashBoard, FAMEWS, iForm; Kits)

Activity 3: Procure NICT equipment (computers, GPS, mobile phone) on which to run the evaluation tools

Activity 4: Map disease-free and affected cassava growing areas

Activity 5: Determine the geographical distribution of viruses and vectors

Outcome 3.2: The impact of cassava viruses is evaluated

Activity 1: Evaluate the impact of cassava viruses on the vulnerability of women and young people

Activity 2: Evaluate the impact of diseases on food security, household incomes, value chains and the national economy

Activity 3: Evaluate the effectiveness of implementation of methods that aim to reduce the incidence of cassava viral diseases

Activity 4: List and evaluate the behavior of existing planting materials (cassava varieties) in response to viral disease.

Activity 5: Evaluate the impact of viruses on the environment

Strategic Objective 4.: Communication and Awareness

Outcome 4.1: Communication channels are in place and operational

Activity 1: Establish a cassava viral diseases communications unit

Activity 2: Establish women's clubs to exchange information about the cassava sector (farmers, retailers, processors)

Activity 3: Establish a network for exchange of phytosanitary information and awareness

Activity 4: Engage the commitment of traditional leaders to EOC activities

Outcome 4.2: Information about cassava viral diseases is effectively shared between stakeholders

Activity 1: Organize awareness days: awareness forum, cassava open day

Activity 2: Develop communications tools (audio, video, guides, leaflets, banners, boards, websites, mobile phone, social networks).

Activity 3: Translate communications tools into local languages

Activity 4: Raise awareness among donors and Technical and Financial Partners (ENABEL, FEC, JICA, WFP, USAID, ADB, World Bank, FAO, etc.) and political decision-makers

Activity 5: Raise awareness among producers about phytosanitary standards, and movement and certification of planting material.

Strategic Objective 5.: Coordination of Activities

Outcome 5.1: Operational national coordination of activities to manage cassava viral diseases

Activity 1: list experts involved in management of cassava viruses in DRC.

Activity 2: list the technical partners involved in virus response activities

Activity 3: organize regular consultation and information exchange meetings about the management of cassava viruses.

Activity 4: Update activities carried out by the various stakeholders to combat cassava viral diseases

Outcome 5.2: The Emergency Operations Center is functional

Activity 1: Create the Emergency Operations Center (EOC)

Activity 2: Integrate the EOC into the institutional framework

Activity 3: Recruit leadership team for EOC

Activity 4: Establish physical presence for EOC

Activity 5: Operationalize the EOC

III. STRUCTURE OF EMERGENCY OPERATIONS CENTER (EOC)

Institutional Anchoring

The EOC that is designed to respond to cassava viral diseases in DR Congo will be under the supervision of the Ministry of Agriculture, in line with Article 2 of Decree no. 05/162 dated 18 November 2005, concerning phytosanitary regulation in DR Congo, and in line with chapter 6 of the agriculture law, which in Article 47 states that: “The Government, together with the provinces and agriculture professionals, sets out and implements the health protection and monitoring policy for plants and plant products”.

Other existing plans in DR Congo that have similar aims are the national Ebola response plan, the national fall armyworm (*Spodoptera frugiperda*) response plan, the national bacterial wilt (*Xanthomonas campestris* pv. *musacearum*) response plan, and these will soon be joined by the national cassava viral diseases response plan (African cassava mosaic virus, cassava brown streak virus and CBSD-like). All these plans are included in the national phytosanitary capacity building strategy.

The present national cassava viral diseases response plan will be implemented via actions that will be in line with current DR Congo phytosanitary regulations, through the Directorate for Plant Protection (DPV).

Governance

Mandate

The prerogatives of the Emergency Operations Center (EOC) are as follows:

1. Preventing and responding to the risks of cassava viral disease outbreaks
2. Coordinating interventions to combat cassava viral diseases
3. Planning prompt interventions in the event of outbreaks of CMD, CBSD or CBSD-like, including mobilization of human, financial and material resources
4. Implementing all activities connected with prevention, mitigation, detection, monitoring and evaluation, before, during and after outbreaks
5. Collecting, collating and analyzing data
6. Share information about cassava viral diseases and how they are controlled and prevented, phytosanitary measures and outcomes achieved
7. Harmonize the viewpoints of all those involved in the EOC

In general terms, the EOC in DRC derives its legitimacy from phytosanitary regulatory laws and decrees. Its legal basis, nationally, regionally and internationally, means it is anchored effectively within the country’s Government institutions.

1. **Nationally**, the planned EOC is based on two laws and decrees: Article 2 of decree 05/162 dated 18 November 2005 concerning phytosanitary regulation in the Democratic Republic of the Congo, and chapter 6 of the law on agriculture, Article 47 (see Appendix)
2. **Provincially**, the EOC is aligned with national directives, contained in the decrees and laws mentioned above
3. **Regionally**, the EOC, along with its supervising Ministry, is part of the strategic framework for plant protection in the African Union (see Appendix)
4. **Internationally**, the strategic framework of the International Plant Protection Convention (IPPC)

Organizational Oversight

Organizational oversight of the EOC will be provided by a steering committee, established by ministerial order. This steering committee consists of WAVE, DPV, the FAO, IITA, INERA, UNIKIN (FacAgro) and CPK. The design and implementation of policies and activity monitoring for the purpose of the EOC's objectives is the responsibility of the Directorate for Plant Protection (DPV), together with the partners mentioned above.

The Directorate for Plant Protection is responsible, together with the various stakeholders and in particular the WAVE program, for designing and creating proposals for policies, strategies, monitoring programs and standards relating to the health of the cassava crop. The EOC is also responsible, together with stakeholders, for this response plan, for creating a program for cassava viral diseases surveillance, and for implementing and monitoring the plan. For operational purposes, the EOC will rely on staff from the DPV.

Organizational structure

Governing Departments and Authorities

Centrally, the EOC will be housed in the DPV's premises, and will largely rely on qualified staff from the DPV. It will work under supervision from the DPV. The EOC's central governing authorities are:

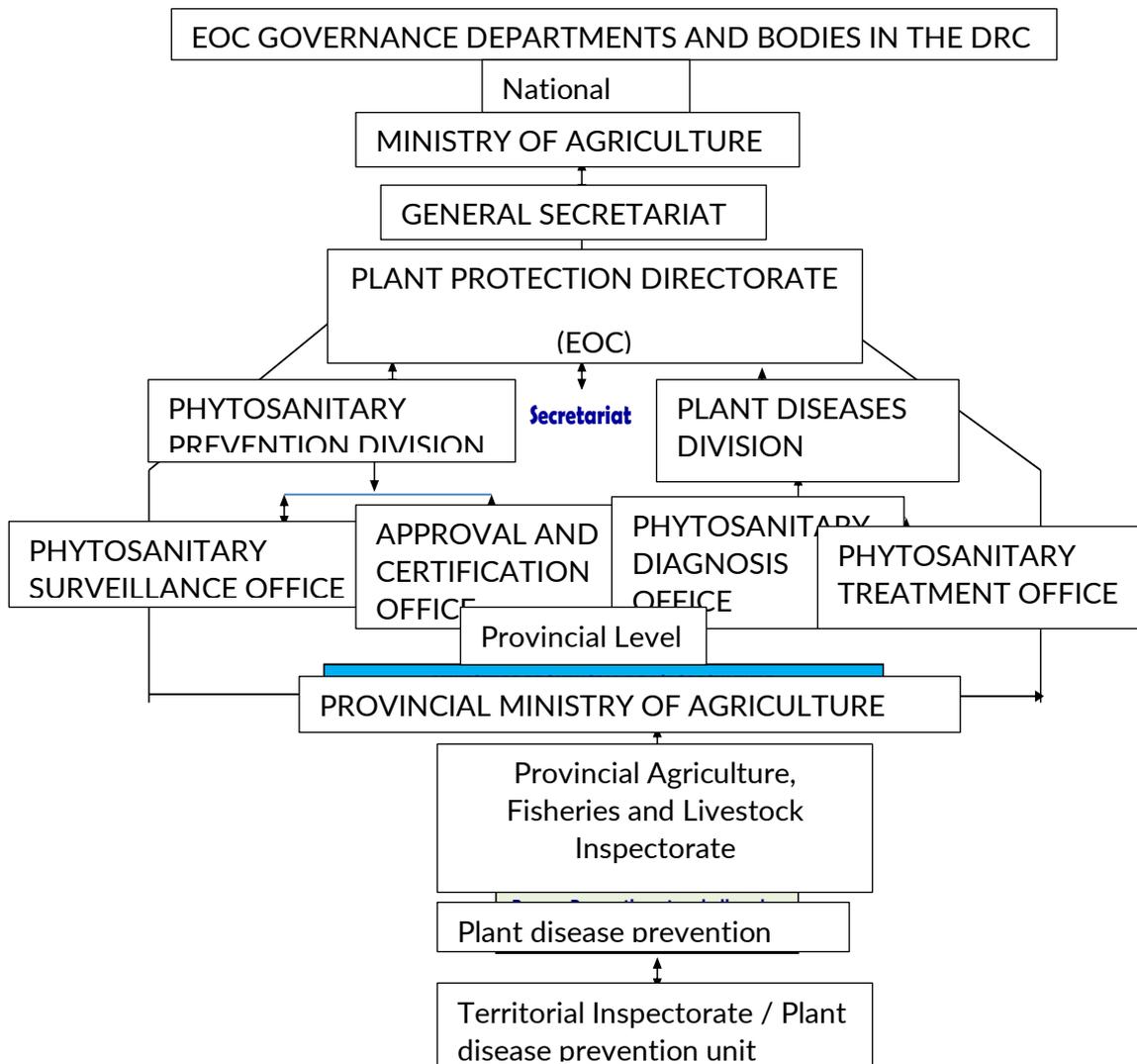
1. National Coordinator
2. Deputy National Coordinator
3. Technical secretariat
4. Operations manager
5. Financial Administrator
6. Plant disease prevention officer
7. Phytosanitary surveillance and diagnosis officer
8. Epidemiology data officer
9. Communications officer

Provincially, the EOC is represented by the provincial agriculture inspectorate. In the territories, the territory inspectorate represents the EOC.

Hierarchical and Decision-making Structure

The hierarchical and decision-making structure of the EOC for cassava viral diseases in the DRC is anchored within the Directorate for Plant Protection in the Ministry of Agriculture.

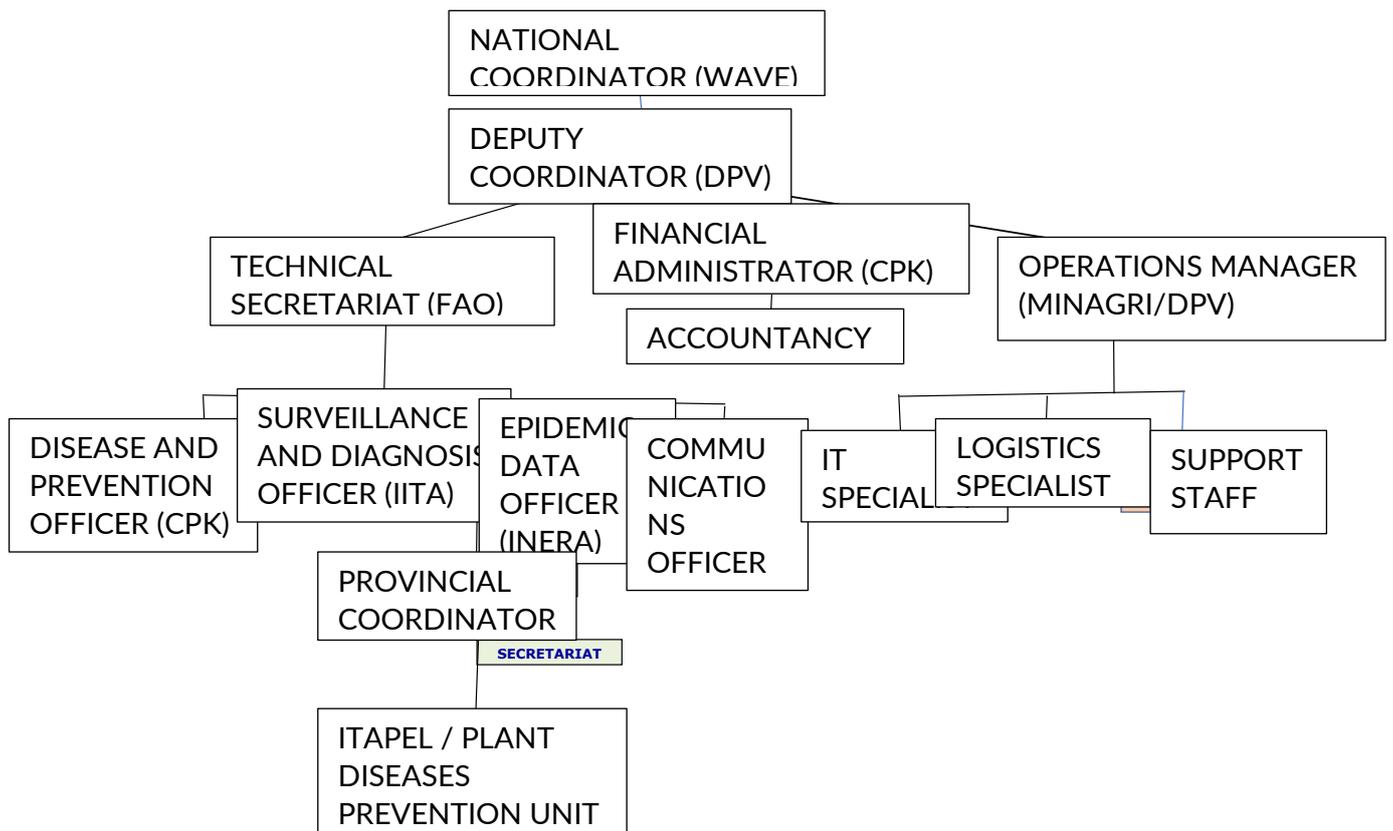
Figure 2: Anchoring of the EOC within the Directorate for Plant Protection in the Ministry of Agriculture in the DRC



Organization Chart

The organization chart of the EOC for cassava disease outbreaks is shown below:

Figure 3: Organization chart of the EOC in the DRC



In summary, coordination is the responsibility of DPV and WAVE, as shown in this chart. Operations management (human and material resources) is the responsibility of MINAGRI/DPV. Surveillance is the responsibility of IITA, WAVE and INERA; response to disease is entrusted to CPK and DPV; financial management is provided by CPK, while communications are handled by UNIKIN.

Human Resources

Core Competencies

The key skills required for smooth operation of the EOC at all levels during the whole outbreak cycle are:

1. Entomologist (of vectors)
2. Phytopathologist
3. Epidemiologist
4. Extension officer
5. Communications specialist
6. Financial Administrator
7. Operations Manager
8. IT specialist (database management specialist)
9. Transport manager

10. Cartographer

Roles and Responsibilities

The permanent staff needs for general functioning of the EOC are:

Nationally, these needs are:

1. Coordinator
2. Deputy Coordinator
3. Technical Secretary
4. Financial Administrator
5. Operations Manager
6. Phytosanitary and plant disease prevention officer
7. Surveillance and Diagnosis Officer
8. Epidemiological database management officer
9. Communication and awareness officer

In the provinces and territories, provincial and territorial agriculture inspectors will act as contacts with the EOC.

The temporary staff needs for general functioning of the EOC are:

1. Expert in Entomology (of vectors)
2. Plant pathologist
3. Viral epidemiology expert
4. Provincial communications officer
5. Extension officer
6. IT specialist
7. Transport manager

The system for assigning roles and responsibilities will be defined by those coordinating emergency interventions. These responsibilities are defined in job descriptions during the recruitment process.

Recruitment Strategy

The recruitment strategy will be needs-based, with calls for applications attached to ToRs in line with official recruitment procedures, and planning for capacity building to secure the future of the provisions of the current plan; The call for applications describing the vacant post will set out the profile of the desired appointee (type and level of education required, level of experience, skills and interpersonal abilities). Qualified staff may be attracted by publishing vacancies in the press, by launching calls for applications, by creating a database and by networking with cassava viral diseases specialists.

The recruitment process will therefore be as follows: publication of an internal/external advertisement, analysis of applications, interviews and tests, candidate selection, bringing on board new recruits.

Training

The need for training, for existing as well as new employees, will become clear after the annual performance review.

Skills gaps will be assessed on the basis of the performance indicators in the employee's job description.

For new employees, there should be a probationary period of 6 months after appointment, to ensure that the desired level of competence is present. If the probationary period is successful, a series of short training courses in specific areas can be planned, to fill any gaps.

For existing staff, there should be periodic updates in specific areas, particularly the use of new data analysis software and diagnostic kits.

Financial and material resources

Financial Requirements

Main figures relating to setting up this new facility, and operating costs per year (the EOC project is set to last 5 years):

- Capital expenditure (infrastructure costs, office equipment, computer equipment, vehicles, laboratory facilities)
- Operating costs (salaries [includes salaries for permanent staff, wages for temporary staff recruited during outbreaks or if there is a critical project requiring additional human resources], training costs, general expenses and other costs, etc.)
- Costs linked to training, including the costs of short training courses and long training programs
- Emergency budget, including expenditure on true response activities, in the event of an epidemic outbreak of cassava viral diseases
- Contingency budget, including all expenditure for unforeseen and urgent activities
- The additional financial resources required in emergency interventions are mission expenses (per diems, travel, accommodation etc.) and allowances and similar costs.

Material Needs

To establish the EOC, and to operate in times of crisis, it is important to provide the material and equipment listed below:

- Office space, fittings, electricity, solar panels, electricity generator, telephones, website etc.

- Transportation, such as vehicles, fuel and lubricant
- A server to store epidemiological data during and after outbreaks
- IT equipment with a high-speed internet connection
- Early diagnosis kits for use in the field
- Accredited laboratories to support the EOC
- Tools to analyze and evaluate the impact of viral diseases
- Kits for recording georeferenced data

Resource Management Plan

Financial and material resources for normal operation of the EOC will be managed in line with the procedural manuals of the funders. To ensure rapid allocation of financial and material resources in crisis situations, there should be a separate bank account, with the Coordinator as a joint signatory who will approve all expenditure. Financial and accounting control mechanisms will be aligned with the procedures manuals of the various funding partners.

The order of priority when disbursing resources for EOC operations will be aligned with recruitment / appointment, setting up and equipping offices (infrastructure), implementation of the various activities.

Partnerships

In the DRC, there is not yet an operational EOC to respond to crop diseases. There are similar committees in the Ministry of Public Health, with a notable example being the Ebola virus response. To operationalize an EOC for cassava viral diseases, the Government of the DRC will call upon its long-standing technical partners, particularly the FAO, UNDP, WFP, Enabel, GIZ, JICA, and its funding partners such as ADB, EU, WB, and IFAD.

Funding from the Bill & Melinda Gates Foundation and DFID will be very welcome when implementing the EOC.

IV. EMERGENCY ACTION PLAN

Actions to be taken before an outbreak

It is important to note that the DRC is already host to an epidemic of cassava viral diseases. The two main viral diseases, African cassava mosaic virus (CMD) and cassava brown streak virus disease (CBSD), are a major constraint on cassava growing in the DRC. The presence of a disease related to cassava brown streak virus disease (CBSD-like) has also been reported. The following strategic actions should be considered, both before and during outbreaks.

Table 1: Actions before an outbreak

	Risk analysis and definition of risk level	Planning	Monitoring	Prevention	Community and engagement	Partnerships
Actions	<ol style="list-style-type: none"> Evaluate the level of the cassava virus epidemic Evaluate the threshold for harm and the level of economic harm caused by CBSD-like, CBSD and CMD Determine how quickly the diseases are spreading. Map the distribution of outbreaks: <ol style="list-style-type: none"> CBSD-Like: a highly destructive emerging disease in western parts of the DRC. No varieties are resistant to CBSD-like, and it is spreading very rapidly via infected cuttings; its causative agent has not yet been identified CBSD: the most destructive emerging disease 	<ol style="list-style-type: none"> Regular consultations (every 3 months) between national and international experts in workshops, meetings etc. Preparing, mobilizing and setting up phytosanitary inspection teams Mobilization of financial and material resources for surveys 	<ol style="list-style-type: none"> Observations of emergence of symptoms of CBSD-like, CBSD and CMD on the cassava crop Routine monitoring of phytosanitary quality of cassava cuttings at entry points to the DRC Early alerts triggered 	<ol style="list-style-type: none"> Prevention activities (phytosanitation; design and distribution of guides; training in symptom recognition) Communication and awareness activities (radio, churches, displays, boards etc.) Propagation and distribution of healthy planting materials 	<ol style="list-style-type: none"> Adoption of strategies to respond to various symptom types Types of disease Types of vector Knowledge of how diseases spread Use of highly-developed prevention and response methods Raising awareness among political, agricultural and technical decision-makers (information exchange) 	<ol style="list-style-type: none"> Mobilization of human, financial and material resources for surveillance and prevention Formal commitment to take part in action

	<p>throughout the east of the DRC. No varieties are resistant to CBSD, and it is spreading very rapidly via infected cuttings and whitefly vector; its causative agents are known to be UCBSV and CBSV</p> <p>c. CMD: a disease that is widespread throughout the DRC. Some resistant varieties are distributed, and it spreads via infected cuttings and whitefly vector; its causative agent is known.</p>					
Responsible	EOC, DPV, WAVE Universities, research centers and national committee for coordination of the response to cassava and banana diseases	EOC, DPV, WAVE	IPAPELs, ITAPELs Local populations Agronomists from the sector, WAVE, NGOs, CPK, propagation workers	DPV, EOC	Civil society organizations, NGOs, MINAGRI, traditional leaders	FAO, IFAD, BMGF, DFID, CPK, Universities, INERA, IITA, SENASEM, TFPs and others
Process	<ol style="list-style-type: none"> 1. Georeferenced surveys in areas where outbreaks have been reported 2. Collect data on incidence, severity and vector population 3. Laboratory analysis for confirmation 	Frequent consultations between experts from EOC, MINAGRI and TFPs	<ol style="list-style-type: none"> 1. Frequent surveys of cassava fields 2. Free telephone line 	<ol style="list-style-type: none"> 1. Cassava open day 2. Exchanging experience 3. Awareness-raising workshops 	<ol style="list-style-type: none"> 1. Communication via community radio 2. Mass awareness-raising campaigns (street signs, schools, agricultural facilities, churches, displays, boards etc.) 	Each partner subscribes to the appeal launched by MINAGRI

Frequency	<ul style="list-style-type: none"> - Annual growing season surveys - One-off surveys - Alerts 	<ul style="list-style-type: none"> - At the end of the growing season - Emergency meeting if the alert is sounded 	Ongoing	Ongoing	Ongoing	<ul style="list-style-type: none"> - Before outbreak - During outbreak - After outbreak
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Actions in the event of an outbreak

Table 2: Actions in the event of an outbreak

	Detection, identification and confirmation	Response, containment, quarantine and elimination	Activation of system	System operation	Evaluation of response
Actions	<ol style="list-style-type: none"> 1. Diagnosis in the field and molecular diagnosis of CBSD-like, CBSD and CMD. 2. Characterize the causative agent of CBSD and CBSD-like and provide notification of an outbreak 	<ol style="list-style-type: none"> 3. Take steps to contain the outbreak of CBSD-like and CBSD. 4. Urgent steps to mitigate CMD by distributing resistant varieties 5. Regulate the circulation of cassava cuttings 	<ol style="list-style-type: none"> 1. Establish a surveillance system 2. Make the population aware of the danger of these viral outbreaks 3. Operationalize 6 plant virology reference laboratories for diagnosis and cleaning of planting materials 	<ol style="list-style-type: none"> 1. Mobilize resources (human, material and financial) 	<ol style="list-style-type: none"> 1. Evaluate the effectiveness of existing response measures
Responsible	DPV and partners (WAVE, IITA, INERA, CPK, Universities and other research centers)	DPV/EOC (emergency operations center)	EOC/DPV and partners	MINAGRI and partners	MINAGRI and technical partners (universities and research centers)

Process	<ol style="list-style-type: none"> 1. Specimen collection and analysis in laboratories 2. Confirmation by DPV 3. Reporting by Official Declaration by Minister at MINAGRI 	<ol style="list-style-type: none"> 1. Containment of infected zone (focus of outbreak) 2. Quarantine of focus of outbreak 3. Regulation of movement of planting materials 	<ol style="list-style-type: none"> 1. At entry points to the country: 2. Procurement and distribution of rapid diagnostic kits for cassava viral diseases for use at the border. 3. Train 720 phytosanitary inspectors to work at the border 4. For phytosanitary inspections: Identification and monitoring of production sites of disease-free planting materials 5. Alert system: 6. Establish an alert system: 7. Set up a free telephone number for communication between farmers and researchers 8. Use rapid detection kits (LAMP, serology test strip, MinION) for detecting cassava virus in the field 9. Use of software to collect data about the impact of viruses on cassava growing. 	<ol style="list-style-type: none"> 1. Data are collected in the database and send to EOC/DPV via the free telephone line (see diagram) 	<ol style="list-style-type: none"> 1. Analysis of gaps in data on the focus of the outbreak, before, during and after the outbreak. 2. Evaluate the impact of the focus of the outbreak on food security, household incomes and the national economy. 3. Effectiveness of NICT resources (software, mobile phone) used
Frequency	- As soon as focus of outbreak emerges	- As soon as focus of outbreak emerges	- Before and during emergence of focus of outbreak	<ul style="list-style-type: none"> - Before focus of outbreak emerges (limited to surveillance) - During emergence of focus of outbreak 	- Before, during and after management measures are put in place

Figure 4: Diagram showing how system functions

Immediate and urgent actions:

1. Coordination of activities to respond to cassava viral diseases
2. Refurbishment and/or fitting out of existing laboratories
3. Propagation and distribution of disease-free planting materials
4. Surveys, phytosanitary inspection, phytosanitation and mapping
5. Blanket ongoing training for all farmers, researchers, technicians and extension workers
6. Awareness of the use of healthy planting materials
7. Official notification of CBSD in the DRC

For CBSD-Like:

1. Identification and characterization of the causative agent
2. Study of geographical distribution of the disease

Phytosanitary measures

Biosecurity and Regulations

Border controls:

In the DRC, movement of plant materials across borders is subject to rigorous inspection. Imports and exports of plants, plant products, soil, culture medium and biological control agents are subject to phytosanitary certification and export permits, which are granted by the Plant Protection Directorate. The following legal texts govern this sector:

- Decree-law no. 05/162 dated 18 November 2005, concerning phytosanitary regulation, and specifically articles 4, 5, 6, 7, 8 and 9
- Law no. 11/022 dated 24 December 2011, concerning the basic principles of agriculture, chapter 6, articles 47, 48, 49, 50 and 51
- International standards for phytosanitary measures (standard 36: Integrated measures for plants for planting)
- Standard 3, containing guidelines for the export, shipment, import and release of biological control agents and other beneficial organisms
- Standard 11, concerning pest risk analysis for quarantine pests

Control of circulation of cuttings in the DRC:

The movement of cassava cuttings in the DRC is governed by decree-law no. 05/162 dated 18 November 2005 and law 11/022 dated 24 December 2011.

International standards for phytosanitary measures (standard 36: Integrated measures for plants for planting).

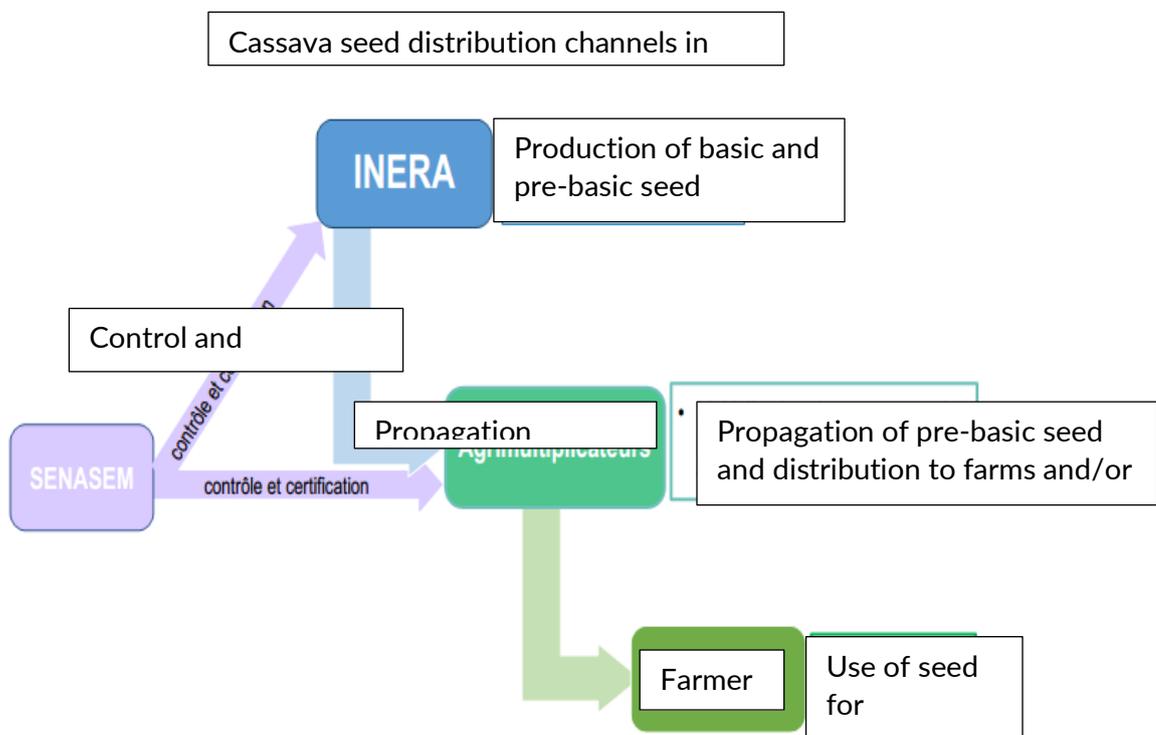
In the strategy for response to viruses affecting cassava and other plant diseases, there is a provision to forbid introduction of propagation material from infected zones into disease-free zones. Phytosanitary inspectors are responsible for enforcing this.

Seed Systems

Certification / production and propagation of cassava cuttings:

In the Democratic Republic of Congo, production of basic and pre-basic seed is entrusted to research institutes (INERA, Universities, etc.), and these are made available to registered seed operators by SENASEM (National Seed Service). This seed is then propagated to produce certified seed to be made available to farmers. At each step of the propagation process, SENASEM performs regular controls in order to guarantee the quality of seed and certify it in accordance with legislation.

Figure 5: Diagram of seed production, propagation and certification in the DRC



Vector control

Treatment for whitefly: chemical treatments for whitefly are not recommended in the Democratic Republic of the Congo, because cassava leaves are the most widely consumed vegetable by the Congolese population, and also because the cost of chemical treatments cannot be justified, given the mobility of this vector.

Instead, natural biological methods and growing techniques to combat whitefly are used.

To improve and strengthen this natural biological response, the following are being considered:

- Promotion of the “push-pull” approach
- Use of pheromone traps
- Extension of the agroforestry approach

For management of infected plants, several growing techniques are used by cassava producers. The main such techniques are:

- Phytosanitation
- Incineration of infected cuttings
- Avoiding use of infected cuttings

For seed fields, the infestation threshold is evaluated during SENASEM inspection, before cuttings are distributed. To certify cuttings, a propagation field is considered to be unusable when the incidence is greater than 7% for CBSD and 5% for CMD (see Inspection of fields for propagation of healthy cassava cuttings and certification protocol, IITA 2017).

Distribution of resistant varieties: there are around ten varieties that are resistant to CMD, including DISANKA (196/0211), ZIZILA, OBAMA (TME 419), NSANSI (195/0160), BUTAMU, GANDAJIKA, WINA (2001/1229), LIYAYI (MM96/0287), MAYOMBE (MM96/8353), MVUAZI (195/0528).

For CBSD and CBSD-like: There are clones on trial at INERA Mvuazi: MUSAMBU, IBA 003866, IBA, MVZ2011B/360 and GKA 012/149. Others are being implemented at IITA-Bukavu.

Communication and Awareness

Producers, technicians and stakeholders from civil society must be made aware of viruses affecting the cassava crop, using leaflets, guides and identification sheets. All stakeholders involved in the cassava sector must be trained and made aware.

Raising awareness in the community about strategies for responding to these viruses should be done via opinion leaders (local authorities, religious leaders). This awareness campaign must start with a mass information approach, a Farm Field School approach for producers, open days, media broadcasts, SNV, etc.

Education:

- Training for technicians and agricultural producers (in recognizing symptoms of cassava viral diseases, and in ways to respond to these diseases)
- Training of phytosanitary inspectors to work at entry points to the DRC; Training of phytosanitary inspectors at entry points to the DRC in how to use rapid diagnostic kits for cassava viral diseases for use at the border
- Training for all stakeholders in phytosanitary standards

V. OPERATIONAL STRATEGY

Strategy Implementation Plan

Resource Mobilization Plan

Sources of funding:

The total budget requirement for operationalization of an EOC and for operating costs over five years is USD 19,917,700, with annual breakdown as follows:

Year 1	###
Year 2	
Year 3	
Year 4	
Year 5	

see EOC budget

A national budget line allocated to this EOC should be encouraged. Financial involvement from funding partners and other donors is strongly encouraged.

The order of priority when disbursing resources for EOC operations will be aligned with recruitment / appointment, setting up and equipping offices (infrastructure), implementation of the various activities.

The stakeholders to be targeted for resource mobilization include technical and financial partners, the Government, banks and embassies. The percentage to be obtained will depend on each stakeholder's level of commitment. For this reason, advocacy is required to elicit further commitments from funders.

The main activities to undertake in the short and medium term, to assure full funding of the EOC, are:

1. Ratification of the document by the Minister for Agriculture
2. Implementation of the administrative framework
3. Organization of advocacy workshops and dinners for funders, ambassadors and parliamentarians
4. Presenting the national cassava viral diseases response plan to the Technical Group of 9 (GT9)

The long-term strategy for financial viability will involve adoption and endowment of funds for operating costs and perpetuation of the EOC's activities.

In addition, the dynamism of leaders is a major asset in mobilizing funds to achieve viability. As the majority of EOC staff are experts from the Ministry of Agriculture, payment of their salaries is in itself a way of perpetuating the EOC. Setting up and equipping commercial laboratories for

diagnosis and consultation on viral diseases of cassava and other crops will enable resource mobilization and thereby the long-term viability of this facility.

Road Map

Table 3: Road map 2019-2023

Specific objectives	Outcomes	Activities	2019			2020			2021			2022			2023			
			Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3	Q1	Q2	Q3	
1: Monitoring of cassava viral diseases	Outcome 1.1: Monitoring system is operational in DRC	Activity 1: Procure and distribute rapid diagnostic kits for cassava viral diseases for use at the border			X													
		Activity 2: Train phytosanitary inspectors to work at the border: there are 240 entry points, and 3 inspectors will be trained for each entry point. This means that 720 inspectors need to be trained within 5 years (240 x 3) or 144 inspectors/year. 144/3: 48 inspectors to be trained		X			X			X			X			X		
		Activity 3: Identify and monitor production sites of disease-free planting materials	X	X	X													
		Activity 4: Establish an alert system	X	X	X													
		Activity 5: Set up a free telephone number for communication between farmers and researchers		X	X													
		Activity 6: Use rapid detection kits (LAMP, serology test strip, MinION) for detecting cassava virus in the field				X	X											
		Activity 7: Use software to collect data about the impact of viruses on cassava growing					X											
		Activity 8: Carry out frequent phytosanitary controls			X				X		X			X				X
		Activity 9: Build work-related infrastructure																
		Jan 2000 - Dec 2. Strategies for managing cassava viral diseases	Outcome 2.1: scientific knowledge about viral diseases in the DRC is increased	Activity 1: Carry out genetic and molecular characterization of the viral strains that cause the diseases, and of vectors for these strains					X	X	X	X	X	X	X			
Activity 2: Study dynamics of vector populations in various agro-ecological zones in the DR Congo				X	X	X	X	X	X	X	X	X	X					

	Activity 3: One-off survey of the dynamics of cassava viral diseases to establish a map of the presence and distribution of viruses and vectors	X		X	X	X	X	X	X		X	X		X	X		X	
	Activity 4: List introductions of germplasms and selection for genetic resistance, using the molecular marker approach	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Activity 5: Vector control using biological methods: promotion of vector's natural enemies, evaluation of local parasitoids and predators. Introduction and evaluation of natural enemies from abroad	X	x	X	X	x	X	X	x	X	X	x	X	X	X	X	X	
	Activity 6: Maintenance and conservation of phylogenetic resources		X	X	X	X	X	X	X	X	X	X	X	X	X	X		
	Activity 7. Develop a national collection of germplasms (varieties) and create a cassava gene bank	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
	Activity 8: List, evaluate and develop good growing practices to respond to cassava viral diseases	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
	Activity 9: Study the impact of climate change on viral diseases and vectors	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
	Activity 10: Evaluate the breakpoints of varieties that are resistant to cassava viruses	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Outcome 2.2: Resistant varieties are listed, propagated and distributed	Activity 1: List, propagate and distribute varieties that are resistant to cassava viral diseases					X	X	X	X	X	X	X	X	X	X	X	X	
	Activity 2: Clean planting materials that are preferred by farmers but that are affected by viruses	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		
	Activity 3: Identify, train and strengthen capacity of propagation workers			X	X									X	X			

	Activity 4: Evaluate levels of adoption of new resistant varieties						X	X	X	X				X	X	X
Outcome 2.3: Increased scientific and infrastructure capacity of reference laboratories for management of cassava viral diseases	Activity 1: Build human resources capacity in the specialist services in MINAGRI, specifically in surveillance and diagnosis of cassava viral diseases and implementation of international phytosanitary standards	X	X		X	X		X	X		X	X				
	Activity 2: Equip and operationalize reference laboratories for management of cassava viral diseases	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Activity 3: Build scientific capacity among laboratory technicians			X			X			X			X			X
Outcome 2.4: Farmers' and local technicians' capacity to manage cassava viral diseases is increased	Activity 1: Train trainers about cassava viral diseases using an FFS approach (farmer field school): recognizing symptoms of cassava viral diseases and ways to respond to them	X	X		X	X		X	X		X	X		X	X	
	Activity 2: Train farmers using FFS (farmer field school) approach to cassava viral diseases		X	X		X	X		X	X		X	X		X	X
	Activity 3: Technician training using the Plantwise approach				X			X			X			X		
	Activity 4: Train extension workers and CAID workers in cassava viral diseases				X			X			X			X		
	Activity 5: Provide training leading to diplomas and placements															
	Activity 6: Train technicians in the use of impact evaluation tools (software: ODK, DashBoard, FAMEWS, iForm; Kits)			X	X	X	X	X	X	X	X	X	X	X	X	
	Activity 7: Identify and boost technical capacity among propagation workers															
	Activity 8: Train technicians in the use of impact evaluation tools (software: ODK, DashBoard, FAMEWS, iForm; Kits)			X	X	X	X	X	X	X	X	X	X	X	X	
Outcome 2.5: Training leading to diplomas and placements for researchers to	Activity 1: Evaluate and identify placement and diploma-level training needs, and candidate selection			X	X	X	X	X	X	X	X	X	X	X	X	
	Activity 2: Select training institutions			X	X	X	X	X	X	X	X	X	X	X	X	
	Activity 3: Organize high-level placements			X	X		X	X	X	X	X	X	X	X	X	

	learn about the management of cassava viruses are provided	Activity 3: Organize training leading to diplomas and placements, to establish a national hub of cassava disease experts (placement MSc, PhD and post-doc)			X	X		X	X	X	X	X	X	X	X	X		
Jan 2000 - Dec 3. Evaluation of impact of cassava viruses	Outcome 3.1: Data acquisition technology contributes to a better understanding of the impact of cassava viruses	Activity 1: Procure and adapt tools for evaluating impact of cassava viruses (software: ODK, DashBoard, FAMEWS, iForm; Kits)		X	X													
		Activity 2: Use evaluation tools (software: ODK, DashBoard, FAMEWS, iForm; Kits)						X	X	X	X	X	X	X	X			
		Activity 3: Procure NICT equipment (computers, GPS, mobile phone) on which to run the evaluation tools	X	X														
		Activity 4: Map disease-free and affected cassava growing areas	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
		Activity 5: Determine the geographical distribution of viruses and vectors;	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	Outcome 3.2: The impacts of cassava viruses are listed and evaluated	Activity 1: Evaluate the impact of cassava viruses on the vulnerability of women and young people	X	X				X	X		X	X						
		Activity 2: Evaluate the impact of diseases on food security, household incomes, value chains and the national economy			X			X			X			X				X
		Activity 3: Evaluate the effectiveness of methods that aim to reduce the incidence of cassava viral diseases			X			X			X			X				X
		Activity 4: List and evaluate the existing planting materials (cassava varieties) in their response to viral disease	X	X	X			X			X			X				X
		Activity 5: Evaluate the impact of cassava viruses on the environment	x	x	x	x	x	x	x	x	x	x	x	x	x			
Jan 2000 - Dec 4. Communication and awareness	Outcome 4.1: Communication channels are in	Activity 1: Establish a cassava viral diseases communications unit	x	x	x													
		Activity 2: Establish women's clubs to exchange information about the cassava sector (farmers, retailers, processors)	x	x	x													

	place and operational	Activity 3: Establish a network for exchange of phytosanitary information and awareness	x	x	x														
		Activity 4: Engage the commitment of traditional leaders to EOC activities	X	X	X														
	Results 4.2: Information about cassava viral diseases is effectively shared between stakeholders	Activity 1: Organize awareness days: awareness forum, cassava open day				X	X	X											
		Activity 2: Develop communications tools (audio, video, guides, leaflets, banners, boards, creation of a website for data management, use of phones, social networks)			X	X	X	X											
		Activity 3: Translate communications tools into local languages						X	X	X									
		Activity 4: Raise awareness among donors and TFPs (ENABEL, FEC, JICA, WFP, FAO, ADB, World Bank, USAID, Chinese cooperation, etc.) and political decision-makers		X	X			X			X			X				X	
		Activity 5: Raise awareness among producers about phytosanitary standards, and movement and certification of propagation material		X	X			X			X			X				X	
	5. Activity coordination	Outcome 5.1: Operational national coordination of activities to manage cassava viral diseases	Activity 1: list experts involved in management of cassava viruses	X															
			Activity 2: list the technical partners involved in virus response activities	X															
			Activity 3: organize regular consultation and information exchange meetings about the management of cassava viruses	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Activity 4: Update activities carried out by the various stakeholders to combat cassava viral diseases			X		X			X			X			X				X	
	Outcome 5.2: The emergency	Activity 1: Create the Emergency Operations Center	X	X	X														

operations center is functional	Activity 2: Integrate the EOC into the institutional framework	X	X													
	Activity 3: Recruit leadership team for EOC	X	X													
	Activity 4: Establish physical presence for EOC			X												
	Activity 5: Operationalize the EOC			X	X	X	X	X	X	X	X	X	X	X	X	X

Operational Budget for Cassava EOC in the DRC

Table 4: EOC Budget 2019-2023

OPERATIONAL BUDGET FOR EMERGENCY OPERATIONS CENTER FOR CASSAVA VIRAL DISEASES IN DRC

				2019	2020	2021	2022	2023
ITEMS	UNIT / HM	Duration	Unit cost (\$)	Total cost (\$)				
EOC staff								
EOC National Coordinator	1	12	2500	30,000	30,000	30,000	30,000	30,000
Deputy National Coordinator	1	12	2000	24,000	24,000	24,000	24,000	24,000
Technical Secretary	1	12	1500	18,000	18,000	18,000	18,000	18,000
Financial Administrator	1	12	1,500	18,000	18,000	18,000	18,000	18,000
Operations Manager	1	12	1,500	18,000	18,000	18,000	18,000	18,000
Disease Prevention Officer (National)	1	12	1000	12,000	12,000	12,000	12,000	12,000
Monitoring and Diagnosis Officer (National)	1	12	1,000	12,000	12,000	12,000	12,000	12,000
Epidemiological data management officer	1	6	1,000	6,000	6,000	6,000	6,000	6,000
Communications officer (National)	1	12	1,000	12,000	12,000	12,000	12,000	12,000

External expertise (non-permanent staff)	4	6	1,500	36,000	36,000	36,000	36,000	36,000
IT specialist	1	6	600	3,600	3,600	3,600	3,600	3,600
Transport manager	1	6	600	3,600	3,600	3,600	3,600	3,600
EOC Provincial Coordinator	26	12	800	249,600	249,600	249,600	249,600	249,600
Disease Prevention Officer (Provincial)	26	12	600	187,200	187,200	187,200	187,200	187,200
Monitoring and Diagnosis Officer (Territorial)	145	12	400	696,000	696,000	696,000	696,000	696,000
Support staff	30	12	250	90,000	90,000	90,000	90,000	90,000
III. Travel and per diems								
Surveys in the field	Field mission	26	20,000.00	520,000	520,000	520,000	520,000	520,000
Activity monitoring	Field missions	26	10,000	260,000	260,000	260,000	260,000	260,000
IV. Materials and facilities								
Computers + peripherals	Kits	30	2,000	60,000	0	60,000	0	0
Rapid diagnostic kits for borders	kits	240	1,000	240,000	0	240,000	0	0
Data collection kits: software, mobile phone, GPS	Kits	100	1,000	100,000	0	100,000	0	0
Consumables	Plans	30	5,000	150,000	150,000	150,000	150,000	150,000
V. Durable equipment								
Laboratory equipment	Kit	6	100,000	600,000	500,000	400,000	300,000	200,000
Vehicle	(unit)	30	40,000	1,200,000	0	0	0	0
Yamaha AG100 motorcycles	(unit)	180	5,000	900,000	0	0	0	0
VI. Training								
Workshops and meetings to support EOC	Workshop	6	10,000	60,000	60,000	60,000	60,000	60,000
VII. Technical support								
Evaluation		1	15,000	15,000	15,000	15,000	15,000	15,000
Reporting		1	5,000	5,000	5,000	5,000	5,000	5,000
VIII. General operational costs								
Safety	months	12	1,000	12,000	12,000	12,000	12,000	12,000
Fuel and lubricant	months	12	10,000	120,000	120,000	120,000	120,000	120,000

Servicing and maintenance	months	12	1000	6,000	10,000	12,000	14,000	15,000
Insurance and vehicle inspection	months	12	1000	12,000	12,000	12,000	12,000	12,000
Telephone	months	12	400	4,800	4,800	4,800	4,800	4,800
Maintenance and electricity	months	12	1000	12,000	12,000	12,000	12,000	12,000
Alert system	months	12	2000	24,000	24,000	24,000	24,000	24,000
Internet	months	12	2000	24,000	24,000	24,000	24,000	24,000
SUB-TOTAL for EOC project				5,716,800	3,144,800	3,446,800	2,948,800	2,849,800
IX. ADMINISTRATIVE COSTS		10%		571,680	314,480	344,680	294,880	284,980
OVERALL TOTAL				6,288,480	3,459,280	3,791,480	3,243,680	3,134,780

Management of risks associated with implementation

Table 5: Risks of implementation and ways to mitigate these

Risks	Likelihood of occurrence	Ways of mitigating risks
1. Social and political instability	High	Government is making efforts to maintain peace and stability in the DRC, with elections at all levels, which is a gage of social and political stability
2. Low level of adoption of some technologies (growing practices, etc.)	Low	<ul style="list-style-type: none"> - Cleaning of varieties that have already been adopted by farmers is a way of mitigating this risk - Active participation (involvement) of producers in FFS will facilitate and increase rates of adoption of new technologies
3. Withdrawal of stakeholder commitment	Moderate	Transparent project management

Monitoring and evaluation plan

Table 6: Monitoring and evaluation plan

Intervention method	Outcomes	Activities	Control indicators	Control frequency	Responsibility for implementation and follow-up	Sources of verification	Assumptions	Frequency of evaluation	Responsible for evaluation
SO1: Monitoring of cassava viral diseases	Outcome 1.1: Monitoring system is operational in DRC	Activity 1: Procure and distribute rapid diagnostic kits for cassava viral diseases for use at entry points	1. Number of diagnostic kits procured and distributed; 2. Quantity of consumables procured	Once (at start of project)	FAO, WAVE	Project delivery report	Order on schedule, delivery on time	Once	External expertise
		Activity 2: Train phytosanitary inspectors to work in the country's 240 entry points: 3 inspectors will be trained for each entry point. This means that 720 inspectors need to be trained within 5 years (240 x 3) or 144 inspectors/year. 144/3: 48 inspectors to be trained	1. Number of inspectors trained 2. Training module delivered 3. Number of entry points involved	3 times a year	EOC, DPV, WAVE, IITA	Project report	Training delivered Inspectors effective and motivated	3 times a year	FAO External expertise
		Activity 3: Identify and Monitor production sites of disease-free planting materials	1. Number of sites identified 2. Number of sites monitored	Annual	WAVE and CPK	1. Project report 2. Report by ITAPELs	Favorable political, economic and social environment	Once a year	FAO
		Activity 4: Establish an alert system	1. Number of sentinel sites set up	Annual	EOC, FAO, WAVE, MINAGRI	Report by MINAGRI, EOC, WAVE and FAO	Effective alert system	Once a year	External expertise
		Activity 5: Set up a free telephone number for communication between farmers and researchers	1. Recorded number of calls each month	Once a month	EOC, WAVE, FAO	Call center report WAVE report	Free telephone number operational Telephone operator is motivated	Once a quarter	External expertise

		Activity 6: Use rapid detection kits (LAMP, serology test strip, MinION) for detecting cassava virus in the field	1. Number of kits used	Annual	WAVE, CPK	Report by WAVE and Kinshasa Plant Clinic	Effectiveness of kit use	Once a year	WAVE, CPK
		Activity 7: Use software to collect data about the impact of viruses on cassava growing	1. Items of data collection software used	Annual	WAVE, CPK, IITA, EOC	Report by WAVE, IITA, EOC and CPK	Effective use of data collection software	Annual	FAO, External expertise
		Activity 8: Carry out frequent phytosanitary controls	1. Number of controls carried out	Annual	DPV, WAVE, CPK	Reports by DPV, WAVE and CPK	Phytosanitary controls carried out effectively and on schedule	Annual	MINAGRI
		Activity 9: Build work-related infrastructure	1. Amount of infrastructure refurbished	Twice a year	WAVE, EOC	WAVE report	Refurbishment on schedule	Annual	MINAGRI
SO2. Strategies for managing cassava viral diseases	Outcome 2.1: scientific knowledge about viral diseases in the DRC is increased	Activity 1: Genetic and molecular characterization of viral strains and vector	1. Number of viral strains and vectors characterized	Annual	IITA, WAVE, CPK	Scientific journal, laboratory notebook, NCBI portal	Favorable working conditions	Midway evaluation	External expertise
		Activity 2: Study spatial and temporal dynamics of vector populations in various agro-ecological zones	1. Number of dynamic vector models built	Annual	WAVE, IITA, FACAGRO/UNIK IN	Scientific journal, laboratory notebook, NCBI portal, WAVE and IITA reports, FACAGRO/UNIK IN	Favorable working conditions	Midway and final evaluations	Internal expertise
		Activity 3: One-off survey to map the presence and distribution of viruses and vectors	1. Proportion of country covered by surveys, number of maps produced	Annual	WAVE, IITA, OSFAC	Reports by WAVE, IITA and OSFAC	Stable security conditions	Midway and final evaluations	GIS

		Activity 4: Select for genetic resistance	1. Number of resistant varieties selected	Annual	INERA, IITA, WAVE	1. Reports by INERA, MINAGRI, IITA 2. Study monitoring sheets	Technical conditions met, engagement of technicians	Midway and final evaluations	SENASEM
		Activity 5: Vector control using biological methods: promote the vector's natural enemies, evaluate local parasitoids	1. Proportion of predators and parasitoids identified	Twice a year	INERA, WAVE and IITA	1. Report by WAVE, INERA and IITA 2. Scientific publications	Favorable environmental conditions	Midway and final evaluations	WAVE
		Activity 6: Maintain and conserve plant genetics resources	1. Number of lines maintained and conserved	Annual	FAO, WAVE, INERA and IITA	1. Reports by WAVE, INERA, FAO and IITA 2. Publications	Favorable environmental conditions Technical conditions met Engagement of researchers	Midway and final evaluations	FAO
		Activity 7: Develop a national collection of cassava germplasms (varieties)	1. Number of varieties collected	Twice a year	FAO, IFA/YANGAMBI, INERA and IITA	1. Reports by FAO, INERA and IITA 2. Descriptive sheets for various materials	Favorable environmental conditions Technical conditions met Engagement of researchers	Midway and final evaluations	FAO CPK
		Activity 8: Develop growing practices that respond to cassava viral diseases	1. Number of growing techniques adopted by farmers	Annual	INERA, WAVE and FAO, MINAGRI	Reports by INERA, WAVE, FAO, MINAGRI	Favorable social conditions Effective involvement of producers	Midway and final evaluations	SNV - the national extension worker service (Service National de Vulgarisation)

		Activity 9: Study the impact of climate change on viral diseases	1. Changes in levels of awareness	Annual	Universities, CPK, IITA and WAVE	Reports by IITA, CPK and WAVE	Research protocol properly implemented	Midway and final evaluations	FACAGRO/UNIK IN OSFAC
		Activity 10: Evaluate the breakpoints of varieties that are resistant to cassava viruses	1. Number of resistant varieties studied	Twice a year	INERA, FAO and IITA	Reports by institutes involved	Favorable environmental conditions Technical conditions met Engagement of researchers	Midway and final evaluations	FAO
	Outcome 2.2: Resistant varieties are propagated and distributed	Activity 1: List, propagate and distribute varieties that are resistant to cassava viral diseases	1. Number of resistant varieties propagated and distributed	Annual	INERA, IITA, IFA, propagation facilities	1. Reports by facilities involved 2. National seed catalog	Existence of resistant varieties	Midway and final evaluations	SENASEM
		Activity 2: Clean planting materials that are preferred by farmers but affected by viruses	1. Number of varieties cleaned	Annual	Reference laboratories (CPK, IITA, WAVE, INERA, etc.)	Reports by facilities involved	Existence of cleaning techniques	Midway and final evaluations	INERA SENASEM
		Activity 3: Evaluate levels of adoption of new resistant varieties	1. Number of resistant varieties adopted	Annual	INERA, WAVE and local NGOs	Reports by facilities involved	Effective involvement of farmers	Midway and final evaluations	EOC/WAVE
	Outcome 2.3: Increased scientific and infrastructure capacity of reference laboratories for management of	Activity 1: Build human resources capacity in the specialist services in MINAGRI, specifically in monitoring and diagnosis of cassava viral diseases and implementation of phytosanitary standards	1. Number of inspectors strengthened 2. Number of standards 3. Training modules delivered	Annual	DPV, WAVE and CPK	1. Reports by facilities involved 2. Training report 3. Content of training	Motivation of inspectors Quality of trainers	Midway and final evaluations	EOC/WAVE

	cassava viral diseases	Activity 2: Equip and operationalize reference laboratories for management of cassava viral diseases	1. Number of laboratories equipped and operationalized	Annual	WAVE	WAVE report	Favorable security conditions	Midway and final evaluations	Independent expertise
		Activity 3: Build scientific capacity among laboratory technicians	1. Number of laboratory technicians trained 2. Number of training modules delivered	Annual	CPK, IITA, WAVE	Reports by facilities involved	Motivation of technicians to be trained	Midway and final evaluations	EOC/WAVE
	Outcome 2.4: Farmers' and local technicians' capacity to manage cassava viral diseases is increased	Activity 1: Train the trainers about cassava viral diseases using an FFS approach (farmer field school): recognizing symptoms of cassava viral diseases and ways to respond to them	1. Number of trainers trained	Annual	FAO, DPV, WAVE	Activity report; Training modules	Learners motivated to follow training program; Training modules properly constructed;	Midway and final evaluations	EOC, DPV, FAO
		Activity 2: Train farmers using FFS (farmer field school) approach to cassava viral diseases	1. Number of farmers trained; 2. Number of FFS set up	Annual	FAO, WAVE, COU	Activity report; Training modules;	Farmers motivated to follow training program; Training modules properly constructed	Midway and final evaluations	MINAGRI
		Activity 3: Technician training using the Plantwise approach	1. Number of technicians trained	Annual	DPV, WAVE, CABI	1. Activity report 2. Training modules	Technicians motivated to follow training program Training modules properly constructed	Midway and final evaluations	FAO

		Activity 4: Train extension workers and CAID workers in cassava viral diseases	1. Number of extension workers and CAID workers trained	Annual	SNV, CPK, IITA	1. Activity report 2. Training modules	Extension workers motivated to follow training program Training modules properly constructed	Midway and final evaluations	WAVE
		Activity 5: Provide training leading to diplomas and placements, to establish a national hub of cassava disease experts (placement, MSc, PhD and post-doc);	1. Number of diplomas obtained 2. Number of placement students supported	Annual	Universities, IFA, CPK, IITA, WAVE	1. Activity report 2. Training modules	Good candidate selection and motivation for training	Midway and final evaluations	MINAGRI, WAVE
		Activity 6: Train technicians in the use of impact evaluation tools (software: ODK, DashBoard, FAMEWS, iForm; Kits)	1. Number of technicians trained 2. Number of training modules	Annual	FAO, WAVE	1. Activity report 2. Training modules	Technicians able to follow training program Training modules properly constructed	Midway and final evaluations	DPV
		Activity 7: Identify and boost technical capacity among propagation services	1. Number of propagation workers trained	Twice a year	SENASAEM, CPK, WAVE	Activity reports by facilities involved	Propagation workers registered and available Favorable working conditions	Midway and final evaluation	WAVE and EOC

SO3. Evaluation of impact of cassava viruses	Outcome 3.1: Data acquisition technology contributes to a better understanding of the impact of cassava viruses	Activity 1: Procure and adapt tools for evaluating impact of cassava viruses (software: ODK, DashBoard, FAMEWS, iForm; Kits)	1. Number of evaluation tools procured and adapted	Twice a year	WAVE, MINAGRI	WAVE reports	Mobilization of financial resources on schedule, Existence of impact evaluation tools Effective involvement of farming inspectors	Midway and final evaluations	External expertise
		Activity 2: Use evaluation tools (software: ODK, DashBoard, FAMEWS, iForm; Kits)	1. Number of evaluation tools used	Twice a year	WAVE, MINAGRI	WAVE reports	Procurement of evaluation tools on schedule, Effective involvement of farming inspectors (and other users)	Midway and final evaluations	External expertise / Universities
		Activity 3: Procure NICT equipment (computers, GPS, mobile phone) on which to run the evaluation tools	1. Number of NICT resources procured and used	Twice a year	Universities, WAVE	Reports by facilities involved	Mobilization of financial resources on schedule, Orders for NICT resources on schedule Operationalizing of resources procured	Midway and final evaluations	External expertise / Universities
		Activity 4: Map disease-free and affected cassava growing areas;	1. Number of cassava production areas mapped	Twice a year	OSFAC, IITA	Reports by facilities involved	Technical conditions met	Midway and final evaluations	WAVE / External expertise

		Activity 5: Determine the geographical distribution of viruses and vectors;	1. Spatial distribution of viruses and vectors determined	Twice a year	OSFAC, IITA	Reports by facilities involved	Technical conditions met	Midway and final evaluations	WAVE / External expertise
	Outcome 3.2: The impacts of cassava viruses are listed and evaluated	Activity 1: Evaluate the impact of cassava viruses on the vulnerability of women and young people	1. Impact of cassava viruses on the vulnerability of women and young people evaluated	Annual	INERA, Universities, CAID	Reports by facilities involved	Effective involvement of farming households Study protocol observed (survey sheets)	Midway and final evaluations	WAVE
		Activity 2: Evaluate the impact of diseases on food security, household incomes, value chains and the national economy	1. Impact of cassava viruses on food security, household incomes, value chains and the national economy evaluated	Annual	CAID, WAVE	Reports by facilities involved	Effective involvement of farming households Study protocol observed (survey sheets)	Midway and final evaluations	Internal expertise
		Activity 3: Evaluate the effectiveness of implementation of methods that aim to reduce the incidence of cassava viral diseases	1. Number of implemented technologies evaluated	Annual	WAVE, FAO, INERA	Reports by facilities involved	Effective involvement of farming households Adherence to work protocol	Midway and final evaluations	Internal expertise
		Activity 4: List and evaluate the behavior of existing planting materials (cassava varieties) in response to viral disease	1. Number of existing planting materials listed 2. Number of existing planting materials evaluated	Twice a year	INERA, FAO, IFA, WAVE	Reports by facilities involved	Existence of planting materials	Midway and final evaluations	Internal expertise
		Activity 5: Evaluate the impact of viruses on the environment	1. Number of environmental screenings	Annual	Universities, IITA	Reports by facilities involved	Technical conditions met	Midway and final evaluations	Internal expertise

SO4. Communication and awareness	Outcome 4.1: Communication channels are in place and operational	Activity 1: Establish a cassava viral diseases communications unit	1. Cassava viral diseases communication s unit is operational	Annual	WAVE, DVP, EOC	2. WAVE activity report	Favorable technical conditions Favorable social and political environment	Midway evaluation	Independent expertise
		Activity 2: Establish women’s clubs to exchange information about the cassava sector (farmers, retailers, processors)	1. Number of operational women’s clubs	Annual	EOC, WAVE, local NGOs (CARITAS, PIDR)	Activity reports by EOC and institutions involved	Favorable social climate Adoption of strategy	Midway and final evaluations	FAO
		Activity 3: Establish a network for exchange of phytosanitary information and awareness	1. Information exchange network operational	Annual	WAVE, FAO	WAVE and FAO reports	Favorable social and political conditions	Midway evaluation	External expertise
		Activity 4: Engage the commitment of traditional leaders to EOC activities	1. Number of traditional leaders committed	Annual	SNV	SNV activity report	Favorable social climate Adoption of strategy Favorable technical conditions	Midway and final evaluations	WAVE, territorial rural development inspectors
	Outcome 4.2: Information about cassava viral diseases is effectively shared between stakeholders	Activity 1: Organize awareness days: awareness forum, cassava open day	1. Number of days and forums organized 2. Proportion of beneficiaries reached	Annual	WAVE, SNV	WAVE activity report	Favorable social and political conditions	Evaluation at start of project and midway	Internal expertise
		Activity 2: Develop communications tools (audio, video, guides, leaflets, banners, boards, websites, mobile phone, social networks)	1. Number of audio programs recorded and broadcast, 2. Number of communication tools set up.	Twice a year	FAO, WAVE, COU	1. Communication tools 2. Activity reports by facilities involved	Technicians properly trained, favorable technical conditions	Midway and final evaluations	The national extension worker service (Service National de Vulgarisation/SNV)

		Activity 3: Translate communications tools into local languages	1. Number of tools translated	Annual	WAVE, SNV	1. Tools translated 2. Activity reports by facilities responsible for the activity	Favorable technical conditions	Midway and final evaluations	The national extension worker service (Service National de Vulgarisation/S NV)
		Activity 4: Raise awareness among donors and Technical and Financial Partners (ENABEL, FEC, JICA, PAM, USAID, ADB, World Bank, FAO, etc.) and political decision-makers;	1. Number of awareness-raising meetings organized	Twice a year	FAO, WAVE, MINAGRI	WAVE activity report	Favorable social, political and economic environment	Midway and final evaluations	Internal expertise
		Activity 5: Raise awareness among producers about phytosanitary standards, and movement and certification of planting material	1. Number of awareness-raising sessions organized	Annual	DPV, WAVE	Report by Ministry of Agriculture	Favorable technical conditions	Midway and final evaluations	The national extension worker service (Service National de Vulgarisation/S NV)
SO5. Activity coordination:	Outcome 5.1: Operational national coordination of activities to manage cassava viral diseases	Activity 1: list experts involved in management of cassava viruses in DRC	1. Number of experts listed	Twice a year	DPV	List of experts drawn up	Call for applications	Midway and final evaluations	MINAGRI
		Activity 2: list the technical partners involved in virus response activities	1. Number of technical partners listed	Annual	DPV, EOC, WAVE	List of technical partners published	Intensive advocacy	Midway and final evaluations	MINAGRI
		Activity 3: organize regular consultation and information exchange meetings about the management of cassava viruses	1. Number of meetings organized	Annual	EOC, WAVE	1. Minutes of meetings 2. Attendance list	Invitations written and distributed on schedule	Midway and final evaluations	MINAGRI

		Activity 4: Update activities carried out by the various stakeholders to combat cassava viral diseases	1. Reduction in extent of cassava viruses	Twice a year	DPV, FAO, EOC, WAVE	New cassava viral diseases management guides created and distributed	Regular meetings and conversations between stakeholders	Midway and final evaluations	MINAGRI
	Outcome 5.2: The emergency operations center is functional	Activity 1: Create the Emergency Operations Center (EOC)	1. EOC operational	At start of project	DPV, WAVE	EOC activity report	Good institutional anchoring Sustained support from Government Recruitment of qualified staff Funding available	Evaluation at start of project	MINAGRI
		Activity 2: Integrate the EOC into the institutional framework	1. Presence of a legal entity	At the start	MINAGRI	Ministerial order	Political will	Evaluation at start of project	WAVE
		Activity 3: Recruit leadership team for EOC	1. Presence of leadership team	Once	MINAGRI	Ministerial order	Political will Funded response plan	Evaluation at start of project	WAVE
		Activity 4: Establish physical presence for EOC	1. Presence of leadership team in the offices	Once	MINAGRI	Set-up confirmation	Willingness of all stakeholders Funded response plan	Evaluation at start of project	WAVE
		Activity 5: Operationalize the EOC	1. Emergency actions initiated	Annual	EOC, DPV, WAVE	Activity report	Willingness of all stakeholders Funded response plan	Annual evaluation	FAO, WAVE

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