REPUBLIC OF RWANDA

RWANDA AGRICULTURE BOARD

EAST AND CENTRAL AFRICA AGRICULTURE TRANSFORMATION PROJECT (ECAATP)

FINAL REPORT

PEST MANAGEMENT PLAN

March, 2018

EXECUTIVE SUMMARY

Agriculture is the backbone of Rwanda's economy, accounting for about 33 percent of GDP, 72% employment, and 25% of all exports. The total arable land in Rwanda is slightly above 1.5 million ha, 90% of which is found on hillsides. The agriculture sector faces several challenges: (i) a binding land constraint that rules out intensification (bringing more and more land under cultivation); (ii) small average land holdings (more than 60% of household cultivate less than 0.6 ha and 15% of rural farms less than 0.1 ha); (iii) poor water management (uneven rainfall and ensuing variability in production); (iv) the need for greater (public and private) capacity from the district to the national levels and insufficient extension services for farmers; and (v) limited commercial orientation constrained by poor access to output and financial markets. Without the option of continuous intensification, agricultural intensification must take place in the context of a potentially fertile, but challenging physical environment.

Steep terrains and the highest population density in sub-Saharan Africa (355 inhabitants per km^2) make good land husbandry practices a strict necessity (to curtail erosion and otherwise maintain the quality of the soil), as well as an environmental prerogative. Arable land on hillsides constitutes the vast majority of the total agricultural land in the country, but erosion costs the country 421 tons /ha of fertile soils per year.

The Ministry of Agriculture and Animal resources (MINAGRI) is in an advanced stage of preparation of the Eastern and Central Agricultural Transformation project (ECAATP). ECAATP seeks to focus on transformation of Agriculture in the region. The aim of ECAATP is to improve the effectiveness of the agriculture sector in raising incomes, reducing poverty, improving nutrition outcomes, addressing the challenges of changing climate, fostering regional integration of markets for food commodities and products, and providing better jobs – including to skilled youth and women.

Rwanda in particular, seeks to improve agriculture transformation by addressing soil fertility loss and through effective Land Husbandry practices on approximately 6300ha of land within an integrated landscape management approach; hence boosting production in target project areas. ECAATP is expected to trigger World's Bank operational policy on Pest Management (OP 4.09) which is an environmental safeguard policy for promoting safe pesticide use and the use of integrated pest management (IPM) to reduce crop losses due to pest damage. This policy requires putting in place a Pest Management Plan (PMP) and structure for adoption of IPM and safe use of pesticides.

The PMP under ECAATP will focus on intensification of 12 target crops namely maize, potato, cassava, tomato, bananas, wheat, cabbage, carrots, beans, onions, pineapple and mushroom. Main pest and diseases problems on these crops were discussed in the report. Major pest problems under Rwandan condition mainly include diseases, insect pests and vectors. While the major diseases of potato, tomato and cabbage need fungicides for their control, the major diseases of cassava, banana, wheat, maize, onion, green beans, carrot and mushroom do not need pesticides, they can successfully be controlled by IPM strategies. The current IPM practices commonly applied by the majority of farmers in Rwanda include a combination of cultural practices, resistant varieties and pesticides. The pesticides application is limited to crops of high value like tomatoes, irish potatoes, rice and coffee, etc, while pest management in staple crops like bean, maize depends mainly on cultural practices and resistant varieties.

The ECAATP will promote among the target crops the use of IPM and where necessary the safe use of pesticides as a component of IPM approach. The use of resistant varieties (eg resistant cassava to mosaic disease) and cultural practices (crop rotation, weeding, etc) will be supported and pesticides will continuously be used on potato, tomato and cabbage. The use of pesticide on other target crops will be very minimal depending on scouting of field damage, but it will generally be reduced or avoided without any significant yield loss. However, it will require close monitoring and capacity building of farmers on safe pesticide use and IPM strategies.

ECAATP will finance the PMP activities in the project areas on all target crops and other demand driven crops. The PMP activities will include (i) training farmers in improved production technologies to produce healthy plants, (ii) Training on life cycle of pest and diseases, (iii) Pest distribution mechanisms (movement from place to place) for major pests and diseases, (iv) pest and diseases impacts on productivity, (v) development of different control methods, (vi) promotion of safe use of pesticides and (vii) integrated pest management for each crop and monitoring programme.

The project will be implemented by Rwanda Agriculture Board (RAB) under MINAGRI and MINAGRI through RAB/ECAATP will coordinate the PMP implementation at national level. The Project and participating Districts will coordinate it at subproject level. The farmers, grouped in Self Help Groups (SHGs), zones and cooperatives will be responsible to learn and implement IPM tools in the pest war. The Monitoring of the implementation of this PMP will be carried out by RAB/SPIU ECAATP, REMA and all key implementing institutions of the project (Districts and farmers organizations).

The SPIU ECAATP has enough capacity to implement ECAATP activities. The safeguards team at the SPIU is made of 3staff (2 Social safeguards specialists and 1 Environment specialist) who have been overseeing the overall issues related to safeguards in the LWH and RSSP project sites. The existing SPIU safeguards team will be repositioned to RAB under the new institutional arrangement and there is no doubt they will still execute the same responsibilities for the implementation of ECAATP.

After the clearance of this PMP by the World Bank, the Government of Rwanda through MINAGRI will locally disclose it and will authorize the Bank to disclose it through its external website. The tentative budget for the PMP implementation and monitoring is US $ 220,000, including an implementation cost of US $ 110,000 and monitoring cost of US $ 110,000.

Given the nature of the project, the potential adverse impacts associated with pesticides use are minimal and can be managed through proposed mitigation measures in this PMP. Successful implementation of this PMP will depend to a large extent on the involvement and participation of local communities. It is recommended that awareness and capacity building on IPM and proper use of pesticide be organized mostly to extension staff, cooperatives and farmers.

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ABBREVIATIONS AND ACRONYMS

ACMV **:** Africa Cassava Mosaic Disease

ASARECA : Association for Strengthening Research in East and Central Africa

BBW **:** Banana Bacterial wilt

CBOs **:** Community Based organizations

CGIAR : Consultative Group on International Agricultural Research

CIAT **:** Centro International d'Agriculture/International Centre for Tropical Agriculture

CMD **:** Cassava Mosaic Disease

CYMMIT **:** International centre for maize and wheat research

EACMV-UgV: East Africa Cassava Mosaic Virus-Uganda Variant

ECAATP **:** East and Central Africa Agricultural Transformation

EDPRS : Economic Development and Poverty Reduction Strategy

FAO : Food and Agriculture Organization

FMD **:** Foot and Mouth bacteria

GDP **:** Gross Domestic Product

GoR **:** Government of Rwanda

GPS **:** Geographical Positioning System

IARC **:** International Agricultural Research Centre

ICIPE : International Centre for Insect Physiology and Ecology

ICRISAT **:** International Centre for Research in Semi-Arid Tropics

ICT **:** Information and Community Technology

IITA : International Institute of Tropical Agriculture

IPM : Integrated Pest Management

IPPC **:** International Plant Protection Convention

IRRI : International Rice Research Institute

LWH **:** Land husbandry, Water Harvesting and Hillside irrigation Project

MDG **:** Millennium Development Goal

MINAGRI **:** Ministry of Agriculture and Animal Resources

MINALOC **:** Ministry of Local Government

MINECOFIN: Ministry of Finance and Economic Planning

MINICOM **:** Ministry of Trade and Industry

PDO **:** Project Development Objective

PMP : Pest Management Plan

PSTA **:** Plan Stratégique pour Transformation d'Agriculture

RAB **:** Rwanda Agricultural Board

RHODA **:** Rwanda Horticultural Development Authority

RSSP : Rural Sector Support Project

SAP **:** Strategic Action Plan

SWAp **:** Sector-Wide Approach

TIMPS **:** Technologies, Innovation, and Management Practices

UNDP **:** United Nations Development Programme

WB **:** World Bank

WTO **:** World Trade Organization

CHAPTER ONE: INTRODUCTION AND PROJECT DESCRIPTION

1.1General Context

Economic progress and poverty reduction has been uneven across the Eastern and Central Africa region, and ongoing challenges related to rising oil prices, drought, and instability will impact near-term growth prospects. The region has experienced uneven growth for decades such that some countries like Kenya and Republic of Congo have reached middle-income status while others, including Uganda, Tanzania, DRC, Rwanda, and Burundi, are still low-income countries. Growth patterns in recent years have also been uneven. For example, while Tanzania and Rwanda have posted remarkable GDP growth of more than 7 percent in 2014 and 2015, growth in Burundi was negative (-3.9 percent) in 2015, mainly due to conflict and instability. Growth in Uganda improved in 2014 and 2015 with annual GDP growth rate staying above 5 percent and expected to rise to 5.6 percent in FY19. But in neighboring DRC, the GDP growth rate has decelerated from an average of 9 percent in 2013 and 2014 to 6.9 percent in 2015, with further deceleration projected in the near-term. Kenya's growth in recent years has surpassed regional peers and other lower-middle-income countries, but growth is expected to decelerate to 5.5 percent in 2017 – a 0.5 percentage point mark down from the 2016 forecast. This is primarily because of: (i) drought; (ii) slowdown in credit growth; and (iii) rise in global oil prices. On the other hand, the rise in oil prices bodes quite well for growth in the Republic of Congo (RoC) where oil accounts for more than half of GDP and more than 80 percent of total exports. Higher oil prices would enable the RoC to continue posting the steady GDP growth of more than 5 percent, which has been ongoing for the past 10 years.

Poverty remains a major concern not just in RoC but across the entire region, despite significant gains in poverty reduction in recent years. Overall, the incidence of poverty ranges from 19.5 percent in Uganda (2012), 28 percent in Tanzania (2012), 39 percent in Kenya (2012),45 percent in Rwanda (2010), 46.5 percent in RoC (2011), 63.6 percent in DRC (2012), and 70 percent in Burundi (2016). Poverty rates are relatively higher in rural areas where majority of the population live, relying on agriculture and non-farm rural income. Growth in agriculture and rural sectors therefore continue to provide the best prospects for poverty reduction than growth in non-agriculture. For example, in Rwanda, the agriculture sector's growth of over 7 percent annually between 2000 and 2015 contributed about 35 percent to national poverty reduction.

The Government of Rwanda (GoR) has been implementing land husbandry practices throughout the country to address some of the fundamental constraints to its agricultural growth. To date, much of the technology transfer is taking place on an ad-hoc basis and is too reliant on the knowledge and experience of individuals. The GoR has received funding from IDA for the establishment of a center of leadership in land husbandry in order to provide a central repository of knowledge and expertise. The center would institutionalize this knowledge and harness it more efficiently and effectively to improve and roll out best practice and technologies across the region.

The preparation of ECAATP has triggered the World Bank's Operational Policy on Pest Management (OP 4.09) which is an environmental safeguard policy for promoting the safe pesticide use and the use of integrated pest management (IPM). This policy requires that a Pest Management Plan (PMP) be prepared to structure the adoption of IPM and safe pesticide use during the implementation of ECAATP.

ECAATP identified a good number of target crops, including cereals (maize, wheat), root and tuber crops (irish potato, cassava), vegetables (French bean, tomato, carrot, onions, cabbage), mushroom and fruits (banana, pineapple) to focus on its support and promotion. In all target crops, pests and diseases are known to cause serious damage leading to reduced yield and income for farmers. The use of pesticide is likely to happen for ECAATP to control pests.

1.2 Objective of the assignment

The objective of the current assignment is to prepare the pest management plan for ECAATP in line with World Bank's Operational Policy on Pest Management (OP4.09) and local regulations on chemicals use.

1.3 Project Development Objective and Project Component

1.3.1 Project Development Objective

The ECAATP development objective is to enhance regional collaboration to improve productivity, resilience, and competitiveness of selected agricultural commodity value chains and increase smallholder farmer access to the regional market for food commodities and products.

1.3.2 Project components

ECAATP will have four (4) components including three technical components and one implementation support component detailed below.

Component 1: Regional Commodity Programs

The objective of this component is to enhance regional collaboration in the development of agricultural technologies, innovations, and management practices (TIMPS) and to facilitate the exchange and dissemination of TIMPS across national boundaries. The regional collaboration is intended to accelerate the development of technologies and technical change at the farm level, foster entrepreneurship and innovation, as well as, save money and time, by eliminating duplicating efforts.

Rwanda is interested to develop a regional center of leadership in land husbandry and also to collaborate with the National Crops Resources Research Institute in Uganda on cassava development.

Sub-Component 1.1: Development of a Regional Centre of Leadership on land husbandry in Rwanda

The regional centers of leadership are intended to guide and lead technology development. These regional centers will collaborate with selected learning institutions to generate and disseminate improved TIMPs. The objective of this sub-component is to strengthen selected centers to lead and guide collaboration in development and exchange of TIMPS and the transfer of scientific knowledge across the region. In Rwanda, this sub-component will focus on land husbandry as this is critical for national and regional food and nutrition security, climate resilience and ultimately incomes from farming. The Regional Centre of Leadership will be hosted by RAB as it has specific expertise in this area and is well positioned institutionally to respond to farmer needs and national priorities.

Sub-component 1.2: Collaborative development of TIMP's

Collaboration with the National Crops Resources Research Institute in Uganda on cassava development.

Component 2: Enabling Policies and Markets

The objective of this component is to provide the current and future labor force with critical knowledge and skills that: (a) promote faster technical change in agriculture, especially in technology development, and innovations to improve access to markets; (b) meet the needs of private sector agribusinesses and the public sector – including policy analysis; (c) are likely to be employable by the food system now and in the future; and (d) encourage innovation and entrepreneurship in transforming agricultural value chains and linking primary agriculture with the emerging food system and formal markets. There are three sub-components: (i) establishment of centers of leadership in key disciplines of agriculture education; (ii) enhancing skills of stakeholders along value chains; and (iii) promoting effective models for service delivery.

Sub-component 2.1: Enabling Policies

The objective of this sub-component is to create a conducive policy and regulatory environment for regional collaboration in development, transfer, and exchange of technologies. The project will finance: (i) completion of regional harmonization of about 17 policies, laws, and regulations identified for harmonization under EAAPP; and (ii) identification, formulation, and harmonization of new policies, including intellectual property rights on plant and animal germ-plasm which is key for sustainable regional collaboration and private sector investment.

Subcomponent 2.2: Agricultural Markets

The objective of this sub-component is to improve smallholder farmer's access to regional and national markets for food commodities and products. The project will finance: (i) linking farmers to regional value chains; and (iii) piloting the use of warehouse receipt systems linked to regional commodity exchanges as a means of enabling farmers access regional commodity markets.

Sub-Component 2.3: Promoting Effective Models for Service Delivery

To apply and derive the full benefits of improved land husbandry practices, a range of complementary agricultural services are needed by farmers. These include a range of services that provide new technologies, weather forecasts, as well as market information and extension services that support the uptake of new technologies.

Component 3: Contingent Emergency Response

This component provides a mechanism for emergency response to crisis of a regional nature, affecting at least two participating countries, and with the goal to enhance resilience and improve recovery from the crisis. Examples of such crises might include drought, severe weather events, and pests and diseases – such as the army worm currently ravaging crops across many countries in the region. No funds will be allocated to this sub-component. However, in case of emergency funds can be re-allocated to this sub-component following a joint decision by the Bank and client country

Component 4: Regional Coordination and Project Management

The objective of this component is to coordinate the project at the regional and national levels. Two sub-components are envisaged: (i) regional coordination and learning; (ii) national project management and evaluation.

1.4 Project activities

The ECAATP will specifically undertake the following activities: (i) conducting baseline studies of landscape management and production system across the country on socio-economic & market, landscape management & production systems, policy frameworks; (ii) modeling landscape based land husbandry practices, mapping climate risk of collaborative TIMPs in correlation to land units maps, (iii) designing climate smart ISFM and IPM TIMPs for enhanced production, (iv) developing decision support tool for monitoring and forecasting sedimentation and soil nutrients loss, (v) Building a regional reference laboratory for rapid landscape diagnostic (drying areas, soil chemical & physical analysis, Remote sensing, GIS, and modeling laboratories), satellite laboratory, greenhouse and physiology & phenomic facilities for agroforestry and agrostology, (vi) establishment of land husbandry regional training and communication center, (vii) Applying integrated soil erosion and fertility control measures, (viii) Afforestation and forest restoration as well as adapting forage species suitable to different agro-ecologies, (ix) adapting cassava TIMPs developed under EAAPP and CGIARs, (x) enabling policies and agricultural markets, (xi) promoting effective models for service delivery through awareness creation on agriculture business models, identification and profiling of business model case studies, training of stakeholders, establishing agribusiness incubation network, etc as well as (xii) contingent emergency response.

The ECAATP activities envisaged to potentially increase pesticide usage and for which this PMP is required include adapting cassava TIMPs developed under EAAPP & CGIARs and planting of other crops for the valorization of terraces. After the construction of terraces, good cassava varieties will be introduced and grown in terraced areas. Other crops (bean, wheat, maize, some vegetables, etc) will also be used for the valorization of terraced areas. Some crops will require the use of pesticides for the control of diseases and some pests.

1.5 Methodology for preparation of PMP

The study for the preparation of the Pest Management Plan (PMP) was conducted by the Project Safeguards team using the following approach and methodology:

a) Desk review

The preparation of PMP involved a review on the existing baseline information and literature material. Detailed review and analysis of the national relevant legislations and policies as well as World Bank Safeguards Policies and other relevant documents were done.

b) Field Visits

Field visits to potential project areas were organized to collect information on IPM experience from other related projects and identify issues and possible impacts of IPM adoption for the future subproject activities. The project team visited the five (5) districts within the 3 different landscapes where ECAATP will be implemented. These are Nyabihu District for highlands, Gisagara, Huye and Nyanza Districts for Middlelands and Gatsibo District for Lowland regions.

c) Public consultations

Various discussions and consultation meetings were held with Project beneficiaries, relevant districts and sectors' officials, other relevant staff of the key implementing partners of the ECAATP including among others Rwanda Environment Management Authority (REMA), Rwanda Land Management and Use Authority (RLMUA), Rwanda Agriculture Board (RAB), and MINAGRI projects.

CHAPTER TWO: LEGAL AND INSTITUTIONAL FRAMEWORK

2.1 Policy framework for Rwanda

2.1.1Policy on Agriculture Sector

The main objective of this policy is to intensify and transform subsistence agriculture into market oriented agriculture. The use of contemporary inputs like improved seeds and fertilizers is envisaged. This policy puts emphasis on marshland development for increased food production because the soil on hills is degraded by erosion, rendering it unproductive.

In order to achieve sustainable development in agricultural sector, the policy emphasizes the need to adopt Integrated Pest Management (IPM) practices. The use of IPM practices is highly recommended in this PMP study as this will guide on the best use of pesticides.

2.1.2 National Biodiversity Strategy and Action Plan

This strategy defines the objectives and priorities for the conservation and sustainable management of biodiversity. The action plan includes hillsides, wetlands and protected areas as some of the areas that need to be conserved. The national biodiversity strategy and action plan approved in June 2000, defined the objectives and priorities for sustainable biodiversity conservation and management. Biodiversity includes wetlands, protected areas and the strategies are ranked as follows: Political and legal frameworks relating to environment unknown by the population and/or decentralized entities; ii) low level of awareness among people with regard to environment; iii) inadequate exploitation of forests; iv) erosion; v) exploiting quarry sites without restoring exploited parts; vi) insufficient knowledge on environment status; vii) weakness of decentralized structures in environment management; viii) absence of appropriate environment-friendly technologies.

The strategy on biodiversity aims at: improving conservation of protected areas and wetlands; sustainable use of biodiversity in natural ecosystems and agro-ecosystems; rational use of biotechnology; development and strengthening of policy, institutional, legal and human resources frameworks; and equitable sharing of benefits derived from the use of biological resources.

2.1.3 Policy on Health Sector

One of the objectives of this policy is to improve the quality of life and demand for services in the control of disease. The policy identifies the most common illnesses in Rwanda and puts priority to addressing these diseases. ECAAT project or any other land husbandry project with intensified agriculture has a vital role to play in the increased incidences of communicable diseases and respiratory diseases.

2.2 Legal instruments

Currently, two major laws regulate the use of pesticides in Rwanda, one for agrochemicals (pesticides and inorganic fertilizers) and another on plant health (addressing issues of plant protection and quarantine). The law on plant health focuses more on phytosanitary (inspection of imports and exports) and safe trade than on plant protection while growing in the field.

The section of protecting growing crops in the field is not well elaborated; as a result there is very little mention of different pests' management strategies such as integrated pest management and other methods.

The law No 30/2012 of 01/08/2012 governing agrochemicals focuses on both pesticides and mineral fertilizers and aims to regulate manufacturing, importing, distribution, use, storage, sale, disposal and burial of expired agrochemicals. The Ministry of Agriculture and Animal Resources (MINAGRI) has the responsibility for its implementation.

However, there are other laws and texts making it possible to reduce the risks of pesticides. This includes the Law No. 04/2005 of 04/08/2005 determining the modalities for the protection, conservation and promotion of environment in Rwanda.

2.3 Institutional framework

2.3.1 Ministry of Agriculture and Animal Resources

The Ministry of Agriculture and Animal Resources (MINAGRI) through RAB/SPIU is the executing agency for the ECAATP. It seeks to protect crops and improve agricultural productivity and soil conservation through selected districts across the Country. MINAGRI is responsible for the implementation of the laws on plant protection and agrichemicals.

2.3.2 Ministry of Environment

Environment is a crosscutting sector because it covers all sectors. The Ministry of Environment (MoE) is responsible for the development of policies, laws and regulations as well as coordination of all activities in the management of water resources activities and environment, as well as their follow up and evaluation.

2.3.3 Rwanda Agriculture Board

Rwanda Agriculture Board (RAB) ensures improved food security and livelihoods of all Rwandans by transforming agriculture from subsistence into modern farming through generating research and extension innovations that generate sustainable crop, animal husbandry and natural resources management.

2.3.4 Rwanda Environment Management Authority

Rwanda Environment Management Authority (REMA) was established in2004 to act as the implementation organ of environment-related policies and laws in Rwanda. REMA is also tasked to coordinate different environmental protection activities undertaken by environmental promotion agencies; to promote the integration of environmental issues in development policies, projects, plans and programmes; to coordinate implementation of Government policies and decisions taken by the Board of Directors and ensure the integration of environmental issues in national planning among concerned departments and institutions within the Government; to advise the Government with regard to the legislation and other measures relating to environmental management or implementation of conventions, treaties and international agreements relevant to the field of environment as and when necessary; to make proposals to the Government in the field of environmental policies and strategies; etc.

2.3.5. Local Governments

With regards to pest management, Local Governments (including the study area Districts, so far not yet confirmed) are tasked to participate in the implementation and monitoring of Environmental and Social Management Plan (ESMP), specifically in the mobilization for the proper use of pesticide and IPM implementation by the Communities.

2.4 World Bank safeguards policies

Within the overall set of OPs, the Bank has identified ten key policies critical to ensuring that potentially adverse environmental and social impacts are identified, minimized and mitigated. These include Environmental Assessment (OP 4.01); Physical Cultural Resources (OP 4.11); Disputed Areas (OP 7.60); Indigenous Peoples (OP 4.10); Project on International Waterways (OP 7.50); Involuntary Resettlement (OP 4.12); Natural Habitats (OP 4.04); Forests (OP 4.36); Pest Management (OP 4.09) and Safety of Dams (OP 4.37).

The World Bank (WB) and Government of Rwanda (GoR) agreed that ECAATP will trigger six (6) WB environmental and social safeguards policies discussed below:

Environmental Assessment (OP 4.01)

This policy requires environmental assessment (EA) of projects/programs proposed for Bank financing to help ensure that they are environmentally sound and sustainable, and thus improve decision making. The core requirement of this policy is to screen early for potential impacts and select appropriate instrument to assess, minimize and mitigate the potentially adverse impacts. Relevant safeguard instrument for the policy include Environmental and Social Impact Assessment (ESIA), which is prepared for specific projects already identified before project appraisal; Environmental and Social Management Framework (ESMF), which is prepared to establish a mechanism to determine and assess future potential environmental and social impacts during implementation of the project activities and investments, which are not specified before project appraisal; and Environmental and Social Management Plan (ESMP).

The policy calls for the proposed project as a whole, and for activities/investments to be identified at a later stage during project implementation to be environmentally screened to determine the extent and type of the EA process.

At screening stage, the proposed project of sub-projects will be classified as Category A, B or C, depending on the type, location sensitivity, and the full scale of the project and the nature and magnitude of its potential environmental impacts. For Category A: full Environmental and Social Impact Assessment (ESIA) will be required, since project activities may have adverse, irreversible and significant environmental impacts. For Category B: a limited ESIA will be adequate, since projects may have site-specific environmental impacts, and their mitigation measure can be designed more readily. Under Category C: subprojects are likely to have minimal or no adverse environmental impacts, hence beyond screening; no further environmental assessment action may be required.

OP 4.01 further requires that the ESIA and ESMF report must be disclosed as separate and stand-alone documents by the Government of Rwanda and the World Bank as a condition for Bank Appraisal of the proposed project. The disclosure should be both in Rwanda where it can be accessed by the general public and local communities and at the Info-shop of the World Bank.

Categorization procedures:

Category "A" Projects

A full EIA is always required for projects that are in this category, and for which impacts are expected to be ′adverse, sensitive, irreversible and diverse with attributes such as pollutant discharges large enough to cause degradation of air, water, or soil; large- scale physical disturbance of the site or surroundings; extraction, consumption or conversion of substantial amounts of forests and other natural resources; measurable modification of hydrological cycles; use of hazardous materials in more than incidental quantities; and significant involuntary displacement of people or other significant social disturbances.

Category "B" Projects

Although an EIA is not always required, some environmental analysis is necessary and some form of environmental management plan should be prepared. Category B projects have impacts that are ′less significant, not as sensitive, numerous, major or diverse. Few, if any, impacts are irreversible, and remedial measures can be more easily designed. Typical projects include rehabilitation, maintenance, or upgrades, rather than new construction.

Category "C" Projects

No EIA or other analysis is required. Category C projects result in negligible or minimal direct disturbance of the physical environment and biological.

Only subprojects classified as category B or C will be eligible for financing under ECAATP in Rwanda. This ESMF sets out to establish the EA process to be undertaken for implementation of project activities in the proposed ECAATP when they are being identified and implemented. This process requires that ECAATP and its implementing partners screen their activities to identify their potential adverse impacts and thereby determine the corresponding mitigation measures to incorporate into their planned activities.

Natural Habitats (OP 4.04)

This Bank Operational Policy recognizes that conservation of natural habitats, like other measures that protect and enhance the environment, is essential for long term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats. Natural habitats are land and water areas where (i) the ecosystems biological communities are formed largely by native plant and animal species, and (ii) human activity has not essentially modified the areas primary ecological functions. All natural habitats have important biological, social, economic, and existence value. Therefore, the Bank natural habitats operation policy (OP 4.04) is triggered in all cases where the proposed investments are likely to have potential adverse impacts on Rwanda's natural habitats including wetlands, underground water sources, open water bodies and forests.

The Bank natural habitats operational policy requires that any activities funded under the ECAATP that adversely impacts these ecosystems must have a successfully mitigation plan so as to maintain the overall balance and integrity of the ecosystems impacted. This requires that ECAATP designs appropriate conservation and mitigation measures to remove or reduce adverse impacts on these ecosystems or their functions, keeping such impacts within socially defined limits of acceptable change. Specific measures may depend on the ecological characteristics of the affected ecosystem.

Such measures must include provision for monitoring and evaluation to provide feedback on conservation outcomes and to provide guidance for developing or refining appropriate corrective actions. Activities that risk significantly degrading or converting critical natural habitat will not be funded under the project.

Pest Management (OP 4.09)

This policy aims at the management of pests that affect either agriculture or public health. The World Bank supports a strategy that promotes the use of biological or environmental control methods and reduces reliance on synthetic chemical pesticides.

The policy supports safe, effective, and environmentally sound pest management. It promotes the use of biological and environmental control methods. An assessment is made of the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management.

The ECAATP project components will trigger this policy especially those activities that will focus on agriculture. In appraising a project that will involve pest management, the Bank assesses the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management. As necessary, the Bank and the borrower incorporate in the project components to strengthen such capacity.

Rural development and health sector projects have to avoid using harmful pesticides. A preferred solution is to use Integrated Pest Management (IPM) techniques of the existing Pest Management Plan of the project. In appraising a project that will involve pest management, the Bank assesses the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and Environmentally sound pest management. As necessary, the Bank and the borrower incorporate in the project components to strengthen such capacity. The Bank uses various means to assess pest management in the country and support integrated pest management (IPM) and the safe use of agricultural pesticides: Economic and sector work, sectorial or project specific environmental assessments, participatory IPM assessments, and investment projects and components aimed specifically at supporting the adoption and use of IPM.

For World Bank funded agriculture projects, pest populations are normally controlled through IPM approaches, such as biological control, cultural practices, and the development and use of crop varieties that are resistant or tolerant to the pest. The Bank may finance the purchase of approved pesticides when their use is justified under an IPM approach.

The policy calls for assessment of the nature and degree of associated risks, taking into account the proposed use and the intended users for procurement of any pesticide in Bank financed projects. The policy sets criteria to apply for the selection and use of pesticides in Bank financed projects including must have negligible adverse human health effects, must be shown to be effective against the target species, and must have minimal effect on non-target species and the natural environment. The methods, timing, and frequency of pesticide application are aimed to minimize damage to natural enemies.

The policy requires putting in place a Pest Management Plan (PMP) and structure for adoption of IPM and safe use of pesticides. A PMP for ECAATP is prepared and will be disclosed both in-country and on World Bank external website.

Physical Cultural Resources (OP 4.11)

Physical cultural resources are defined as movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Their cultural interest may be at the local, provincial or national level, or within the international community. Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices. The Bank assists countries to avoid or mitigate adverse impacts on physical cultural resources from development projects that it finances. The borrower addresses impacts on physical cultural resources in projects proposed for Bank financing, as an integral part of the environmental assessment (EA) process. When the project is likely to have adverse impacts on physical cultural resources, the borrower identifies appropriate measures for avoiding or mitigating these impacts as part of the EA process. These measures may range from full site protection to selective mitigation, including salvage and documentation, in cases where a portion or all of the physical cultural resources may be lost.

Forests (OP 4.36)

This operational policy aims to reduce deforestation, enhance the environmental contribution of forested areas, promote forestation, reduce poverty, and encourage economic development. The policy recognizes the role forests play in poverty alleviation, economic development, and for providing local as well as global environmental services.

The forest strategy suggests three equally important and interdependent pillars to guide future Bank involvement with forests including harnessing the potential of forests to reduce poverty, integrating forests in sustainable economic development, and protecting vital local and global environmental services and forest values.

The Bank does not finance projects that, in its opinion, would involve significant conversion or degradation of critical forest areas or related critical habitats. If a project involves the significant conversion or degradation of natural forests or related natural habitats that the Bank determines are not critical, and the Bank determines that there are no feasible alternatives to the project and its sitting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs, the Bank may finance the project provided that it incorporates appropriate mitigation measures. Therefore, activities under ECCATP that is likely to have negative impacts on forests will not be funded by the World Bank.

Involuntary Resettlement (OP/BP 4.12)
Interventions in the agriculture sector could lead to displacement, loss of assets and restriction of access to sources of livelihood. Project areas would be screened for impacts and a Resettlement Action Plan (RAP) will be prepared, if required.

Resettlement Policy Framework (RPF) sets the guidelines for the Resettlement and Compensation Plans (RAPs) that would have to be prepared when any project investment (activity) triggers this policy. The standalone Resettlement Policy Framework (RPF) has to be prepared by the Government and approved by the Bank in compliance with OP 4.12. The RAPs would be prepared by the subproject implementers (e.g. districts) and would have to be submitted to the Bank for approval.

This policy is triggered when a project activity causes the involuntary taking of land and other assets resulting in: (a) relocation or loss of shelter, (b) loss of assets or access to assets (c) loss of income sources or means of livelihood, whether or not the affected persons must move to another location. Therefore, people are in most cases compensated for their loss (of land, property or access) either in kind or in cash of which the former is preferred. The resettlement policy applies to all displaced persons regardless of the total number affected, the severity of the impact and whether or not they have legal title to the land. Particular attention should be paid to the needs of vulnerable groups among those displaced.

The policy also requires that the implementation of the resettlement plans are a pre-requisite for the implementation/start of the construction to ensure that displacement or restriction of access does not occur before necessary measures for resettlement and compensation are in place. For chosen sites involving land acquisition, it is further required that these measures include provision of compensation and of other assistance required for relocation, prior to displacement, and preparation and provision of resettlement sites with adequate facilities, where required. In particular, the taking of land and related assets may take place only after compensation has been paid, and where applicable, resettlement sites, new homes, related infrastructure and moving allowances have been provided to displaced persons.

2.5 World Bank industry Sector Guidelines for Agribusiness

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). The General EHS Guidelines contain information on cross-cutting environmental, health, and safety issues potentially applicable to all industry sectors. The EHS guidelines should be used together with the relevant Industry Sector Guideline(s).

The WB industry Sector EHS guidelines for Agribusiness cover EHS Guidelines for annual crop production, aquaculture, breweries, dairy processing, fish processing, food and beverage processing, mammalian livestock production, meat processing, perennial crop production, poultry production, poultry processing, sugar manufacturing and vegetable oil processing. ECAATP is anticipated to comply with the annual crop production, perennial crop production as well as food and beverage processing (possible processing of vegetables like tomato and fruit raw materials into value-added food and beverages).

The industry sector EHS guidelines to be complied with by ECAATP provide potential issues associated with annual crop production, perennial crop production and food and beverage processing along with recommendations for their managements.

The Environmental, occupational health and safety and community health and safety issues both in annual crop production and perennial crop production primarily include Soil Conservation and Management, Nutrient Management, Crop Residue and Solid Waste Management, Water Management, Pest Management, Use and Management of Pesticides, Fertilizers, Biodiversity and Ecosystems, Genetically Modified Crops, Energy Use, Air Quality and Greenhouse Gas (GHG) Emissions. Occupational health and safety (OHS) issues associated with annual and perennial crop production include the physical hazards (operational and workplace hazards, machinery and vehicles, confined and restricted space entry, exposure to organic dust), risk of fire and explosion as well as biological and chemical hazards. The potential exposure to pesticides and presence of pesticides or by-products in potentially harmful concentrations in foodstuffs and postharvest products, potential exposure to pathogens associated with the use of manure, potential exposure to air emissions from fires, burning of crop waste, residues, or solid waste and increased risk of vehicle or machinery injuries on roads and access routes around the community are the major community health and safety risks. These guidelines provide specific recommendations and performance indicators to monitor to minimize risks to communities.

CHAPTER THREE: CURRENT STATUS OF IPM AND USE OF PESTICIDE IN RWANDA

3.1 Current and anticipated pest problems

ECAATP was designed to promote of IPM practices on areas developed with terraces in the targeted project sites. This requires a plan for the development and promotion of IPM for targeted crops. The 12 targeted crops under this project can be grouped into four categories as follows: (a) cereal crop (maize and wheat), (b) root and tuber (cassava and potatoes), (c) Fruits (banana and pineapple), and (d) Vegetables (cabbages, carrots, green beans, onions, tomatoes and mushroom). These crops are importantly produced by both small and large scale farmers in their small plots either under cooperatives or crop intensification programme (CIP) in leased marshlands and hillsides.

Major pest problems under Rwandan condition include mainly diseases, insect pests and vectors. While the major diseases of potato, tomato and cabbage need fungicides for their control, the major diseases of cassava, banana, wheat, maize, onion, green beans, carrot and mushroom do not need pesticides, they can be controlled by IPM strategies successfully. In particular, a combination of cultural practices, resistant varieties and minimum pesticides may control most of pest problems.

3.2 Current and anticipated pest problems in cereal crops

3.2.1 Maize

a) Major pests and diseases of maize

Maize is an important staple crop in Rwanda both as a food and source of income. The crop has a list of pests and diseases which are generally considered to be major constraint in production, however, their economic importance varies according to environmental conditions and cultural practices applied by farmers. These include maize stalk borers such as *Busseola fusca*, maize streak virus, leaf blight, striga weeds and storage pests. The diseases like maize streak, leaf blight are currently controlled using resistant or tolerant varieties such as Tamira, Katumani, Isega, and Magumba and cultural practices such as crop rotation with legumes for at least three months and flooding along Akanyaru river marshlands commonly practiced by many farmers.

The storage pests like grain weevils *(Sitophilus* spp.) and tropical warehouse moth (*Ephestia cautella*.) are a threat, where there's need for storage of cereals.

In addition, there is also striga weed (*Striga asiatica* or *Striga hermonthecas)* which is expanding in the Eastern province and is reported to cause up to 100 % yield loss. This will be controlled by using "push-pull" technology as an IPM tool. The couchgrass (*Digitaria scularum*) is widely distributed in the country while it is one of noxious weed of the world, specifically found in eastern African region. It causes a large loss if not controlled. Farmers use deep cultivation, but the later reduces area cultivated per person/day, hence use of system herbicide such as glasphosate (round up) is a best option recommended. However, it will require training and demonstration to farmers and extension staff.

Nevertheless, maize insect pests and diseases are manageable using cultural practices, resistant varieties and reduced pesticides as components of IPM tools. The current maize production systems such as crop rotation with legumes or potatoes, application of organic manure, flooding in marshlands like "Akanyaru" where large quantities are produced reduce pests and diseases. In addition, the current hermetic grain storage (known as "cocoons") promoted by Rwanda's Ministry of Agriculture and Animal Resources helps to reduce storage losses from pests through suffocation, which is a good IPM tool.

b) Current pest and diseases management practices of maize in Rwanda

Many farmers lack the basic knowledge in good crop husbandry which gives high productivity, and pest and disease management techniques. Therefore, the Rwandan farmer interested in investing in maize production should learn improved maize production technologies and their role in pest and diseases management.

Maize crop is produced on hill side and in some marshlands. In the Southern province, it is mainly produced in the marshlands along Akanyaru River and its tributaries during the dry season. It is followed by a rotational crop or flooding during the rainy season. In the Northern and Eastern provinces, maize is produced on the upland and as rain feed crop and in rotation with other crops like bean, potato, etc. Maize stalks are also used to feed livestock in the Northern Province. This is a good practice which is useful in the management of stem borer and other maize pests. The management of major maize pests and diseases are indicated in the following sections.

The maize crop has a list of pests which are generally considered to be major pests. However, their economic importance varies according to environmental conditions and cultural practices applied by farmers. Nevertheless, maize stalk borers, striga weeds, maize streak virus, leaf blight and storage pests are among the major pests. Diseases like maize streak and leaf blight are reliably controlled using resistant varieties.

Currently, some of these pests are not a threat because the current maize production system which include crop rotation with other crops such as beans, soya beans or potatoes, and in some places flooding as seen in along Akanyaru river marshlands and tributaries. All these practices and their implications on IPM approach will be further elaborated in the sections below.

b.1) Current pest management practices of maize stalk borers

Stem borers are the most destructive pests of maize crops. Its immature stage (larvae) causes damage either by 'windowing' of the unfolding leaves as an early symptom or death of the central shoot of maize called "dead heart". Sometimes the early stage larvae mine into leaves causing yellow streaks in addition to the 'windowing.

The yield loss from stalk-borers varies from 23 to 53 % of the crop. Control of stem borers by insecticides is not economically justifiable and feasible because it is expensive for poor resource farmers. Moreover, it needs timing of application before boring into stem; otherwise pesticides do not reach the stem borers once inside the stem. There are three species of stem borers: *Chilo partelus*, *Sesamia calamistis* and *Busseola fusca*. These differ in ecological condition preference.

In Rwanda, there is a possibility that *Busseola fusca* is more abundant and may be causing more damage to maize crop. *Busseola fusca* is indigenous to Africa and present in high and mid-altitude (areas above 1077 m asl). It is therefore expected to be the most common in Rwanda. The following crop management practices can reduce the damage of stem borers to a low and uneconomic level. However, there is a need for nationwide testing and promotion.

a) Cultural practices: The management of stem borer is more effective when life cycle is well understood in a particular area. The following cultural practices control borers and reduce the population below economic damage level. These include manipulation to reduce population below the damage threshold such as (1) Simultaneous early planted maize over a large area at the onset of rain to complete its vulnerable stages before the population of borers has time to build up, (2) destruction of thick-stemmed grass weeds which would act as an alternative host, (3) Uproot young plants which have been killed, (4). crop residues burning, deep burying or feeding to cattle to kill pupae left in old stems and tall stubble, (5) destroy damaged cobs and stems which might harbour diapausing larvae, since they will increase infestation in the next crop, (6) watch out for young plants with signs of 'windowing', and apply control early in the season for two reasons: (i) if the first generation is allowed to go unchecked, there will be greater damage to the cobs by the second generation; (ii) the caterpillars are most vulnerable to insecticides when they are in the funnel of the plant, and before they begin boring in the stem; and (7) closed season of at least two months to prevent population continuity, the objective here is to have as long period as possible when there are few hosts for it to feed on. If maize were planted only in the long rains, when it grows best, it would mean an eight month period from harvesting one crop to the young plants of the next, during which the maize stalk borer would find it difficult to survive. Most of them are commonly applied in Rwanda, especially in the marshlands and Virunga areas.

b) Push pull strategy: This is a technology developed by ICIPE and her partners as an effective, low-cost and environmentally friendly technology for the control of stem borers and suppression of striga weeds. It is a simple cropping strategy, whereby farmers use Napier grass and Desmodium legume (Silverleaf and Greenleaf Desmodium) as intercrops. Desmodium planted between the rows of maize produces a smell odour that stem borer moths dislike. The odour of Desmodium 'pushes' away the stem borer moths from the maize crop, while Napier grass *(Pennisetum purpureum)* which is planted around the maize plot attracts the adult moth and pulls to lay their eggs on it. Since the Napier grass does not allow stem borer larvae to complete development on it; the eggs hatch and the small larvae bore into Napier grass stems, the plant produces a sticky substance like glue which traps them, and majority of them die, and very few survive. As result the maize crop is saved from damage. In addition, Desmodium fixes nitrogen in the soil and enriches the soil. Details are provided in the maize IPM tool kit.

b.2) Management of other maize pests and diseases

The maize diseases are important and are serious threats causing heavy losses up to 100 % if not well controlled. The major diseases of maize include: (1) maize streak virus disease, (2) southern and northern leaf blight, (3) leaf rust and (4) grey leaf spot (not yet in Rwanda). However, during the visits, disease incidence and severity were very low in many fields.

(i) Management of maize streak disease

Maize streak virus disease is transmitted by leafhopper of the genus" Cicadulina". The diseased plants show a marked streaky chlorosis of the leaves. The chlorotic streaks are individually narrow, often discontinuous, but evenly arranged in parallel across the leaf. The streaks occur uniformly over the infected parts of the plant that has grown after infection. The leaves produced before infections are free from streaks. The severity varies according to resistance of the host and virulence of the virus strain. The yield loss is proportional to the time of infection. The seedling infection results in 100% yield loss.

Disease management include the following practices: (1) Use of resistant varieties is the best management option, (2) maize crop planted early escapes buildup of vector population and gets low infection, (3) close season by destroying source of infection from crop grown during dry season and also avoid to plant near the crop that was produced during the dry season using irrigation, and (4) rogue out all diseased plant as soon observed in the field.

(ii) Management of southern leaf blight (*Helminthosporum maydis*)

This disease is common in areas with warm damp climate. The dry weather is unfavourable for disease development. The primary source of inoculum is frequently plant debris from previous season. The disease develops very fast and can appear on young crops from infection of neighboring fields. The fungus is also seed born and can spread by untreated seed, and seed should be dressed using fungicide & insecticide mixture. The disease management includes the following practices: (1) Use of resistant varieties is the best management option and the most important measure, (2) destruction of crop residue prevents early diseases development, (3) use of seed dressed with fungicide & insecticide mixture to delay early infection.

(iii) Management of maize leaf rust (*Puccinia polysora, P. sorghi*)

This is a host specific disease and it does not have an alternative host. The spores are air-borne and are carried long distances by wind. The infected plant can spread diseases over long distance. P. polysora favors high temperature and high humidity and it is common in low altitudes, while P. sorghi is common in cooler high elevations in the tropics. Maize leaf rust management include the following practices: (1) Use of resistant varieties which is the best management option and the most important measure, (2) use of resistant varieties screened against rust, and (3) destruction of source of infection at community level to delay early disease development.

(iv) Management of striga weeds (witch weed) (*Striga hermonthica, Striga. asiatica*)

The parasitic weed Striga 'witchweed' is an important pest of maize, especially in drier areas like the Eastern Province. There are two species of Striga which are common ***(Striga hermonthica andStriga. Asiatica)***. The *Striga hemotheca* has large attractive pink flowers, while the *Striga Asiatica* is smaller species with purple flowers. A distinctive feature of both species is that each striga plant can produce up to 20,000—50,000 seeds, which lie dormant in the soil until a cereal crop is planted again.

This dormancy can last for over 15 years. As striga germinates, its roots grow towards the host crop because the host plant releases chemicals which break dormancy and stimulates striga seed germination. The roots of seedlings of striga penetrate the host crop's roots and start to draw nutrients from the host.

The young striga plants tap the roots of the maize plant and draw water and nutrients in the underground part, reducing production from 30% to 100%, or complete loss of the crop. If maize plants are attacked by both stem borers and striga weed, the yield loss is often 100%. When a farm is infested with striga, the affected plants seldom grow more than one foot (30 cm) tall. The weed does not put roots into the soil so as to grow on its own, but grows by attaching itself onto the host (e.g. maize) plant.

Taking into account the peculiar nature of striga seeds, farmers are advised to control it before the weed emerges above the soil. Manual removal of the striga reduces re-infestation, but it is uneconomical since most damage is done even before the weed emerges. Any control strategy has to begin within the soil. Currently striga management is possible using "push-pull" technology. A ground cover of Desmodium (*Desmodium uncinatum*, or silver leaf), interplanted among the maize, reduces striga weed. Research at ICIPE has shown that chemicals produced by the roots of Desmodium are responsible for suppressing the striga weed. Therefore, striga does not grow where Desmodium is growing. Being a legume, Desmodium also fixes nitrogen in the soil and thus enriches the soil. Therefore, "push-pull" technology used on maize stalk borers manages also both stem borers and striga.

3.2.2 Wheat

a) Current and anticipated pest and disease problems in wheat

Wheat has extensive pest spectra, but with different economic importance according to region. In the tropical regions where wheat is increasingly being grown in semi temperate environment, there are remarkably few major pests. However, as the acreage of wheat crop increases, the minor pest situation may become more serious due to continuous availability of nutritive food in isolated areas like island. The semi temperate regions in the tropics are found in the highlands, surrounded by wide area of the tropical hot climate.

Therefore, the few insects pest currently present may multiply because of continuous supply of food especially under continuous mono-cropping system without rotation.

Currently in Rwanda, there is no serious pest problem, except head smut; This would require a continuous field monitoring and reporting as soon as possible any infestation observed on minor scale. Most of wheat pests and diseases can be managed by cultural methods with a combination of resistant varieties without need for pesticides use. The best and sustainable strategy for smallholder farmers is the use of resistant varieties. It is also important to note that the resistance to some pathogens, such as rust, is short-lived and cultivars may need to be changed at short intervals as pathogens adapt to overcome the resistance of locally grown cultivars. Seed dressing using fungicide is often effective against seed-borne or soil- borne pathogens.

The major diseases of wheat are mainly rusts and head smut leaf and glume botch, and root rot, seedling blight and spot blotch:

a.1) Wheat rust

There are three types of rust which include: (i) Stem or black rust (*Puccinia graminis f.sp. tritici*,); (ii) Stripe or yellow rust (*Puccinia striiformis*), and iii) Leaf or brown rust (*Puccinia recondita f.sp. tritici*). *P. recondita* is the most widely distributed and occurs together with *P.graminis* in all tropical wheat

areas; while *P. striiformis* is most prevalent in cooler areas (temperate or semi-temperate highlands in the tropics).

P. graminis can parasitize barley, rye, oats as alternate hosts; *P. sfriiformis* has a wide host range on barley, and many other grasses; however, there is no known alternate host or sexual phase (Uredospore) in the life history, and it can very damaging in areas over 2400 m asl. While the *P. recondita* can also occur on barley species; and it is less important and occur at low altitude. In general, alternate and alternative hosts are unimportant in disease epidemiology, because the spore are air borne and are carried over long distance.

a.2) Leaf and Glume blotch

The leaf and glum blotch is caused by*Septoria tritici (Mycosphaerella graminicola* — Ascomycete), *Septoria nodorum (Leptosphaeria nodorum* - Ascomycete); and *Septoria avenae* f.sp. *triticea (Leptosphaeria avenaria* f.sp. i*riticea* — Ascomycete). They also parasitize barley, rye and some grasses especially *Poa* and *Agrostis* spp. The lesions of leaf blotch appear first on lower leaves as necrotic flecks which later expand to irregular elongated blotches. They become necrotic and develop a yellow to reddish brown colour often with paler centres in which the pycnidia are embedded.

The lesions of *Septoria tritici* are dark, and are arranged in rows along lesion and can be seen with hand lens. While the lesions of *Septoria nodorum* often develop chlorotic haloes and may join together to kill the areas of leaves and cause premature senescence.

The fungi survive in crop debris and can be seed borne. The spore can remain viable for long period and the conidia can be dispersed by rain from debris in soil and between leaves. Later in season are dispersed by wind.

a.3) Root rot, seedling blight and spot blotch

Drechslera (Helminthosporium) sativa (Cochiiobolus saavus — Ascomycete) Drechslera (= Helminthosporium) tritici-repentis (Pyrenophora tritici-repentis — Ascomycete). It also occurs on a wide range of Gramineae. The root rot occurs sporadically as a restricted brown discolouration of roots. The plant may die if the secondary infection by *Fusarium spp*. occurs. The seedling blight kills the coleoptiles and young leaves. The light to dark brown necrotic blotches lesions spread along the leaf causing premature senescence. The fungus survives in crop debris and can persist in the soil as mycelia and conidia.

a.4) Loose/head Smut: *Ustilago nuda (Ustilago tritici)*

The fungus causing loose smut is internally seed borne and remains viable in stored seed for long time. They infect through the flower and establish in ovary. The fungus remains in dormant mycelium in the seed till when the seed germinates, the fungus also grows as seed concurrently keeping pace with growing point till inflorescence when the fungus forms smut spores.

The entire inflorescence, except the rachis, is replaced by masses of smut spores (teliospores). These black teliospores often are blown away by the wind, leaving only the bare rachis and remnants of other floral structures. Yield losses depend on the number of spikes affected by the disease; incidence is usually less than one percent and rarely exceeds thirty percent of the spikes in any given location.

a.5) Flag Smut (*Urocystis agropyri)*

Masses of black teliospores (masses of spores) are produced in narrow strips just beneath the epidermis of leaves, leaf sheaths and occasionally the culms. Diseased plants often are stunted, tiller profusely and the spikes may not emerge. A severe infection usually induces the leaves to roll, producing an onion-type leaf appearance. The epidermis of older diseased plants tends to shred, releasing the teliospores. Flag smut generally is not an economically important disease, but where present, yield losses can range from trace amounts to moderate levels when susceptible cultivars are grown.

b) Current pest management major pests of wheat

The management of major diseases of wheat are mainly rusts and head smut, leaf and glume botch, and root rot, seedling blight and spot blotch.

Wheat rust*:*

There are three types of rust which include: i) Stem or black rust (*Puccinia graminis f.sp. tritici*,); ii) Stripe or yellow rust (*Puccinia striiformis*), and iii) Leaf or brown rust (*Puccinia recondita f.sp. tritici*). *P. recondita* is the most widely distributed and occurs together with P. graminis in all tropical wheat areas; while *P. striiformis* is most prevalent in cooler areas (temperate or semi-temperate highlands in the tropics), *P. graminis* can parasitize barley, rye, oats as alternate hosts; *P. sfriiformis* has a wide host range on barley, and many other grasses; however, there is no known alternate host or sexual phase (Uredospore) in the life history, and it can very damaging in areas over 2400 masl. While the *P. recondita* can also occur on barley species; and it is less important and occur at low altitude. In general, alternate and alternative hosts are unimportant in disease epidemiology, because the spore are air borne and are carried over long distance. This is minor disease which is managed by cultural practices.

Leaf and Glume Blotch

The leaf and glum blotch is caused by *Septoria tritici (Mycosphaerella graminicola* — Ascomycete), *Septoria nodorum (Leptosphaeria nodorum* - Ascomycete); and *Septoria avenae* f.sp. *triticea (Leptosphaeria avenaria* f.sp. *Iriticea* — Ascomycete). They also parasitize barley, rye and some grasses especially *Poa* and *Agrostis* spp. The leaf and glume blotch are controlled using phytosanitary measures such as stubble destruction, crop rotation with none host (eg legumes), use of clean seeds, avoid excessive nitrogenous fertilizer, and use of recommended spacing.

Root rot, seedling blight and spot blotch*:*

Drechslera (Helminthosporium) *sativa*, (*Cochliobolus sativus (*Ascomycete),*Drechslera* (= Helminthosporium) *tritici-repentis, Pyrenophora tritici-repentis* (Ascomycete). It also occurs on a wide range of Gramineae such barley, rye, grasses in particular *Agrostis spp* and *Poa spp*.

The diseases can be controlled using crop rotation with none host like legumes which limits pathogen survive in the debris from season to season, use clean seeds, clean Cultivation, avoid excessive nitrogen fertilizers, timely planting to avoid moisture stress.

Loose/head Smut (*Ustilago tritici):*

The entire inflorescence, except the rachis, is replaced by masses of smut spores. These black teliospores often are blown away by the wind, leaving only the bare rachis and remnants of other floral structures. Yield losses depend on the number of spikes affected by the disease; incidence is usually less than one percent and rarely exceeds thirty percent of the spikes in any given location.

Control of loose smut*:*

The disease can be controlled by cultural practice such as use of clean seed from clean field. Where infestation is high, ensure that all diseased plants are removed and destroyed to reduce spread. In addition, the seeds may be clean before planting using hot water treatment as follows: soak the seeds in cold water for five hours followed by soaking in hot water at 54-56^{0}C for 10 minutes. The cold water helps to activate the mycelium and renders them more sensitive to heat. Since the loose smut is an internal infection, it can be killed only by hot water treatment of seed. However, care should be taken to ensure that temperature does not exceed 56^{0}C and harm the seed. The systemic fungicide like benomyl (0.2.-0.25 %) can also be used in seed treatment as it gives good results. The reliable control method is to use certified seed.

Flag Smut (*Urocystis agropyri):*

Masses of black teliospores are produced in narrow strips just beneath the epidermis of leaves, leaf sheaths and occasionally the culms. Diseased plants often are stunted, tiller profusely and the spikes may not emerge. A severe infection usually induces the leaves to roll, producing an onion-type leaf appearance. The epidermis of older diseased plants tends to shred, releasing the teliospores. Flag smut generally is not an economically important disease, but where present, yield losses can range from trace amounts to moderate levels (when susceptible cultivars are grown). The cultural practices such as .clean cultivation, crop rotation, nutrient management, seed treatment, residue destruction and resistant varieties such as Mwamba distributed under crop intensification programme (CIP) are currently being used.

3.3 Current and anticipated pest and disease problems of target root and tuber crops

3.3.1 Irish potato

a) Current and anticipated pest and disease problems of potato

The experience from the field visit is that the major pest and disease problems of potatoes are (1) Late blight, (2) Bacterial wilt, (3) Potato tuber moths and (4) Aphids (serious during low rain season). The potato crop is one of the major crops in Rwanda and it is produced in rotation with maize in the Northern Province.

Among the major pests and diseases, the late blight is the most serious and is continuously controlled using fungicides (e.g., Dithane M45 or Ridomil) in combination with resistant varieties.

Late blight (*Phytopthora infestans*) is a major disease which cause up to 100% yield loss when no control measures are applied. To date there is no record of resistance to fungicides.

Moreover, resistance can occur mainly on systemic fungicides. The commonly available systemic fungicide is ridomil which is not used regularly, hence not easy to develop resistance. It is applied only when rainfall is continuous and heavy rains can wash out protective on leaves.

b) Pest Management of major pests and diseases of potato

The pest management in potatoes is complicated and difficult, as the potato is a vegetative propagated crop using tubers for seed. The seed can carry easily bacteria, viruses, fungi and insects. Additionally, and some pests and diseases are rapidly disseminated by cutting knives. Therefore, the source of relatively pest-free seed is essential for healthy potato production. This is complicated by the quantities needed as seed rate per unit area. The experience from the field visit under RSSP1 was that major pests and disease problems include: (1) Late blight (*Phytophthora infestans)*, (2) Bacterial wilt *Pseudomonas solanacearum*, (3) Potato tuber moths and (4) aphids. Pest management tools include cultural practices, resistant varieties and fungicide application.

Increase in potato yield is a result of good cultural methods such as right fertilizer, weed, insect and disease management. There is a wide variety of cultural practices and agro-ecosystem manipulations used to control potato pests. Some of them may be integrated into pest management programs in Rwanda.

The best IPM tool is the use of healthy planting material since most of the major diseases of potato can be carried by 'seed tubers'. The production of healthy seed tubers requires the use of virus-free mother parts. These are often produced by micro-propagation techniques; and are grown under disease-free conditions, including the absence of virus vectors. Basic prerequisite for improved agricultural production is the availability of a reliable source of relatively disease free seed. Potato seed producers should obtain their seed from "foundation" seed produced in isolated areas either at ISAR or certified fields, where they are maintained extremely in high standards free from disease.

The general phytosanitary techniques such as crop rotation are also essential. Potato rotation with other crops is a component of both traditional and modern agriculture. Crop rotation is recommended as a means of disease control, and is especially important for the long-term control of diseases such as verticillium wilt, and fusarium wilt *(Fusarium* spp.) etc. It is important that crop rotation does not include plants that are also hosts of the potato pathogens, like tomatoes since that may make the problem more serious.

The cultural manipulations and sanitation procedures such as use of clean seed, destruction of source of inoculums, hilling up and killing of infected vine near harvesting are used to reduce losses due to disease organisms such late blight disease (*Phytophthorainfestans),* asit is important to delay initial infection.

The potato farmers in the North Province are very conversant with both protective and curative fungicide against late blight.

They apply Dithane M45 (protective fungicide) when rainfall is not continuous, and Ridomil (systemic fungicide) when there is continuous rainfall which can wash out protective fungicide. This knowledge is good and their experience is an important tool in IPM because it is based on their observation.

It is recommended to apply fungicide (e.g. Mancozeb/Dithane M45), when growing both susceptible and resistant varieties as cash crop, especially when weather condition is favorable for spread of disease.

A combination of fungicides and resistant varieties gives a relatively higher yield. The only risk with potato farmers is that they mix the insecticide with fungicide whenever they apply on weekly basis without any recommendation.

Management of potato late blight *(Phytophthora infestans, Oomycete):*

The late blight disease is caused by the fungus (*Phytophthora infestans, Oomycete)* and it is the most important limiting factor for high potato yields in the country. The epidemics are more severe in the North province of Rwanda. The first reason for the severity of blight epidemics is the absence of a prolonged dry period to check the disease; where it thrives throughout the year not only on potato crops, which are planted in many months of the year, but also on volunteer potato, tomato and alternative species. The second reason is that the climatic requirements of both the fungus and the crop are identical and are met in most months of the year. The management options include:

i) ***Resistant varieties****:* Although resistant cultivars are important tools in disease management, given the highly variable pathogenicity of the fungus, complementary fungicides have to be applied in order to get high yield. There are a number of resistant varieties in the country under national seed service including Kigega, Gikungu, Mizero, Ngunda and Nderera etc. The production and distribution of clean tubers is important in disease management. Farmers will learn how to get clean tubers on time in their own community.

ii) ***Cultural control****:* The cultural manipulations and sanitation procedures are used to reduce losses due to late blight disease (P. *infestans).* It is important to delay initial infection as long as possible by using whole clean tuber seed, destruction of source of inoculums, hilling up and killing of infected vine near harvesting. The details of these practices are found in the potato IPM tool (copy attached) kit.

(iii) **Fungicides management***:* It is recommended to apply fungicide (e.g. Mancozeb), whether a farmer is growing a susceptible or resistant variety, especially when weather conditions are favorable for the spread of the disease. The potato farmers in the Northern Province are very much aware that the fungicide spraying is necessary when growing susceptible varieties. There is an increasing use of fungicide in Rwanda to control late blight, which at the same time controls the other fungal diseases like early blight *(Alternaria solani),* because fungicides used are broad spectrum. In general, fungicides used are essentially protectants, and for effective control, a continuous film over the entire surface of the plant is necessary. Many of the protective fungicides control late blight effectively and economically. They are applied at regular short intervals of 5, 7, or 10 days depending on weather conditions and the proximity of source of infestation. The mode of action of the protective fungicide is generally nonspecific in interfering with many vital functions of fungi. In contrast, systemic fungicides (e.g., Ridomil) penetrate the cuticle and are translocated throughout the plant making their action much more efficient. However, some systemic fungicides such as Ridomil/ Metalaxyl are highly specific in their mode of action.

Thus, their fungicidal action seems to depend on the interference with only one or a very few vital organs, and a single gene mutation in the pest organism can result in a modified system, which may be no longer sensitive to an attack of fungicide. Such change would result in an immune individual and provide the basis for a resistant population. As a result, a fungus population with resistance to that fungicide may probably arise.

Management of bacterial wilt (Ralstonia solanacearum , Bacterium) :

Bacterial wilt disease is caused by the bacteria *Ralstonia (formerly known as Pseudomonas) solanacearum.* The external symptom is wilting of the vegetative parts in spite of a moist soil. A white bacterial mass oozes from the vascular tissue when the base of the stem or a tuber is cut. The main method of spread is by diseased seed tubers. Once the bacteria are in the soil, it remains there almost indefinitely and it can survive saprophytically since it parasitizes a number of very common weeds. The disease management plan includes the following:

a) Resistant varieties: Planting of resistant varieties is the only reliable means of combating bacterial wilt. There are a number of tolerant varieties including Mabondo, Kirundo, Mugogo, Mizero, Ngunda, Nderera. Currently, there is only one resistant variety in the list of RAB/RADA namely cruza which is not favored by farmers.

b) Use of clean seed: Bacterial wilt is often transmitted in tubers. It is important to use clean seeds when growing susceptible variety on clean site. The use of bare fallowing during the dry season reduces the amount of inoculum by desiccation but it cannot eliminate it entirely. Infected tubers often show vascular discoloration. Typical wilting with bacterial exudation from the vascular tissue is clear symptom. Other cultural practices have very little impact.

Management of potato tuber moth (*Phthorimaea operculella,* Gelechiidae):

The tuber moth is one of the main pests of potato. Infestations arise initially in the field and continue during storage of the tubers. Potato is the main hosts, while tomato, eggplant, tobacco and other Solanaceae members and *Beta vulgaris are al*ternative hosts. The potato tuber moth was in the past reported in the former Mutura district and was serious, but currently it is under control.

Cultural control*:* The cultural manipulations and sanitation procedures are used to reduce losses due to potato tuber moth (*Phthorimaea operculella).*

It is important to delay initial infestation by hilling up to cover the tuber properly and delay infestation in the field. To avoid continuous availability of hosts in the field before the following season, encourage crop rotation with none host crops to ensure complete rotting of potato residues and rejected tubers.

Management of aphids in the potato production will depend on natural control. The heavy rainfall in the area is sufficient to minimize aphids' problem. Aphids are usually a serious problem during dry season in the tropics.

3.3.2 Cassava

a) Current and anticipated pest and disease problems in cassava

In Rwanda, cassava production is currently constrained mainly by cassava mosaic disease (CMD) which has devastated major growing areas in the country. Therefore, among the biotic factors, the cassava mosaic disease (CMD) is the most important. Epidemics are particularly ravaging with root yield losses as high as 100 %. CMD is caused by at least three gemini viruses, which include the African cassava mosaic virus (ACMV), the East African cassava mosaic virus (EAMV) and the Uganda variant of the EACMV (EACMV-UgV), which is a hybrid virus of EACMV and ACMV. The CMD is commonly found in many fields of cassava, and farmers who cannot follow good crop management such as rouging out of infected plants and cannot access the CMD free cuttings are at high risk.

Cassava green mite (*Mononychellus tanajoa*) and cassava whitefly (*Bemisia tabaci*) are the most abundant pests in Rwanda. Mite damage as well as mosaic disease incidence and severity were higher on local varieties. However, whitefly populations were higher on improved varieties.

The use of clean and resistant cassava planting materials would be the best alternative for smallholder farmers in Rwanda. Currently these varieties are still not enough and are expensive to buy as each hectare would need 10,000 cuttings. Combined efforts of RAB/Research and farmers organizations (Ingabo and Imbaraga) are ongoing to avail to farmers' sufficient amount of healthy cuttings. The IPM support under ECAATP will strengthen access to the planting materials of resistant varieties including new release for diversification**.**

b) Current management of major pests and diseases of cassava

Among the biotic factors, the cassava mosaic disease (CMD) is the most important. Epidemics are particularly causing yield losses as high as 100%. CMD can be managed and its damage and effects can be reduced by well-coordinated efforts. The major strategies to be adopted in order to reduce CMD damage include: (i) phytosanitary, (ii) use of resistant varieties, (iii) improved crop husbandry, (iv) training of farmers and extension workers, (v) monitoring and diagnosis and creation of public awareness, and (vi) coordination and linkages.

The phytosanitary strategies include:

a)Using Clean Planting Materials: Selection of symptom less plants in the field for planting.

b) Rouging of infected plants: The rouging of diseased plants with of age 1-3 MAP (months after planting) will reduce yield loss by 40%. However care should be taken to identify the CMD infection. The infection of plant older than three months may produce low yield but at least some roots may be obtained.

c) **Disposal & burning of crop debris:** Proper disposal & burning of crop debris removes alternative sources of infection. The uprooting of infected plants should be accompanied by destroying them; otherwise they may sprout and spread further the infection.

d) **Multiplication of Resistant Varieties**: The application of community based approach in the multiplication and the distribution of cassava planting materials is the only reliable means of timely distributing widely the available recommended resistant varieties.

Training of trainers (TOT):

Training farmers on the effects of CMD and its management is the priority strategy in fight CMD. However, to make sure that it is sustainable, the field staff working with farmers should be trained as TOT to enable them to train farmers and coordinate their activities.

The staff to be trained as TOT includes the GOV extension staff at District and Sector level, the staff of NGOs working on agriculture in rural areas, and CBOs. The training should also cover pests and disease identification, symptoms, causes, transmission and vectors.

The coordination of stakeholders is important for success of CMD management. RSSP-3 needs to establish strong stakeholder coordination down to Sector level, determine the roles and linkages between them, and organize regular stakeholder meetings to discuss CMD status, management and new varieties on pipeline and other cassava production technologies, markets and opportunities.

3.4 Current and anticipated pest and disease problems of target fruits

3.4.1 Banana

a) Current and anticipated pests and diseases of banana

The banana (dessert, cooking and brewing cultivars) production in Rwanda is found in highlands, above 1500 m asl. Currently, the major threat of bananas in the basin in Rwanda is the banana bacterial wilt, which is spreading in all banana growing areas and its management does not require the use of pesticides. The second most important disease in the country is the fusarium wilts (Fusarium oxysporum fs musae) which is soil borne disease and remain in the soil up to 30 years. It is not easily controlled by pesticides. It is very serious on exotic banana cultivars such Gros Michel etc. However, there are resistant new exotic cultivars under dissemination by MINAGRI and RAB like FHIA 17 and FHIA 25 which are resistant to fusarium wilt.The other pests of banana are not significant, however, they require close monitoring since their severity is limited by temperature due to high altitude above 1400 m asl.

Basing on climate change threat which may adjust local climate, it is important to establish robust pests and disease monitoring. These pests include banana weevils (*Cosmopolites sordidus*), nematodes (like *Pratylenchus goodeyi*, *Helicotylinchus multicinctus*, and *Radopholus similis* and *Meloidogyne spp*.) and leaf spots (yellow sigatoka, black sigatoka and cladosporium etc) are not a threat because of altitude effect. These pests are threat below 1400 m above sea level, while major banana growing areas in Rwanda are above this altitude. Even if they occur, the use of pesticides is not economical.

b) Management of major pests of bananas

b.1) Management of banana insect pests

Highland bananas (*Musa AAA-EA*) are traditional food and cash crop in the East and Central Africa highlands, where they are largely produced and unique in the world. Highland cultivars (*Musa AAA-EA*) are endemic in the region and account for 75% of production in Africa and 20 % in the World. The major banana insects pests include lesion nematodes (*Rodophilus similis*, *Practeynchus goodyei*, *H.multincictus*) and banana weevil (*Cosmopiltes sordidus*). Banana weevil and Rodophilus are more serious and are limited to altitude below 1400 m asl.

Since bananas in Rwanda are mainly grown above 1400 m asl, the insect pest problem is minor and can be checked using cultural methods such as postharvest residue destruction, mulching, clean planting materials, clean site selection, and proper fertility management. The improvement of crop management, using the following pest management strategies will be effective in increasing productivity. Similarly, it will also control the minor pests. These strategies are indicated in the following section.

a) **Use of clean planting material:** Cleaning through paring and hot water treatment reduces infestation to new plantations and delays pest population build up.

b) **Improved agronomic practices:** Practices such as weeding, mulching and application of manure encourage vigorous crop growth thus reducing pest attack. The use of mulches and manure has been shown to result into better bunch weight as a result of improved plant vigour. Good weeding reduces weed competition such as *Commelina bengalensis* (which is alternate hosts of the banana nematodes) and couch grass (*Digitariascalarum*).

c) **Management of crop residues:** Destruction of crop residues of the harvested plants reduces breeding sites for the weevils. The use of pseudostem traps continuously to low or monitor weevil population and reduced damage to the bananas,

d) **Host resistance to weevil and nematodes**: Improved banana cultivars with high levels of resistance/tolerance offer one of the solutions to weevil and nematode damage.

e) **Use of neem in banana pest management**: Treatment of pseudostem traps with neem oil (1-5%) has been found to inhibit the growth of weevil larvae up to 14 days. Neem repels the insects and treatment corms show less weevil damage.

f) **Use of insecticides**: Insecticides may be used sparingly when the methods have been found to be ineffective.

b.2) Management of banana diseases

The major diseases of banana include**:** Banana Bacterial Wilt (*Xanthomonas campestris pv musacearum)* Fusarium wilt (*Fusarium Oxysporium fs musae)*:

(a) ***Management of Fusarium wilt (Fusarium Oxysporium fs musae):*** The main foliar diseases of banana can be easily controlled in Rwanda mainly through culturally-based practices. The Panama disease caused by Fusarium oxysporum, is the only threat found in all banana growing areas in the country together with Banana Bacterial Wilt (*Xanthomonas campestris pv musacearum)* which is expanding in different banana growing areas.

The Fusarium pathogen is spread between areas mainly through affected planting materials or equipments. The disease can be prevented through adoption of: (i) clean planting material, (ii) improved crop hygiene and (iii) good soil fertility. Moreover, the highland cultivars (*Musa AAA-EA*) which are endemic in the region and account for 90% are not susceptible. Farmers with problem of Fusarium wilt can plant local cultivars (*Musa AAA-EA*) and keep them for up to 30 years, because the fusarium spore can remain in the infested soil without host for about 30 years.

(b) Management of banana bacterial wilt (*Xanthomonas campestris pv musacearum):* The banana bacterial wilt (BBW) is a serious disease attacking all cultivars of bananas. The incidence is very high and yield loss can go up to 90 – 100-%. The management is still under development by research. So far the following options are used:

- ✓ Cut the male bud after flowering and sterilize the equipment after every cut
- ✓ Disinfect equipment and tools after work and make sure they are sterilized before using another field
- ✓ Destroy and uproot infected plants and bury them to rot in the soil
- ✓ Destroy any re-growth from destroyed stools
- ✓ Restrict movement of bananas from infected areas (quarantine) to none infected zones
- ✓ Mobilize the threatened communities and involve them to enforce the restriction of banana movement to their area
- ✓ Monitor any new infestation and involve the community to give report on time

3.4.2 Pineapples (*Ananas cosmosus*)

a) Current and anticipated pests and diseases of pineapples (Ananas cosmosus)

The pineapple crop has relatively few pests and diseases if well managed. The major insects pests and diseases attacking pineapples include: (i) mealbugs (*Dysmicoccus brevipes*), (ii) attendant ants, (iii) Nematodes (*Meloidogyne spp*.), (iv) scales insects, (v) Top fruit rot and root rot (*Phytophthora spp*), and .(vi) Base rot and water blister (*Ceratocystis paradoxa*).

b) Management of major pests and diseases of pineapple

Pineapple is mainly produced all year-round. Commercial production is based on a series of fruit cycles whose number depends on the effectiveness of pest and disease management. The different diseases affecting pineapple can be grouped in the following main categories: leaf diseases, stem diseases, root diseases and fruit diseases.

Yellow spot disease. This disease is caused by a virus named Tomato spotted wilt virus (TSWV) previously known as Yellow spot virus. This virus is transmitted to pineapple by a vector *Thripstabaci*. Infection with this pathogen is fatal.

Yellow spot Disease management: The disease management is done by use good cropping practices which decreases incidence and severity of the disease, use of clean planting materials free from virus, removal of all infected plants, weed control and rotating crops.

Pineapple mealybug *(Dysmicoccus brevipes):* The first symptoms of mealybug are leaf reddening usually at the margins of field due to root system collapse and cessation of root growth. This type of symptoms can be related also to nematodes or to root rot. Plants can be killed because can affect severely the root system.

The severity of meal bug is due to the being vector of virus causing pineapple wilt which serious disease of pineapple. The control of meal bug controls also the viral disease, the pineapple wilt..

Pineapple mealybug management: The mealbug is most serious and is controlled by controlling attendant ants and allows natural enemies to reduce the mealbugs. Use of insecticide to control the attendant ants and mealybugs is also effective. The diseases and nematodes are controlled using good cultural practices. The attendant ants are controlled by spraying insecticide around the plant to keep them out, however, it should be done carefully, because it can also kill the natural enemies. The use of clean planting material is most effective by dipping the slips in a solution of insecticides, preferably systemic insecticides such as carbofuran (furadan) and leaves them vertically for 24 hours to allow insecticide to accumulate in the leaf base. Then apply the insecticide granules in the planting hole to ensure that the plant is well protected.

The scales and nematodes may be a localized problem in some places, and they can be managed by use of systemic insecticides like furadan indicated above for mealbug, as it is broadspectrum insecticide.

Since furadan is soil applied insecticide, it is effective against both nematodes and scales, at the same time it does not affect natural enemies for scales. The scale is difficult to control using sprayed insecticides because of their cover of secreted materials.

The top fruit rot and root rot (*Phytophthora spp*), base rot and walter blister (*Ceratocystis paradoxa*) are easily managed using cultural practices like well-drained soil, deep ploughing, planting on ridges, raised beds and use of fungicides such as captafol.

3.5 Current and anticipated pest and disease problems of target vegetables

3.5.1 French beans *(Phaseolus vulgaris)*

a) Current and anticipated pests and diseases of french beans (*Phaseolus vulgaris*)

The French beans (*Phaseolus vulgaris*) are among the major crops produced in Rwanda. It is the major source of protein for majority of people (both urban and rural areas). Bean crop has many pests (insects and diseases) both in the field and in the store. Some diseases are seed born and are easily transmitted through infected seeds. The major insects pests and diseases attacking bean are the following: (i) beans fly or bean stem maggot (*Ophiomyia spp*.), (ii) Angula leaf spot (*Phaeoisariopsis griseola*), (iii) bean anthracnose (*Colletotrichum lindamuthianum*), (iv) common blight (*Xanthomonas campestris pv phaseoli*), (v) halo blight (*Pseudomonas syringae pvphaseolicola*), (vi) bean common mosaic virus, (vii) White flies: *Bemissia tabaci* and *Trialeurodes vaporiorum*, (viii) cutworms (*Agrotis spp*.), (ix) Pod borers: African bollworm (*Helicoverpa armigera*) and Legume pod borer (*Maruca testulalis*), (x) Stinking bug (*Nezala viridula*), (xi) Flower and Pollen beetles: Blister beetles (*Mylabris spp*.) and *Coryna spp*., (xii) Aphids (*Aphis fabae*), (xiii) Thrips: African bean flower thrips (*Megalurothrips sjostedti*) and Blossom or cotton bud thrips (*Frankliniella schlultzei*), (xiv) red spider mites (*Tetranychus spp*.). These diseases are seed born and are managed through clean seed or treated seed.

b) Management of major pests of French beans

Management of French beans field pests (insects and pathogens): The successful management of pests and diseases of beans depends on the crop husbandry applied. The important beans diseases are seed borne and are transmitted by using infected seeds. Field insect pests have little effects on a health and vigorous plant. Therefore by applying recommended agronomic practices, the pests and diseases management can be easily achieved. The following are the general management options for producing health bean crop without significant pest damage effects.

- ✓ **Clean seed**: Use treated clean seeds, and plant on clean soil which was not planted with beans for at least 2 years.
- ✓ **Resistant variety**: Plant your crop using resistant varieties against major diseases where they are available, accessible and affordable.
- ✓ **Crop rotation**: Rotation of beans with none legume crop such as tuber crops. This practice will reduce bean stem maggot (BSM) and root rot.
- ✓ **Fertility management**: Make sure the soil is fertile, and if not, apply manure and inorganic fertilizers as recommended. A vigorous crop tolerates small infection without significant effect on yield.
- ✓ **Weeding**: Timely weeding is important for producing healthy crop. While weeding, it is recommended to do hilling up soil around the stem of the seedlings to encourage development of adventitious roots and enhance recovery of plants from BSM damage.
- ✓ **Crop residue management**: After harvesting, bury the crop residues, and do not use manure from livestock which were fed residues from legume crop.
- ✓ **Fungicide**: In case the above methods fail, you can apply systemic fungicides like benomyl at recommended rates in your area.

3.5.2 Tomato

a) Current and anticipated pests and diseases of tomatoes

Tomato is one of the most important vegetables, relatively easy to grow, important source of nutrition (vitamin A and C) and income for smallholders. Tomato varieties can be divided into two main types. (1) *Bushy varieties* (also called *determinate* cultivars) which can usually grow without support (e.g. Roma variety), (2) *Vine varieties* (also called *indeterminate* cultivars such as Money maker) which need to be supported by *stakes*, and usually *pruned* to leave only one or two main stems.

The tomato crop is attacked by a variety of insect pests and a wide range of diseases attack leaves, fruit and roots, particularly in the rainy season when high humidity favours insects and pathogen development and transmission.

The major insect pests include**:** Bollworm (*Helicoverpa armigera**)***, Leafminer (*Liriomyza spp*.)**,**Cutworm (*Agrotis spp*.) African Spider Mites (*Tetranychus spp**.)*,** Aphids (*Myzus persic**a**e*&*Aphisgossypii*)**,** Whitefly (*Bemisia tabaci*)**,** Root-Knot Nematode (*Meloidogyne spp*.)**;** while the major diseases include**:**

Late Blight (*Phytophthora infestans*), Damping Off (*Pythium spp*. &*Rhizoctonia solani*), Early Blight (*Alternaria solani*), Fusarium WiIt (*Fusarium oxysporum f. sp.lycopersici*), Verticillium WiIt (*Verticillium dahliae*), Powdery Mildew (*Leveillula taurica*), Septoria Leaf Spot (*Septoria lycopersici*), Anthracnose (*Colletotrichum spp*.), Leaf Mould (*FulviaFulva*), Bacterial Wilt*(Pseudomonas solanacearum* also known as *Ralstonia solanacearum***,** Tomato Yellow Leaf Curl Virus (TYLCV), Tomato Mosaic Virus (TMV) and Blossom End Rot. Farmers possess little knowledge of most of these pests. It is important to monitor the use of pesticides on tomatoes otherwise farmers may overuse them. Among these diseases, the late blight (*Phytophthora infestans*) is the most serious and is currently controlled using fungicides such as Dithane M45/Mancozeb or Ridomil/Metalaxyl. Both fungicides are category U and III respectively which are acceptable.

Staking practice helps to avoid diseases by improving air circulation in the crop, and preventing plant parts and fruits from touching the soil. Tomatoes are usually grown in seedbeds and then transplanted when they have grown to a height of about 10 to 15 cm. As with many crops, it is better sowingseeds thinly and to remove competing weeds to produce vigorous plants which are more likely to withstand pests and diseases. .

b) Management of major pests of tomato

Tomato is one of the most important vegetables, relatively easy to grow, important source of nutrition (vitamin A and C) and good source of income for smallholder farmers. In general tomatoes production is constrained by diseases and insect pests and all are economically important.

African Bollworm (*Helicoverpa armigera*): Bollworms are large caterpillars often seen feeding in tomato fruit. Adults are largebrown moths (figure 1a) which fly at night. The larvae (caterpillars) feed on leaves, flowers and fruit. The leaf damage can reduce leaf area which slows plant growth and the flower feeding can prevent fruit formation.

When they burrow in the fruit they are difficult to reach and control with insecticide. The damage may cause the fruit to drop or make it more susceptible to secondary fungal and bacterial diseases. Management options include:

(1) Scouting is important to detect infestations early, preferably for the presence of eggs, since the larvae are well-protected once they move into the flowers and fruits. When larvae have entered the fruit, the damage caused is severe, (2) crop rotation can only help to prevent build-up of populations, if it is done over large areas, since adult moths can move quite long distances and is likely practical for smallholders in associations, (3) hand picking of eggs and larvae can be an effective method if infestations are not too severe.

Chickens can help by eating larvae and pupae at certain times of crop development, although they should not be allowed in seedlings or plants with fruit since their scratching and pecking will cause damage, (4) infested fruit should be destroyed, and after harvesting infested plants should be composted or burnt, (5) infested crop residues are carefully destroyed to prevent pest switching backwards and forwards between

different hosts. Pesticide may be used as last resort when other options have failed. A number of pesticides are effective and commonly available in Rwanda e.g., Dimethoate

Cutworm (*Agrotis spp*.): Cutworms cause serious damage by cutting young plant stems at the base. Young larvae may feed on leaves and cause tiny holes, but they drop to the ground after a few days. Mature larvae are about 4 cm long, but because they hide in the soil during the day, and only emerge at night to feed on the crop, they are not often seen unless the farmer digs them up. The caterpillars are easy to recognize by their smooth skin, greasy grey/black colour and C-shaped posture when disturbed.

Cutworm infestations can appear suddenly (as a result of moths flying into the area) and are often associated with fields that are weedy, having high amounts of organic residue or very wet due to poor drainage or heavy irrigation. The following are management options: (1) prepare fields and eliminate weeds at two weeks before planting to reduce cutworm number. Ploughing can help to expose larvae to predators and bury others so that they cannot reach the surface, (2) early detection of cutworm infestations helps to initiate control before serious damage occurs. Cutworms are usually present when seedlings are found cut off at the base of the stem. However, small infestations can be controlled by digging near damaged seedling to find and kill the individual larva, (3) delayed transplanting slightly ensures bigger size seedlings that can be more tolerant to damage, (4) widespread outbreaks may require use of a pesticide application around the plant as drenchor granules. Granules are best option when spread in a circle around the plant, (5) in the marshlands areas like Nyabarongo valley, flooding of the field for a few days before transplanting helps to kill larvae present in the soil.

Leaf miner (*Liriomyza spp*.): The main damage is caused by larvae mining inside the leaves and reducing the photosynthetic leaf area. Some species mine over 2cm per day. If the infestation level is high, when the weather warms up, the leaves may be killed and drop off, leading to yield loss, fruit sun scald or in serious cases, death of the plant. The management options are indicated in tomato IPM tool kit.

Spider mites (*Tetranychus spp*.): Infestations start first on the lower surface of leaves, particularly around the main vein. The leaves may become spotted, yellow, brown or silvery as a result of the spider mites' feeding activity. Yield can be greatly reduced as the plants are weakened or even killed as a result of feeding by large numbers of spider mites. Fruit can also be attacked, causing white speckling and loss of market value. The pest management options are indicated in the tomato IPM tool kit.

Aphids (*Myzus persicoe & Aphis gossypii*): Aphids damage tomato plants in two ways. (1) They suck plant sap which can reduce plant growth; and (2) they excrete sticky liquid called honeydew, which coats the leaves, causing sooty moulds and develop slow plant growth. Aphids infest upper and lower leaf surfaces and are often seen on tomato plant stems.

Infested plants may showsigns of curling, wrinkling, or cupping of leaves. This is a minor pest during rainy season. Pest management options are indicated in tomato IPM tool kit.

Whitefly (*Bemisia tabaci*): Whiteflies damage plants in three ways. Firstly, by sap-feeding of adults and nymphal stages which distort and cause yellowing of the leaves and weakens the plant. Secondly, mould develops on the excreted honeydew deposit which reduces plant growth and fruit quality. Thirdly, whiteflies can carry some virus diseases tomato yellow leaf curl virus.

Plants with heavy whitefly infestations will not yield well, however, a small numbers of whitefly can be tolerated, and pesticide sprays not necessary. When the tomato yellow leaf curl virus is known to be common in the area, even small numbers of whiteflies should be controlled. The white fly can be managed using the following options.

(1) Spraying the plant with soap and water solution controls whitefly. However, the mixture should be no more than 1 part soap to 20 parts water (1:20). If it is too concentrated, it can burn the plant, (2) the use of neem seed extracts in control of whitefly is effective, as it inhibits young nymphs to grow and develop into older nymphs, and reduce egg-laying by adults, (3) growing African marigolds has been reported to discourage whitefly, however, it is bad weed which is difficult to control when it is established, (4) in case the population of whitefly increases to high levels, application of pesticide by spraying may be necessary using effective and commonly available pesticides. The application of a systemic pesticide will be more effective than contact one.

The addition of soap to the spray solution will help the spray droplets spread on the waxy wings of the whiteflies. A single pesticide application may not be effective against eggs or nymphs, so a second application may be necessary to control the adults which have emerged from the immature stages. Whiteflies develop resistance to pesticides very quickly so pesticides should be rotated to prevent it.

Damping off (*Pythium spp. & Rhizoctonia solani*) : Damping off disease can occur in two ways, first as pre-emergence damping off when seedlings die before they have pushed through the soils, resulting in patches which appear to have germinated poorly. The second type is post emergence damping-off which occur after seedlings have emerge, which fall over and die while still small, and usually within two weeks after emergence. The fungus infects the roots and base of the stem, and the infected plant show water soaked and shrivelled stem at ground level. The damping off disease of seedlings in the seedbed is caused by fungi. Development and spread of fungi is influenced by wet soils, crowded seedbeds and high temperatures. Damping off usually occurs in small patches at various places in the seedbeds, and disease spots increase in size from day to day until the seedlings hardened after two weeks from emergence.

The fungi are common in moist soils and may survive for several seasons without crop. The infection of plants is through the roots or via leaves which are touching the soil or have been splashed by rain or irrigation water. The fungi can also be transmitted on seed which has not been treated. The management of damping off include the following options:

Use disease-free seed, and sow thinly to avoid crowding of seedlings in the seedbed and do not apply too much irrigation water or nitrate fertilizer. When buying seedlings, examine them in the seedbed to be sure they have been grown well. If there is doubt about the seed, for example, with farmer-saved seed, it can be given the hot water treatment (for 10 minutes at 50-52°C) or seed-treated with systemic fungicide. Use wax stick to bind a piece of metal and a floater tied on thread and stick which lay across the pot to monitor temperature. When temperature reaches 52^{O}C the wax will melt and the metal drops in water, the floater comes on surface. Destroy diseased seedlings by burning them; do not throw them in the field where tomato is to be planted. Make the seedbeds on land which is several metres from land which has previously produced crops of tomato or related crops such as potato, pepper or eggplant, and if there is a tomato field, make sure the seedbed is preferable located up-wind or upstream.

Seedbed soil can be partly sterilized by fire, solarisation or by drenching with a fungicide. If damping off occurs in the seedbed, spraying may be effective using effective and commonly available fungicides. Make sure the seedlings are thinned to enable good air circulation.

Early blight (*Alternaria solani*): Early blight affects all aerial parts of the plant. Disease incidence increases in warm moist conditions (high temperature and humidity).

The disease may defoliate the crop in the seedbed; plants may develop dark, wet patches all around the stem *(girdling)* near the soil surface. This is sometimes called collar rot, and will damage or kill small plants. When older seedlings are infected, it causes stem lesions that are usually restricted on one side, to become elongated and sunken.

The affected leaves have brown circular spots with concentricrings (rings inside each other) and yellow halos, the pattern of which distinguishes this disease from other leaf spots on tomato. The leaf spots first appears early in the season on the older leaves and progress upward on the plant.

The greatest injury occurs as the fruit begins to mature. When this coincides with favourable conditions for disease development, it causes great loss of foliage, weakening the plant and exposes fruits to sunscald. When plants are larger, patches of disease *(lesion)* sink into the tissue of the stem forming dark hollows. Black sunken spots can also develop around the stalk of the fruit causing it to fall.

Control options are as follows: Avoid planting tomatoes next to related crops such as potato, pepper and eggplant, and remove Solanaceous weeds such as *Solanum nigrum.*, if there is doubt about the seed, for example, with farmer-saved seed, it can be given the hot water treatment (sink in hot water at 50-52^{0}C for 10 minutes with seeds lapped in cloth, use thermometer to monitor temperature) or treated with a fungicide. (See details above), when the crop is harvested, remove plant residues and use them for compost making or destroy them and do not plant consecutive tomato on the same land, if the problem of blight is serious, spray the crop using effective and commonly available fungicides such as Mancozeb, and avoid windbreak and shade areas as they encourage dew and disease development, and keep the field free from weeds.

Late blight (*Phytophthora infestans*): Late blight is one of the most serious diseases in cool moist conditions, and may completely and rapidly destroy the crop (contrary to early blight which prefers warmer condition see above) causing 100% yield loss in absence of any intervention.

The disease causes leaves to develop irregular greenish-black, water soaked patches, usually at the edge of the leaves. The leaves turn brown and wither but often stay attached to the plant. Under humid conditions, a white dusty layer which contains spores can be seen on the underside of the leaves.

When conditions are good for the development and spread of the disease, the whole crop can be lost in a very short time. Grey green watery spots can develop on the upper half of the fruit, which later spread and turn greasy brown and bumpy. Stems can also develop long watery brown patches. However, it is usually a very minor or non-existent problem in the dry season.

Cultural techniques can help to reduce the risk of blight outbreaks. Stake plants to keep them off the soil, mulch to reduce splashes, and remove or deeply bury in old crops after harvest. Pruning will increase air movement and allow good spray penetration if pesticides are to be used. Irrigating in the heat of the day should allow the crop to dry before nightfall and reduce transmission and development. If there is wet weather, apply fungicide as soon as the disease is seen or as soon as local experience suggests that the weather conditions are favourable for disease development. Use of effective and commonly available fungicides such as Mancozeb or Ridomil can provide adequate control.

Fusarium wilt (*Fusarium oxysporum f. sp.lycopersici*): Fusarium wilt disease affects the tubes which carry sap (water and nutrients) and blocks the supply to the leaves. The leaves turn yellow and die, usually the lower ones are the first to die The wilt is typically one-sided - at first only one side of a leaf is affected, then leaves on only one side of a branch, then leaves on only one side of the whole plant. If a stem is cut lengthways, the tubes appear brown/reddish. Light sandy soil and high temperatures both cause water stresswhich makes the disease worse. Fusarium wilt can be accidentally introduced to the field on infected seeds and seedlings. It can be in soil on farm tools, staking materials and shoes. Once it has been introduced, it can survive in the plant residues and weed hosts and can re-infect new crops. The fungus also produces special spores which can survive for many years even when no tomatoes are grown. Acidic soil and nitrogenous fertilizer favor the disease, and there is evidence that presence of root knot nematodes encourages Fusarium wilt.

Disease management includes the following options: Do not locate seedbeds on land where Fusarium wilt is known to have occurred, where soil is acidic, raise soil pH to 7 by liming or use of farmyard manure, avoid excessive nitrogen fertilisation and control root-knot nematodes.

Verticillium wilt (*Verticillium dahliae*): Verticillium wilt is a disease which affects the tubes carrying sap (water and nutrients) around the plant. The symptoms are similar to those of Fusarium wilt. The older affected leaves turn yellow and gradually wither and/or fall off, but the damage is not one-sided as with Fusarium wilt. Plants with early infections often wilt during the day and then recover at night, but eventually the wilt becomes permanent. When cut lengthways, the plant often shows symptoms of brown colouration of the tissues. The plant may develop a lot of extra roots at the base of stem. This disease can have a devastating effect on the individual plants, but nearby plants may not be affected

Verticillium wilt can be both seed-borne and soil-transmitted. Unfortunately it can remain in the soil for many years in a dormant form or as soil inhabitant. When a plant is infected the spores can also be blown by the wind to infect other plants. The disease is serious if there is any slight root damage when transplanting or cultivation which can allow the disease to establish, or due to root-knot nematode damage.

The control options include the following: avoid alkaline soil which is good for the disease development, control root-knot nematodes if present in the field, do not locate seedbeds on land with a history of the disease, destroy crop debris after harvest, rogue out and burn any diseased

plants and fruit, if plant is grown in the valley, temporary flooding will help to reduce the verticillium pathogen in the soil.

Anthracnose (*Colletotrichum spp.)*: The anthracnose is indicated by small, slightly sunken circular spots developing on the ripe fruits. Even if green fruit is infected, they will not show any symptom until they begin to ripen. As the disease progresses, the spots spread and fruit cracks open. Leaves and stems of infected plants do not show any clear symptoms. The fungus can be seed-borne or can infect new crops from infected plant residue in the soil. Spores from the soil splash onto lower leaves of the new crop and infect them. Spores produced on these newly infested leaves can be carried by rain splash to the young fruit and spread around the farm by people moving through the crops.

Bacterial wilt (*Pseudomonas solanacearum also known as Ralstonia solanacearum*): Bacterial wilt disease causes rapid wilting of the whole plant and the plant usually collapses and dies without any yellowing or spotting of leaves. All branches wilt at about the same time. If the stem of a wilted plant is cut, the centre appears brown and water-soaked and hollow. Squeezing the cut stem may cause white or yellowish bacterial slime to appear and if the stem is held in glass of water for a few minutes, the milky bacterial slime starts streaming down from the cut end. Roots turn brown and may become soft and slimy in wet conditions.

The bacterium is soil-born and can survive in the soil for long periods. It has a very wide host range and infects all members of the Solanaceae family, including eggplant, peppers and Irish potato and some common weeds like lantana, black nightshade etc. It infects plants through theroots and when diseased plants are removed, the pieces of infected root which remain can infect new crops.

It is often introduced to fields via diseased seedlings which have been raised in infected seedbeds, in drainage and irrigation water. The disease develops best under warm (above 24^0C), wet conditions, and in slightly acidic soil, not favoured by alkaline soil (high pH). Root-knot nematodes can increase the severity of the disease. When the roots of diseased plant decay, the bacteria are released back in the soil.

Disease management include the following practices: growing varieties which have some tolerance; do not grow tomatoes in soil where bacterial wilt has occurred before; removal of wilted plants to reduce spread of the disease from plant to plant; control root-knot nematodes since they may help the disease to establish and spread; liming the soil to raise soil PH; maintain high nitrogen level. If possible prolonged flooding of the field can reduce disease levels in the soil. Spraying pesticides will not help to control this disease.

Tomato yellow leaf curl virus (TYLCV): Infection of young plants causes severe stunting of leaves and shoots which results in the plant looking very small and bushy. The small leaves roll up at the edges and yellow between the veins. Fruit set is severely affected with less than one in ten flowers on infected plants producing fruit. There are no signs of infection on fruit.

TYLCV is neither seed-borne nor mechanically transmitted - it is spread by the whitefly *Bemisia tabaci* and can be accidentally introduced on infected seedlings. High temperatures and very dry conditions favour whitefly populations and therefore help the spread of leaf curl virus.

The earlier plants are infected, the more serious the impact on them. Tobacco can also be infected and, although there are no symptoms, it becomes a carrier which can be the source for re-infection of tomato crops.

Disease Management options include**:** Rogue out diseased plants (in the seedbed and the field) and destroy them. Replace them with healthy plants; protect seedbeds from whitefly, because when plants are infected when are old/large enough, they are less affected, have low yield loss; spraying with oil is said to be effective against the disease, probably because they reduce the infestation of whiteflies. Use different methods to reduce the ability of whiteflies to find the crop, for example, planting in a new area away from previous tomato cultivation, or planting maize around tomato fields, apply mulches (straw, sawdust etc) to control the whitefly as vector. However, whitefly control may be not be sufficiently effective to control the TYLCV in areas where the disease incidence is high, because very small numbers of whiteflies can transmit the disease between plants. Cultivars such as Roma and Marglobe are highly susceptible and should not be used in areas where the disease is common

Tomato mosaic virus (T0MV) management: Affected plants show light and dark green mottling and some distortion of the youngest leaves which may be stunted or elongated, a condition called "fern leaf" This refers to the resemblance of these leaves to leaves of many kinds of ferns. Under high temperature and high light intensity, the mottling can be severe. Under low temperature and low light intensity, stunting and leaf distortion are severe. If fruit is infected when nearly mature, they can develop discoloration and brown streaks inside the flesh. The disease can be seed-borne, but can also survive on plant debris in the soil and so re-infect newly planted crops. The virus is easily mechanically transmissible by contact between plants, or through human activities, for example, transplanting seedlings or pruning.

Disease Management are as follows**:** Remove crop debris and roots from the field, and do not overlap tomato crops; remove any crop or weeds in the Solanaceous family from within and around the field; workers should not smoke or take snuff when working in tomato fields as it is believed that ToMV can be transmitted from the tobacco.

When working with plants, it is claimed that dipping the hands in milk or skimmed milk prevents spread from plant to plant; and field tools should be washed thoroughly.

Blossom end rot: Blossom end rot usually begins as a small water-soaked area at the blossom end of the fruit. This enlarges, becomes sunken and turns black and leathery sometimes turning the core of the fruit brown. In severe cases, it may completely cover the lower half of the fruit, becoming flat or concave. Secondary pathogens can invade the fruit and destroy it. The problem is caused by calcium deficiency brought about by rapid changes in soil moisture and poor root development. Other factors that reduce calcium uptake, such as use of ammonium nitrate and high humidity, can make the problem worse. Rapidly growing plants are more susceptible to the disease.

3.5.3 Carrots

a) Current and anticipated pests and diseases of carrots (*Daucus carota*),

The carrot crop is usually free from major pests and diseases. However, it is attacked by the following insect pests and diseases. (i) carrot blight (*alternaria dauci* and *cercospora carotae*), (ii) Carrot yellows, (iii) root rot, (iv) carrot rust fly maggot, (v) carrot weevil, (vi) carrot caterpillar (*Papillio polyxenes*) and (vii) leaf hoppers. These are all minor pests.

b) Management of major pests of carrots

The major pests of carrots are managed by good cultural practices. Crop rotation for 2-3 years may be effective against major pests. Use of pesticides may also be effective when pest pressure is high, destroy crop residue after harvesting, destroy source of inoculums around the field.

Likewise carrot diseases are controlled by application mainly good practices such as: rotate with cereals such as maize, crop sanitation, avoiding injuries and bruises at harvesting, dry roots in the sun before storage, clean store, avoiding hipping roots in store, keep temperature in store at around 0-2^{o} C and 90 RH. However, in the field plant the clean seed, use clean fields, when the signs of carrot blight appear on leaf spray bordeau mixture, zineb or dithane as recommended in area.

3.5.4 Onions

a) Current and anticipated pests and diseases of onions (Alliums cepa.)

The onions and leeks are produced in many parts of Rwanda, and commonly used by many people, especially in urban areas. These crops are attacked by many pests and diseases.

The major pests include: (i) onion thrips (*Thrips tabaci*, (ii) cut worms , (iii) Nematodes, (iv) (iv) Aphids (*Myzus persicae*), (v) downy mildew (*Peronospora destructor*), (vi) Purple blotch (*Alternaria pori*), (vii) Blast and neck rot (*Botritis spp*.) (viii) and other minor pests and diseases which may attain higher significance with time and need close monitoring.

b) Management of major pests of onion

The onions and leek have less pest problem. They are easily managed using the cultural practices such as:

(i) Good cultural practices,

(ii) destruction crop residues and off season or continuous production,

(iii) use resistant varieties,

(iv) plant on clean soil, avoid infested soils where previous crop was attacked,

(v) Apply pesticide like furadan against thrips when necessary, in its granule formulation applied on soil. However, dimethoate may also be effective. The right dose and timing will be established through field trials with farmers

3.5.5 Cabbages

a) Current and anticipated major pests and diseases of cabbages

Cabbages are attacked by many insect pests and diseases causing yield loss in quantity and quality. The major insect pests include: (i) cabbage aphids, (*Brevicoryne brassicae*, *Myzus persicae*), (ii) diamond-back moth (*Plutella xylostella*), (iii) Cutworms (*Agrotis ipsolon*), (iv) cabbage sawflies (*Athalia spp*.), (v) black rot (*Xanthomonas campestris pv campestris*), (vi) damping off (*Pithium spp*., *Fusarium spp.*, *Rhizoctonia spp.), and (vii)* bacterial soft rot (*Erwinia carotovora var. carotovora),* and there are other minor diseases attacking the cabbage plant.

b) Management of major pests and diseases of cabbages

The cabbage crop is attacked by many insect pests and diseases. However, they are well controlled using integrated pest management plan as indicated below. (i) Use clean seed free from seed born disease or treat them using hot water, (ii) take maximum care of seedlings in nursery to ensure good growth vigour, (iii) apply recommended cultural practices like proper fertility management, spacing, weeding or mulch application for vigorous plants, (iv) apply good crop hygiene and sanitation and destruction of crop residues after harvesting, (v) scout the crop to check diseases and insect presence, (vi) apply pesticides such as dimethoate which is systemic and broad spectrum insecticide when necessary using recommended dose.

3.5.6 Mushroom

a) Current and anticipated major pest and disease of mushroom

Mushroom production is completely different from growing green plants. Mushrooms do not contain chlorophyll and therefore depend on other plant material (the "substrate") for their food. Generally, each mushroom species prefers a particular growing medium, although some species can grow on a wide range of materials. Choosing a growing medium, Pasteurizing or sterilizing the medium, Seeding the beds with spawn (material from mature mushrooms grown on sterile media), Maintaining optimal temperature, moisture, and other conditions for mycelium growth and the conditions that favor fruiting. Spawn, Substrate, Environment are important factors of mushroom cultivation.

Environment: The appropriate environment is an important factor for mushroom production for both vegetative and reproductive growth. They are easily affected by their growing conditions. The success or failure of mushroom cultivation depends on the control of growing conditions. The environmental factors affecting mushroom cultivation include temperature, humidity, light and ventilation. Optimal levels of them at vegetative stage differ from those at reproductive stage. Mushroom mycelia can survive between 5 and 40^{o}C depending on the species. Mushroom mycelia grow well with the temperature range between 20 and 30^{o}C. Substrate moisture content should be 60-75 % and log moisture content, 35-45 %. During fruiting, different relative humidity levels, ranging from 80-95 % are needed at the early, mid and latter stage. Though mycelia like dark to grow but some species require light for fruiting body formation. Being aerobic fungi, mushrooms need fresh air during growing and ventilation is more required for reproductive stage. In conclusion, among the three factors, the most important is environmental control. By maintaining optimal conditions at each growing stage and for each species, growers can produce the desired yield of quality mushrooms (Imtiaj and Rahman, 2008).

b) Mushroom pests infestation: Mushroom are attacked by many pests and diseases in particular: mushroom flies (Phorid fly= genus *Megaselia and* Sciarid fly=The genus *Lycoriella).* The larvae like to eat mushrooms and can cause great damage, nematodes, mites (also act as vectors of Trichoderma and other diseases), slime molds (*Physarum compressum.and Stemonitis herbatica)* make mushrooms unappealing; *Verticillium (*causedry bubble, distortion and spotting), and virus (cause change in color).

Pests and diseases attack and destroy both mycelia and fruit body of edible fungi, which greatly affects the growth and value of edible fungi. Sometimes the edible fungi may even die. Edible fungi may be contaminated by the weed fungi or bacteria during the whole process of cultivation. The weed fungi compete with the edible fungi for nutrients, oxygen and water 'or even secret toxin to inhibit the mycelia growth of edible fungi. Consequently, the yield and quality of edible fungi will be influenced significantly. Therefore the prevention and control of weed fungi and pests is main point for the successful cultivation of edible fungi with high quality and yield. The main prevention measure is sanitation or hygiene.

Mushroom flies (Sciarid fly: *Lycoriella spp and Heteropeza spp*). The sciarid fly is the major pest problem among cultivated mushrooms. They are attracted by smell of decaying vegetation such as mushroom substrates. The larvae (maggots) do damage, as they live on wild mushroom as their natural food.

Pest management in mushroom production

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Mushroom pest management: Integrated pest management (IPM) is the least-toxic approach for managing pests of mushroom. The integrated pest management is accomplished by altering the environment to the disadvantage of that pest. You may be able to encourage natural enemies that will keep the population of the pest below the economically damaging level

Sanitation/hygiene: The basic pest management principle in mushroom production is prevention crop from pests and diseases. It is also important to sterilize the growing room and the preparation areas on a regular basis. Mushrooms are produced mostly in an enclosed environment and the risk of pests and diseases spreading rapidly within the crop are high, therefore it is important to monitor the crop on a daily basis for incidence of pests and diseases, to prevent losing at least some of the crop.

When pests or diseases are detected, control measures should be applied immediately. This may involve removing infected mushrooms by carefully picking them off without spreading the disease, then applying a pesticide. The type of pesticide required should be carefully chosen from a list of registered chemicals and used strictly in accordance with the directions given on the label. For example, screening the mushroom house ventilation system will keep adult flies out. Double doors and positive atmospheric pressure within the structure also prevent flies from entering. Since adult flies are drawn to standing pools of water on benches, walks, or floors, places where water can collect should be eliminated. Biocontrol is another option for several mushroom pests, the sciurid fly among them. A predatory nematode attacks this fly in its larval form. Therefore, this nematode can be added to the composting substrate.

3.6 Integrated Pest Management (IPM) experience of SPIU RSSP-LWH and in Rwanda

The IPM experience among farming community has increaseddue to RSSP3 and LWH capacity building of lead farmers on pest and diseases control and Farmer Field School (FFS). Trainings, workshops, study tours and demonstration plots were organized for direct project beneficiaries. The IPM and safe handling and use of pesticide were the major topics. However, the development and promotion of IPM and safe use of pesticides is still an urgent issue to address low knowledge on pesticides hazards among extension staff, farmers and retailers in rural areas since the RSSP and LWH and other MINAGRI projects did not cover the whole country and the skills of trained resources need to be strengthened. This is an important activity because the future of agriculture in Rwanda is dependent on crop intensification and more use of agricultural inputs including pesticides.

The pesticide survey done in 2005 revealed that the trade of the pesticides inside the country was mainly made by farmers' organizations which deal with a particular crop without sufficient knowledge of safe handling of pesticides. Training of people involved in storage, handling, marketing and uses of pesticide is urgent to develop capacity at all levels.

The current pest management practices commonly applied by the majority of farmers include a combination of cultural practices, resistant varieties and pesticides. The pesticides application is limited to crops of high value like tomatoes, potatoes, rice and coffee etc, while pest management in staple crops like maize depends mainly on cultural practices and resistant varieties. It is very rare for farmers to buy pesticide for controlling maize field pests unless there is a serious pest outbreak like African armyworm problem and availability of external support like projects or NGOs. Some farmers may avoid producing a particular crop during a certain season of a year because they are anticipating high disease attacks. For instance, farmers avoid growing tomato during rainy season since they know that they may face high yield losses due to diseases.

The MINAGRI has already a plant protection law (Law No 16/2016 of 10/05/2016)and law governing agrochemicals (Law No 30/2012 of 01/08/23012)to regulate pesticides use in the country and reduce risks of pesticides. In addition, there are different laws including (i) Environmental law of June 2004 prohibiting the introduction and the use of the products dangerous for human health and the environment and bearing creation of the Rwandan Environment Management Authority (REMA); (ii) The law creating Rwandan Office of Standardization (RBS: Rwanda Bureau of Standards) which makes it possible to control the quality of the pesticides introduced into the country, the use and supervision of stocks of pesticides, and (iii) at the institutional level, the Ministry of Environment (MoE) is responsible for the formulation of the policies and laws that aimed to protect human health and the environment, which includes the management of pesticides.

Trainings of agronomists and lead farmers in RSSP-LWH sites have taken place but there is a need to continue and strengthen this important activity and extend it to other sites not covered by SPIU. It is important that pesticides are used safely and in a way which is not hazardous to the users, consumers of the produce, livestock, and/or to the environment. The farmers should be aware and observe the safe use of pesticides as specified in a pesticide guide. All pesticides should be treated with care whether they are known to be particularly poisonous or not.

During ECAATP, it is anticipated that there will be capacity building at all levels including farmers, extension staff, pesticide traders and local leaders within the project areas. The baseline data for pesticide use in each target crop is not available at the moment because the cooperatives can buy and supply fungicides only and individual farmers buy insecticides and fungicides on their own. This makes it difficult to establish reliable pesticides quantities used. A rough estimate may be established using area per crop, number of sprays per season and amount per spray. The M&E may be able to establish this information during baseline study at the beginning of ECAATP.

3.7 Circumstance of pesticide use, capability and competence of end-user

3.7.1 Circumstances of pesticide use in different crops

The circumstance of pesticide use under ECAATPwill be mainly in disease management using fungicides and few insect pests for some crops like cabbage.

Pesticides use in bananas.The use of pesticides on banana is very little. Currently, the major threat of bananas in the basin in Rwanda is the banana bacterial wilt, which is spreading in all banana growing areas and its management does not require the use pesticides. The second most important disease in the country is the Fusarium wilt (Fusarium oxysporum fs musae) on exotic banana cultivars, which is soil borne disease and does not depend on pesticides for control or management.

The others pests of banana are not important but needs close monitoring due to climate change which may adjust to local climate. These include banana weevils (Cosmopolites sordidus), nematodes (like Pratylenchus goodeyi, Helicotylinchus multicinctus, and Radopholus similis and Meloidogyne spp.) and leaf spots (yellow sigatoka, black sigatoka and cladosporium leaf spot) are not a threat because of altitude effect. These pests are threat below 1400 m above sea level, while major banana growing areas in Rwanda are above this altitude. Even if they occur, the use of pesticides is not economical.

Current pesticides use in potato: In the potato crop, the commonly used pesticide is the fungicide, and the most commonly used fungicides are Dithane M45/Mancozeb (contact preventive), and Ridomil/Metalaxyl (systemic). Both of them are unlikely to cause hazard because they are categorized as U and III under WHO respectively. Farmers apply Dithane M45 (protective fungicide) when rainfall is not continuous, and use Ridomil (systemic fungicide) when rainfall is continuous and can wash out protective fungicides. This experience is good and is an important tool in IPM development, since it is farmers' knowledge of their local conditions.

Current pesticides use in cassava: The pests and diseases of cassava are managed using resistant varieties and cultural practices. The use of pesticides is not economical.

Current pesticides use in maize: The pesticides use in controlling insect pests is not common except for a few farms where the problem is severe and there is external support from some projects or NGOs to control maize stalk borers. The diseases are managed using resistant varieties.

Current pesticides use in tomatoes: Thetomato crop suffers a large number of diseases. However, the pesticides are used only to control late blight (*Phytophthora infestans*).The latter is major constraint especially during the rainy season. The disease is controlled using the fungicides such Mancozeb/Dithane M45 or Ridomil/Metalaxyl (category U and III respectively).

Pesticides use in French/green beans: The use of pesticides in pest management in the bean crop is very low under field condition. The use of systemic fungicides like benomyl is effective, however, not applied because the cost of control is very high while the value of beans is very low.

Pesticides use in cabbage: The cabbage crop is attacked by various major pests causing loss in yield, quality, and marketability. The major pests include cabbage sawfly, diamondback moth, flea beetles, whitefly, aphids, thrips and mites. The pesticide use in cabbage is anticipated for the control of cabbage sawfly and diamondback moth (DBM).The DBM is known to develop fast resistance to many known pesticides due its short life circles (about 12 generations per year) and fast population build up of resistant generation.

Pesticide use in other target crops: The pesticides use in other target crops in particular onions, carrots, pineapple, wheat and mushroom is expected to be very rare. The circumstance leading to pesticide use in the other target crops for ECAATP will occur in isolated cases and could be easily handled.

3.7.2 Capability and competence of end-user to handle pesticides

Due to small pesticides market in Rwanda, the legal framework, end-user capability and competence are not well developed for wider community. However, for those directly involved in the pesticides application like in coffee producers, irish potato producers, they have been trained through support offered by their cooperatives and/or coffee and potato authority.

However, for wider community of stakeholders in agriculture, they are not aware on the hazardous nature of pesticides and their effects on health of people, animals and the environment. The farmers are not informed on dangers of over use or sub-lethal dose on pests and environment, on how in long run the pests develop resistance and cause more crop losses.

Similarly, the consumers are not sensitized on the dangers caused by pesticides treated food and impact on their health. Community sensitization on hazardous nature of pesticides and implication on their health in short term and in long period is urgently needed. The adoption of IPM depends on many factors including the community involvement in the process of IPM development in order to understand why it is needed, and that pesticides can be used safely and timely when necessary. Therefore, ECAATP should include in their budget the cost of capacity building and sensitization of safe pesticides use at all levels from production, trading and consumers.

The current pesticides use in Rwanda is limited to few crops of high value and is not guided by legal obligation; moreover, pesticides are profitable for limited crops of high value and in most cases are either not affordable or not accessible in many parts of the country. According to MINAGRI reports, the national average of pesticide use is below 1kg/ha and is mainly fungicides used on coffee and potatoes. The data available are more than ten years old, however, they are indicative. During a three year period (1997 – 2000), the proportion of different pesticides, fungicides, insecticides and herbicides was 75%, 23% and 2% respectively. This is trend may persistent for some time, because fungal diseases are more a threat than insect pests.

The Ministry of Agriculture and Animal Resources (MINAGRI) is currently addressing the problem of pesticides by re-enforcing pesticides laws and regulations as the draft bill is with the parliamentary committee for review as of November 2011. Currently, the regulatory legal framework is not strong enough to address all problems which may arise during intensification of agriculture without support of capacity building among crop producers.

According to the national pesticide survey conducted in 2005, the following actions were recommended: (i) Registration of the pesticides to regulate importation, storage, handling and marketing; (ii) formation of associations for pesticides distributors and importers; (iii) training of all pesticides dealers and distributors; and (iv) introduce competence licence in pesticide handling for importers and distributors, in addition to trade licence. Meanwhile international regulations will be used for storage and handling of pesticides.

Source of pesticides: In Rwanda, there are two major sources of importation of the pesticides: (i) importers having trade licences of importation and (ii) donations coming from development partners (e.g. European Union, FAO, Japan, NGO etc).

The pesticide marketing is liberalized and supply is done by private sector. There are only a few importers in Rwanda dealing with import, wholesale and retail of pesticides. Pesticide retailers based in the country (e.g. Agrotech) have their own storage, transport and disposal of containers. However, due to low purchasing power of farmers and high price of pesticides (e.g. insecticides and some fungicides), the retailers have tendency to buy in large quantities and repack in small containers.

3.7.3 Prerequisite measures to reduce specific risks associated with pesticide use

Legal framework and enforcement: The plant health law and agrochemical law will address all issues concerning pesticides use in the country. As indicated above, MINAGRI has alreadyplant health law and agrochemical law that will regulate the use of pesticides in the country.

Capacity building: ECAATP will expand the work done so far by various partners (RSSP, LWH, etc) and address issues of capacity building at all levels (farmers, traders, extension staff, local leaders and decision makers etc) in project sites. Rwanda has small market for pesticides, as result distribution and marketing of various pesticides is small moreover many farmers depend on cultural practices and resistant varieties. Nevertheless, the training of farmers, extension staff and retailers of pesticides is an urgent and important activity during ECAATP. Most extension staff employed by farmers' cooperatives have educational background in pesticide technology, but these skills need to be continuously updated.

Pesticide technology: The training should include more information for safe use of pesticides which should be taught to all farmers, like poisonous effect of pesticides thus safe handling, storage, protective clothes, disposal of containers, sprayer maintenance and calibration, etc. Since farmers will continuously produce potatoes, tomatoes or rice for greater part of their life, the safe use of pesticide is important for their safety, other people's safety and environment in general. Therefore, to ensure safe use of pesticidescapacity building exercises will be important at all levels during ECAATPimplementation, including local leaders, traders and policy makers. In addition, as some of the pests of target crops of ECAATP (e.g. Diamondback moth of cabbage) are known worldwide to develop resistance to pesticides very fast. This gives another reason to give priority to training on pesticide management.

Minimum requirements for a pesticide store

Any pesticide store should answer the following criteria:

- ✓ Impermeable floor
- ✓ Adequate ventilation
- ✓ Locked store
- ✓ Secured site
- ✓ Location that does not pose specific health or environmental hazards (distance from homes, schools and water)
- ✓ Managed by store-keeper with knowledge about hazards and capable of handling leakage and other emergencies
- ✓ Emergency materials and protective gear needed to deal with emergencies (including emergency plan, Material Safety Data Sheets for products kept in store, fire extinguisher, emergency shower for staff)

CHAPTER 4: CURRENT PEST AND DISEASE MANAGEMENT PRACTICES RELEVANT TO ECAATP

4.1 Introduction

The 12crops targeted by ECAATP are among the national priority crops and the execution of IPM will involve different partners. In addition, IPM is normally executed at community level rather than at individual plot level; the execution of IPM plan will therefore involve MINAGRI, MINALOC, District authorities, farmers' organizations and farmers.

MINAGRI needs to recommend IPM as a national approach in pest management and develop IPM policy to promote its use in addressing pest problems. Furthermore, improvement to legal framework and enforcement at all levels is needed, as part of the law for plant protection, in the areas of pesticide registration, handling and use. The District and Cooperative authorities should accept IPM as an important activity and include it in their performance contracts on an annual basis.

The execution of IPM at project level alone is not sufficient; resources will be needed to sensitize the community about the plant protection law and some IPM practices like closed season which require cooperation with the community and Local leaders and extensive training of farmers. It is recommended to establish IPM at community level, not at individual farm level only. The plots in the same locality should apply the same principles to avoid source of infestation from the neighbourhood. Therefore, the IPM options should be taught to farmer groups and not to individual farmers. Farmers should be organized into groups to work together, make regular field observations, discussions and agree on the best IPM approach to apply at the various growth stages of their crop.

Training of farmers in IPM is an important activity because they should be able to know and distinguish pests and none pest insects, recognize and appreciate damage caused and associate it with particular pests, diseases or weeds. Finally, they should be able to make decision on pest management action to take control of pests, diseases and weeds and the reasons that are underlying the decision to take a particular action.

The pest and diseases control is essential component in crop production. The insects and pests are part of biodiversity of any ecosystem and they cause great losses if not well managed. They become pests only when they multiply and exceed a certainly population level as a result of supply of good and high nutritive food from crops. When the damage causes economic loss, then they become major pest worth of investing in cost for control and stop further yield loss. In Rwanda, the common pest management practices include (i) informal cultural practices for diverse crops, (ii) use of resistant varieties, (iii) natural control (use of natural enemies), and (iv) Pesticides application, mainly done on cash crops and horticultural crops. The pest management practices applicable to ECAATP are discussed below:

4.2 Relevant pest and disease management practices to ECAATP

4.2.1 Informal cultural practices use in pests and disease management

The use of cultural practice is the most common practices among farmers. Although not formally developed into IPM package, it is still the only method which keeps the pest below damage threshold while preparing their own fields. The cultural practices applied in Rwanda have some important elements useful in pest management. In most crops, apart from irrigated rice and potatoes, other crops are planted in rotation or under mixed cropping system. The crop residues are normally destroyed by burying, burning or heaping or feed to livestock.

All these methods do not allow population increase of the insect or diseases. The burning of crop residues is no longer allowed and banned across the country. Crop rotation is generally practiced by the majority of farmers.

4.2.2 Resistant varieties use in pests and disease management

Currently, the use of resistant varieties is the most reliable, affordable and sustainable pest management method in the country, in particular for diseases control. Among the most recently released crop varieties, the majority are resistant to particular disease; and both farmers and Government are much interested in such varieties as they provide affordable and sustainable solution to the disease problem. For example, during the last three years, the Government has been involved in assisting farmers to get resistant cassava varieties against cassava mosaic disease.

4.2.3 Natural control in pests and disease management

The natural control or use of natural enemies is an important tool and method in biological control. In Rwanda, the biological control is not one of formal crop protection practices. However, due to very low pesticide use, the effect of pesticides on natural enemies is very low, and conservation of natural enemies is of course effective. In absence of side effect of pesticides, some pests are kept down by a combination of conserved natural enemies with good cultural practices. A field visit in different parts of Rwanda will indicate the importance of this combination. The field observation will indicate that there is much more disease problem at farm level than insect pests.

Since, protective fungicides have little effects on natural enemies as compared to insecticides; it is obvious that the natural enemies of some insect pests are not much affected. However, research on natural enemies distribution and population dynamics for major and minor pests need to be established and funding for research is essential.

4.2.4 Current Pesticides use in pests and disease management

Under this report pesticides means insecticides, herbicides, fungicides, rodenticides and other chemicals used to control, prevent, destroy, repel, or regulate pests. As toxicants (poisons), they detrimentally affect living organisms and usually have adverse effects on other forms of life. Because of their poisonous nature, pesticides can injure or kill people, pets, and livestock; damage beneficial insects, birds, fish, and other wildlife; and can harm desirable plants. It is mandatory that all such materials be very carefully managed and handled during storage, transport, mixing and loading, application, and disposal. It is critical to stress the importance of safe pesticide use and need for IPM program.

In general, pesticide use in Rwanda targets mainly plant diseases management and nearly 75% are fungicides while the remaining 25% is composed of different insecticides and a few herbicides. Among the fungicides imported, more than 90% of the products are Mancozeb and Ridomil which are applied to potato and tomato against the late blight (Phytophtora Infestans), coffee leaf rust and coffee berry disease.

Nevertheless, the impact of pesticides use is very high especially in the fungal diseases control such as late blight (*P. infestans*) in potato and tomato, coffee leaf rust (*Hemilea vastatrix*), CBD (*Colletotrichum coffeanum*), and rice blast (*P. oryzae*). These diseases are mainly managed using fungicides, and their impact can be tremendous. For example, the late blight without fungicide application can cause up to 100% yield loss on tomato crop in heavy rainfall areas of the country. As a result, fungicides use is more than other pesticides.

During a three years period (1997 – 2000) the proportion of different pesticides was as follows: fungicides (75%), insecticides (23%) and herbicides (2%).

Although, the amount used is very small, pesticides use is associated with both positive impact through pest control and negative impact through risks on humans (producers and consumers) and the environment.

In Rwanda, there are two major sources of importation of the pesticides: (i). importers having trade licences of importation and (ii) gifts coming from various partners (European Union, FAO, or NGO (e.g., World vision). The pesticide marketing is liberalized and supply is done by private sector, and directly sold to retailers, while the capability and competence of end-users to handle products within acceptable risk margins is negligible. In general farmers and extension staff have very little capability to handle and use pesticides at low risk.

Basing on the national pesticide survey in 2005 for the whole country, it was realised that there was a need for the following actions: (i) legislation of the pesticides to regulate importation, storage, handling and marketing; (ii) initiating the formation of associations of the distributors and the importers of pesticides; (iii) organizing sessions of training for all distributors of the pesticides; and (iv) importers and the distributors must have not only trade licence but also pesticide dealing licence indicating their competence in pesticide handling delivered by the competent Ministry. Currently there is no policy or regulation as regards to safe pesticide handling and use as required by international code of conduct.

It is important that pesticides are used safely and in a way which is not hazardous to human (producer and consumers), animal/livestock, and to the environment. The farmers should be aware and observe the safe use of pesticides as specified in a pesticide guide. All pesticides should be treated with care whether they are known to be particularly poisonous or not.

It is urgent to do capacity building at all levels including: farmers, extension staffs, pesticides traders, local leaders and politicians. A brief description of current pesticides use in few selected crops is indicated in the following sections. The base line data for pesticides for each crop is not available because some cooperatives can buy and supply fungicides to farmers as loan deductible after harvest, while individuals buy insecticides using their own cash. This makes it difficult to establish reliable data on pesticides quantities used in each crop.

Due to the nature of Rwanda land terrain, coupled with high rainfall, the use of pesticide should be limited or used judiciously to minimize side effects to human, animals and environment downstream of watershed and in riparian countries. The alternative pest control means non-chemical methods (cultural, physical and biological) should be explored first before embarking on chemical pesticides application. The use of IPM accepts pesticides as last resort, i.e. if they cannot be avoided. The list of pesticides (insecticides, fungicides, herbicides, rodenticides and nematicides) allowed in Rwanda is provided in annex section, together with prohibited pesticides.

Pest management during RCAATP will focus on major pests and diseases of target crops. In addition, it will support other crops on demand driven basis as need arises. Moreover IPM is normally executed at community level rather than at individual plot level; the execution of IPM plan will therefore involve Ministry of Agriculture and Animal Resources, District authorities, NGO's, farmers' organizations and farmers.

The Ministry of Agriculture and Animal Resources needs to recommend IPM as a national approach in pest management and develop IPM policy to promote its use in addressing pest problems. In addition, it needs to improve the legal framework and enforcement at all levels. The pesticide registration, handling and use is required as soon as possible as part of the law for plant protection. The District authorities should accept IPM as an important activity and include it in their performance contracts on an annual basis.

The execution of IPM at project level alone is not sufficient as it will not bring the much needed impact. Resources will be needed to sensitize the community about the plant protection law and some IPM practices like good agricultural practices which require cooperation with the community and Local leaders and extensive training of farmers.

It is recommended to establish IPM at community level, not at individual farm level only. The plots in the same locality should apply the same principles to avoid source of infestation from the neighbourhood. Therefore, the IPM options should be taught to farmer groups and not to individual farmers. Farmers should be organized into groups to work together, make regular field observations, discussions and agree on the best IPM approach to apply at the various growth stages of their crop.

Training of farmers in IPM is an important activity because they should be able to know and distinguish pests and none pest insects, recognize and appreciate damage caused and associate it with particular pests, diseases or weeds. Finally, they should be able to make decision on pest management action to take control of pests, diseases and weeds and the reasons that are underlying the decision to take a particular action. The following section will outline a range of IPM practices for major pests and diseases of each target crops which will form a part of training package for farmers.

4.3 Proposed pesticide use during ECAATP

Among the crops that will be supported by ECAATP, pesticides will continuously be used on potato, tomato and cabbage. The use of pesticide on other target crops will be very minimal depending on scouting of field damage, but in general, it will be reduced or avoided without any significant yield loss. The project will not increase pesticide use because of promoting IPM and safe use of pesticides and needs to be strengthened in the marshlands with double cropping.

4.3.1 Pesticides use in management of potato and tomato pests and diseases

The pesticides will mainly be used against late blight (*Pytophthora infestans*). This diseases is very stubborn, and is not easily managed even when potato resistant varieties are planted, fungicides are also applied to minimize yield loss. This calls for frequent use of pesticides. The frequency depends on the rainfall, but usually varies from 5 - 10 days between sprays. However, a combination of resistant varieties and fungicide may reduce the amount used. The IPM research should focus on this combination of different options to find the most economical approach.

Protective fungicides: Currently, the commonly used protective fungicide in large amount is Mancozeb/Dithane M45 which is categorized as unlikely to present acute hazard in normal use. Mancozeb is wettable powder which is mixed with water and applied using knapsack sprayer. This fungicide will continuously be used against late blight in both potato and tomato crops because there is no resistant varieties available at the moment in tomato, while in potatoes, the resistant variety need also fungicide application because they are not sufficiently resistant.

Systemic fungicides: When there is wet weather with a combination of heavy rainfall and humidity, farmers prefer to use systemic fungicide, Ridomil/Metalaxyl to control late bright. The alternation of protective and systemic is working among potato farmers and they are conversant with the approach. Since Ridomil is categorized in III, slightly hazardous, and mancozeb as category U, the two fungicides will be useful as IPM component of on both potato and tomato during ECAATP. The researchers will establish an alternative fungicide.

Insecticides use in potatoes: It is anticipated that potato tuber moth (PTM) in potatoes will not need the use of insecticides. However, in tomato pest management, the insect pests are also major pests and pesticides will be used as a component of IPM.

4.3.2 Pesticides use in management of rice pests and diseases

A combination of cultural methods and chemical options are necessary in the management of rice blast. There is a wide range of systemic fungicides with specific actions available such as Isoprothiolane which is systemic and active against rice blast and it is rated slightly hazardous; and IBP/Kitazin which is also systemic and effective against rice blast and it has insecticide action. The latter is rated category III.

4.3.3 Pesticides use in management of cabbage pests and diseases

The pesticides will mainly be used against cabbage sawfly and diamond back moth (DBM). These two pests are major pests and require regular monitoring, scouting and timely application of right recommended safe pesticide, at right dose and frequency. The frequency of insecticides is major problem among farmers because they do mix with fungicides and apply at the same time irrespective of recommended interval.

4.3.4 Pesticides use in management of pests and diseases of other target crops (maize, wheat, banana, onions, pineapples and cassava)

It is anticipated that very little pesticides will be used against the pests of these crops. In case it occurs, the researchers will determine the most appropriate pesticide, rate and frequency of application.

CHAPTER FIVE: PUBLIC CONSULTATION AND PARTICIPATION

5.1 Introduction

Project stakeholder consultation is a vital component of the ESMF process. The consultation process focuses on providing information on the proposed project in a manner that can be understood and interpreted by the relevant audience, seeking comment on key issues and concerns, sourcing accurate information, identifying potential impacts and offering the opportunity for alternatives or objections to be raised by the potentially affected people; nongovernmental organizations, members of the public and other stakeholders.

Consultation has also been found to develop a sense of stakeholder ownership of the project and the realization that their concerns are taken seriously, and that the issues they raise, if relevant, will be addressed in the PMP and will be considered during project design refinement.

5.2 Public consultation

5.2.1 Consultations with Stakeholders

Consultation with the project stakeholders began during the Scoping phase continued throughout the entire PMP process and will continue into the construction and operational phase of ECAATP.

These consultations assisted the participants to understand the local conditions, different NGOs and institutions doing similar projects within the sites as well as the existing traditional methods used by the communities. The stakeholder's consultation meetings also helped in highlighting the socio-economic and environment concerns and impacts that could arise from the project which was significant in coming up with appropriate mitigation measures.

Consultations with Districts and farmers' representatives were organized in the represented Districts and conducted in Kinyarwanda. They engaged among others; representatives of affected people in the community, Stakeholders and District authorities (Vice-Mayor or his representative in certain Districts, Agronomists, District Executive secretary, Environmental officer, etc).The PAPs representatives were invited from the local farmers' organizations, private sector, civil society and other community opinion leaders.

5.2.2 Consultation with affected people

The affected people have a right to be informed, consulted and involved in the activities that will affect their livelihoods. The exact number of directly affected people in ECAATP is yet to be determined; this is because the specific locations and sites have not been identified yet. Nevertheless, indirectly affected people in the represented Districts were represented by community leaders and local leaders and several consultation meetings conducted.

During consultation with the affected people, the project and district staff explained the scope and objective of the upcoming project and were also explained that the negative impacts anticipated are minor. Some of the things discussed include the concerns to the public, compensation procedures including a proposed and effective grievance redress mechanism, generation of income, gender inclusion and participation.

Affected people were allowed to give their feedback and their suggestions were documented and will be taken into account during the project design and implementation.

In total, about 405people (293 Men and 114Women) from 5 Districts were consulted between January 2018. The meetings in Nyanza, Gisagara together with Huye, Gatsibo and Nyabihu Districts were respectively arranged for January 10th, 2018, January 11th, 2018, January 12th, 2018 and January 19th, 2018. The consultations and meetings discussed the scope of the project, the impacts that are expected to arise, the mitigation measures in place etc. The minutes and attendance lists with the consulted people are presented in Annex 6. The photos showing consultation meetings held are presented below.

All the consulted categories are in favor of the project and perceive it as a possibility of increasing economic activity in the area through creation of Jobs; and in improved soil conservation measures that will boost agricultural productivity hence enhancing the overall livelihoods of the communities.

The benefits of the consultation meetings include among others;

- Early involvement of the affected people
- Improved community understanding of the project scope and objectives
- Promised safeguards compliance through increased ownership
- Enhancement of decision making by the project decision makers

Below, are some photos from several consultation meetings held

Public consultation in Nyanza DistrictPublic Consultation with District officers in Nyabihu

Citizen engagement in Gatsibo DistrictConsultations in Gisagara and Huye District

In regards to social and environment concerns, consultation meetings revealed that all expected negative impacts, will be addressed during identified project's ESMPs preparation.

The key recommendations drawn from consultation meetings are as follows:

- Continued engagement of the PAPs, Local leaders and stakeholders
- The type compensation agreed upon between the expropriator and the PAP should consider updated market prices;
- PAPs to be given priority during recruitment and employment
- Affected persons and local communities will be given priority during recruitment of manpower and technical staff.
- IPM and proper use of pesticides to be taught/ strengthened to farmers
- Create strategies for effective communication among all the concerned parties

The table below highlights the key outcome of the meetings

Table 1: Key outcomes of the consultation meetings

ISSUE RAISED	**RESPONSE**
Timely availability of funds for compensation	Planned activities will not imply loss of assets nor access to assets but rather loss of income by some PAPs who will miss one agricultural season due LH works. In order to restore loss of income expected during civil works, PAPs will be given employment in LH works, agricultural inputs (lime and compost) and tree seedlings, fruit inclusive. No financial compensation will be done.
Roles of the District in implementation safeguards tools	The Districts will closely work with RAB/ECAATP for RPF and RAP implementation
Expected risks and negative effects of the Project to the local communities.	This is a Category B project, its impacts are manageable and include among others: - loss of perennial crops and trees - Loss of income, -air pollution by dust -Noise pollution from labor -Communicable diseases and diseases associated with pesticide use -Child labor

Mitigation measures to potential risks and adverse project impacts to local community	-Assistance to resettled PAPs, including the vulnerable PAPs -Appropriate mitigation measures taken for pollution and health safety control, erosion control -Employment PAPs in ECAATP implementation works - Provision of seedlings and agricultural inputs - Capacity building
Anticipated benefits likely to be occurred from the project for stakeholders.	- Increased income for all employed personnel that will be recruited in the civil works -Soil erosion control - Overall agricultural productivity from improved soil fertility -Access to regional even international market by selling their products. -Capacity building
Information regarding grievance redress mechanisms.	-Grievance redress mechanism strategies will be put in place, including grievance redress committees that will be voted and close to the affected people
Employment Opportunities for PAPs during civil works	The local people were promised to be given priority during recruitment
Engagement of the vulnerable	The project will engage all people; Vulnerable People will be employed in Tree nurseries that will be used during forest rehabilitation and in creation of check dams.
Soil erosion and landslides	In ESIA studies, measures for soil erosion control and landslides will be provided and will be fully observed.

CHAPTER SIX: POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS AND PROPOSED MITIGATION MEASURES

6.1 Environmental and public health impacts of pesticides use

6.1.1 Environmental and public health impacts of pesticides use

Pesticides are chemicals used to kill fungal or animal pests and improve productivity and control yield loss. However, reports indicate that more than 95% of applied pesticides reach a destination other than their target species because they are sprayed across the whole agricultural land. Runoff can carry pesticide into aquatic environments while wind can carry them to other fields including croplands, grazing areas, forest areas, human settlements or undeveloped areas. A portion of the applied chemical can also infiltrate the soil or spread in the atmosphere. Over time, repeated applications will lead to soil contamination, soil fertility reduction due to soil microorganisms population reduction, air and water pollution and affect plant and animal species (non-target organisms ranging from beneficial soil microorganisms to insects like bees, birds, fish and plants. They can also increase pest resistance, while its effects on other species can facilitate the pest's resurgence.

The best way to reduce pesticide contamination in our environment is for all of us to do our part to use safer, non-chemical pest control (including weed control) methods.

6.1.2Occupationaland public health impacts of pesticides use

In addition to environmental risks, there is overwhelming evidence that some of the pesticides are potentially hazardous to human health. Deaths and chronic diseases (like throat irritation, sneezing, coughing, cancer, etc), reproductive toxicity, etc. due to pesticide poisoning are reported in various sources.

6.2Proposed mitigation measures

The pesticide transport, storage, handling, and use under local conditions need much improvement. Similarly the disposal of containers and obsolete stocks require much more effort, especially in teaching people involved in pesticide marketing and use since there is little understanding on risks involved at all levels. Moreover, there is no report on soil contamination, air and water contamination, food safety or pest resistance because insecticides are used in small quantities and on few crops. However, with agricultural intensification and horticulture promotion, there is a fear that misuse or inadequate application of pesticides may cause risks on environment and human health.

In a bid to minimize risks associated with pesticide use, the following are proposed:

1) ***Regulation of pesticides use***

The pesticides range from the category of extremely and highly dangerous to less toxic pesticides. Where the use of pesticide is unavoidable, it would be good to reduce or avoid the use of extremely and highly dangerous to moderately dangerous category and replace them with pesticides with less toxic alternatives.

2) ***Enforcing safety behaviours in workplace***

The workplace safety behavior is critical for preventing occupational pesticides exposures. Safety measures in workplaces (ie farm, stock, etc) include wearing personal protective equipments (PPE),

showering after works, wearing and changing clean clothes between work shifts and frequently washing hands at works. Wearing PPE (eg respiratory mask, gloves, protective over clothes, etc) is an effective way to reduce risk of developing pesticide-induced respiratory diseases when handling pesticides. Awareness and knowledge of pesticide exposures should also organized to farmers and dealers for their safety when handling pesticides.

3) Integrated Pest Management strategy

IPM is a strategy integrating diverse methods and practices to achieve effective and economic pest control. In an IPM programme, pesticides will be applied as a last resort in suppression systems and selected based on least negative effects on environment and human health. The IPM strategy has the potential to reduce unnecessary pesticides applications.

It is anticipated that ECAATP will promote the use of IPM during its implementation and pesticides will be used once IPM practices become ineffective in pest control. In case it occurs, the Project will work with researchers to determine the most appropriate and less toxic pesticide to use, its rate and frequency of application. The pesticides will always be used in combinations using IPM approaches.

Based on the above information, capacity building for farmers and extension staff, pesticides dealers in IPM practices will be an important component of technology transfer for crop intensification during ECAATP.

CHAPTER SEVEN: COMPONENTS OF THE PEST MANAGEMENT PLAN AND IMPLEMENTATION STRATEGY AND CAPACITY BUILDING

The objective of PMP is to combine together several different control methods to fight against the pests, while minimizing environmental hazards and maximizing economic benefits for producers and consumers.

7.1. Integrated pest management under ECAATP

Integrated pest management in ECAATP will focus on major pests and diseases of target crops. In addition, the Project will support other crops on demand driven basis as need arises. Moreover IPM is normally executed at community level rather than at individual plot level because the plots in the same locality should apply the same principles to avoid source of infestation from the neighborhood. Therefore, the IPM options should be taught to farmers' groups and not to individual farmers. Farmers should be organized into groups to work together, make regular field observations, discussions and agree on the best IPM approach to apply at the various growth stages of their crop.

The execution of IPM at project level alone is not sufficient as it will not bring the much needed impact. Resources will be needed to sensitize the community about the plant protection law and some IPM practices like good agricultural practices which require cooperation with the community and Local leaders and extensive training of farmers.

In each project area, Self Help Groups (SHGs) will be formed not only for the valorization and maintenance of developed land husbandry infrastructures but also for the easier execution of IPM plan. About 15 to 20 neighboring land owners with terraces will form an SHG and several SHGs will be organized in Zones, which in turn will be grouped to form a Cooperative. The latter will be the farmers' organizations to manage the developed site through which IPM programme will be implemented. MINAGRI/RAB will also involve District authorities in this IPM implementation chain.

Training of farmers in IPM is an important activity because they should be able to know and distinguish pests and none pest insects, recognize and appreciate damage caused and associate it with particular pests, diseases or weeds. Finally, they should be able to make decision on pest management action to take control of pests, diseases and weeds and the reasons that are underlying the decision to take a particular action.

7.2 Scope of the Pest Management Plan under ECAATP

ECAATP will finance the PMP activities in the project areas on all target crops and other demand driven crops. The PMP activities will include (i) training farmers in improved production technologies to produce healthy plants, (ii) Training on life cycle of pest and diseases, (iii) Pest distribution mechanisms (movement from place to place) for major pests and diseases, (iv) pest and diseases impacts on productivity, (v) development of different control methods, (vi) promotion of safe use of pesticides and (vii) integrated pest management for each crop and monitoring programme. The PMP activities will be carried out as a learning plot for farmers or other selected members selected from their communities. The PMP activities will form a part of district activities and the later they should own it and include in performance contracts for sustainability.

7.3. Institutional arrangement

MINAGRI

At National level, MINAGRI through RAB/ECAATP will coordinate PMP implementation. In addition, RAB/ECAATP will work with different research institutions (RAB, International Agriculture Research Centres, CGIAR, etc) for new technologies, taking advantage of Regional organizations like East Africa community and Africa Union.

District

The District has agronomists at District, Sector and Cell levels who will be trained on IPM, seed technology and safe use of pesticide. ECAATP has a Coordination unit responsible the day-to-day running of the Project site (though not yet confirmed, a project site is likely to cover partial or entire district or more than a district). The Site Project staff will coordinate the PMP activities in partnership with the officers responsible for agriculture in the District and will monitor and report on progress made by farmers' groups. This will include also organizing study tours to different parts of the country (provinces or districts) where is success to re-enforce the training offered to farmers. Since the project will operate demand driven approach, it should establish mechanism to support the local community for timely and affordable inputs (seeds, fertilizers and other agrochemicals and farm equipment, etc).

Community based organizations (SHGs, Zones, Cooperatives)

The farmers, grouped in SHGs are responsible to learn and apply IPM tools in the pest war. SHGs will identify members to participate in training of trainers (ToT). Each group will comprise of 20-30 farmers for training and not more than 40 at a single training/learning plot. Every trained farmer will be responsible to train other 15 - 20 farmers at his/her site. The training will last at least one season long. This would mean that the PMP and its implementation will form part of farmers' cooperatives and District authorities as key activities to include in performance contract. The ECAATP will therefore give support to District (district, Sector and cell level) extension where the project is operating to facilitate the PMP execution.

7.4. Implementation strategy

a) National IPM Workshop

ECAATP will organize the launch workshop involving different stakeholders and partners such as donors, NGOs and research institutions (national, regional and international), local leaders and different technical staff in different ministries to initiate the promotion of IPM and sound pesticide use. This will streamline the IPM agenda and improve training curriculum.

b) Capacity building of extension staff in IPM, safe pesticide handling and use

The extension staff will include for every site the Agronomist of the Project site, District, Sector and Cell, Cooperative and other partners' Agronomists within the site. The objective of capacity building in IPM and pesticide technology is to improve extension staff and farmers knowledge in alternative pest control methods at an economical level and safe use of pesticides without compromising the environment. The training will cover in detail all ECAATP target crops and pesticides technology.

They will likewise train farmers over season long period on weekly basis on the pests and diseases identification, damage problems, yield loss caused, control methods, and
safe pesticide use.

The training in IPM and pesticides technologies will focus extension staffs in the Sectors and Districts where ECAATP is working with farmers. The training will also create among them the habit to be accountable to the farmers through implementation and close monitoring of plan activities developed during the training. The training will cover PMP and pesticide technology irrespective of the crop specialized by the participants.

The training of target extension staffs will be followed by an on-site training during execution through experiential learning. Since the application of IPM technologies/practices are site specific; it is therefore recommended to go on training of extension staff on new concepts, options and strategies for them to gain specific skills and knowledge for their respective areas, and share with others experience gained during execution period.

The initial training will be for four weeks (one month) as follows below:
The first two weeks will cover the three crops IPM strategies and safe pesticides use. This is equivalent to three days per crop, and three days for pesticides which is an intensive training. The assumption is that they already have field experience and previous training from their institutions.

The third week will cover pesticides, seed technologies and field and institution visits to assess field situations. This will include a visit to RAB, agrochemical suppliers etc as need arises.

The fourth week will be used for planning and budgeting the demonstration and reporting systems. The resource person will guide them on the planning and costing the demonstrations and other related training such as field days, study tours etc. Every extension staff will produce a plan suitable for the site. It will also indicate the link with the whole community. The District and Sector participants will indicate the cost of monthly meetings and reporting and on how it fits in with their plans.

c) Capacity building of farmers in IPM

The training of farmers will be a continuous activity for a season long. Each demonstration or study plot will have 20-30 farmers and not more than 40 farmers. The extension officer will continuously be updated in all aspects of IPM and crop production to enable him/her to train farmers in new improvements. The linkage with research institutes is an important activity. Apart from IPM technologies, farmers will be trained in farm record and cost assessments of all inputs (fertilizers, pesticides, seeds etc) including labor spent for each operation (person days or hours) throughout the season.

The importance of farm record knowledge will enable farmers and extension staff to assess crop productivity by comparing different crop gross margins and make use of this facility in planning for the following season.

d) Demonstrations of IPM technologies

In most cases, farmers training in the application of various IPM techniques and practices will be conducted at the demonstration plots (training sites) established at lead farmer field or other plots of the

SHG, in case the lead farmer does not have suitable site. The SHG lead farmer will offer a plot for establishing the demonstrations, and ECAATP will provide all inputs required. Therefore, the site must be accessible and suitable for the crop. The harvest from the demonstration belongs to the owner of the plot. Farmers learn fast when they immediately practice what was taught. It is anticipated that some farmers will start using IPM approach in the following seasons. The latter will be monitored during the project period.

The extension officer will establish a demonstration plot for each crop to address problems identified by farmers, he will also establish control plot with farmers own practices. The activities on control plot are always done a day before the actual demonstration. The two plots will be used to train farmers in all aspects of crop husbandry, from land preparation, planting and pest and disease assessment and timing of management practice etc.

The demonstrations will be established for each crop. Farming community in the District will get access to learn and practice improved techniques within their reach, since the demonstrations will be more or less accessible to all. The demonstrations are training sites and are useful to farmers willing to learn new technologies which will be well illustrated.

The extension staff together with the farmers will prepare activity plan for the whole cropping season to address the IPM problems arising during the season for each demonstration. The extension staff will make sure that the activities programmed are executed, and weekly training is clearly shown according to crop growth stages.

The extension staff will organize the farmers into small groups of at least 20 - 30 farmers per group from the whole cooperative for weekly training sessions. The farmers in each group, and the extension staff responsible, will decide on the frequency of the training, weekly or biweekly, and the IPM topics to be covered at each session basing on the crop grown. The members of the group may be the lead farmers in the area for large cooperatives.

Each group will be organized by choosing its leadership (chairman, secretary) and together with the extension staff, prepare work programs to be implemented during the whole cropping season. During the field visits, the extension and cooperative leaders will invite farmers and local leaders from neighboring areas to participate. This is an occasion for sensitizing the community on IPM technologies.
.
In addition to demonstration of new technologies, some members may need special training outside project to focus on crop diversification, such as the searching for external markets, meeting market demands and producing sufficient quantities and in right qualities, promotion of processing and conservation of different crops, demonstration of new crops which are not widely produced but have potentials to assist the farming community in wealth creation and poverty reduction like fruit production and marketing e.g. egg plants, pineapples, macadamia and vanilla etc.

e) Organizing field days on demonstration site

The field visit is an occasion at each demonstration to reach the whole community with the message of improved technologies and it is very important in agricultural development.

During every major field visit, actions such as planting, fertilizer application, pesticide application and harvesting can benefit the wider community and local leadership. The extension staff will organize the field day and explain the IPM technology and reasons behind the practice, its application, and importance in improving productivity and production. The community will learn about the technology and will be able to follow up the progress throughout the growing season.

In addition, during the growing season, the extension staff will organize farmer to farmer visits for the cooperative or association in which farmers get opportunities of sharing and gaining skills and practical experiences within themselves and from other farmers near the demonstration which does not require transport.

The extension officer will train farmers on farm record keeping as a tool to follow up and assess productivity and cost of different activities and inputs; to enable assess of the profitability or loss of their agricultural activities in terms of resources, input and labour applied. During the farmer to farmer visits and field days, the farmer will show and explain the record he/she has been taking and their importance in the modern farming in their demonstration. The record keeping is compulsory for every demonstration.

f) Study tours for extension staff and farmers

The training of farmers is a continuous activity involving different approaches to accelerate the adoption process. Farmers learn fast when explained to by other farmers who are practicing similar approaches. The extension staff and farmers will learn and acquire the new technologies when they are exposed to a variety of improved technologies applied by other farmers in different parts of the country or neighboring countries.

ECAATP would finance study tours to other Districts, Provinces or neighboring countries as need arises and when the experts feels that both the farmers and extension can gain benefit from the knowledge from such a trip. There are many places within the country and Region where farmers may profit from the experience of other farmers on pest problem, thus accelerating their adoption of new technologies. In particular, visiting institutes of research or cooperatives such as in Kenya like KARI, ICIPE, and CAB with proper focused guidance will benefit many farmers, extension and research staff in improved technologies available within the region, elsewhere in the world and on how to diversify.

ECAATP would also finance the study tours with focused objectives to address specified problems identified by farmers during execution of their work plan. This will be a follow up training to strengthen the first training. It is better to organize such study tours after first season/year of execution to allow enough time for application and adjustment before the beginning of the following season/year depending on the field experience. The experience elsewhere has shown that the focused study tours give good results.

7.5 ECAATP Capacity and PMP execution

7.5.1 Institutional Assessment and Capacity building

The overall ECAATP management will be the responsibility of Rwanda Agriculture Board (RAB) under the Ministry of Agriculture and Animal Resources (MINAGRI). The Pest management falls under the Directorate of Agriculture Development of MINAGRI.

This Directorate has enough capacity to enforce pesticide regulation. The staffs responsible for pest control, fertilizer application, environment and climate change are key available staff in the Directorate to monitor the implementation of regulations related to pesticide use.RAB does not have social and environmental safeguards staff to manage safeguards matter. However, it has extension and research staff managing aspects related to pest control who are responsible for the implementation of the pesticide related regulations.

MINAGRI has been managing many Projects with same activities as ECAATP, including RSSP and LWH projects which are World Bank funded (LWH and RSSP) through Single Project Implementation Unit (SPIU). The latter has a Safeguards Team familiar with Rwanda and WB safeguards policies. With the new institutional arrangement, the WB funded SPIU will move together with its experienced safeguards team to Rwanda Agriculture Board (RAB) to undertake the ECAATP Project since the ECAATP components are very similar to those of LWH and RSSP.

The existing Safeguards team under WB funded SPIU working on LWH/RSSP projects will need to be strengthened through capacity building to be able to manage the tasks mentioned above for the implementation of ECAATP.

7.5.2 Human Resource Capacity Requirements

The safeguards team at the SPIU is made of 3staff (2 Social safeguards specialists and 1 Environment specialist) who have been overseeing the overall issues related to safeguards in the LWH and RSSP project sites. As mentioned above, the existing SPIU safeguards team will be repositioned to RAB under the new institutional arrangement. There is no doubt they will still execute the same responsibilities for the implementation of ECAATP.

ECAATP will be implemented in close collaboration with participating Districts. Each District, Sector and Cell levels among other staff who are responsible for the Pest management component of the development projects in the District. They are all responsible for the implementation of ECAATP PMP. Due to limited budget, workload and capacity limitation, the engagement of the staff mentioned above is specifically restricted to minor community level development actions.

The SPIU will emphasize on capacity building through trainings and workshops of the relevant district staff and cooperative staff on PMP implementation and monitoring aspects. Such trainings and workshops shall be provided by the project management to ensure proper safeguards management under ECAATP.

7.5.3 Technical Capacity Enhancement

Mobilization meetings, awareness campaigns and trainings on PMP and IPM practices will be required for the following institutions and personnel:

1. RAB/ SPIU ECAATP staff,
2. Local Government Authorities (District, Sector, Cell Agronomists of the Districts covered by ECCATP activities).
3. Farmers organizations (Cooperatives and Associations) and farmers;
4. Community opinion leaders.

The Capacity building will cover the following topics:

- Overview on ECAATP and Pesticides risks/ impacts and mitigation measures
- Stakeholder engagement, consultation and partnerships
- Implementation and monitoring the compliance of safeguards during the operation phase of the ECAATP activities.
- Reporting, monitoring and follow up

CHAPTER EIGHT: PMP IMPLEMENTATION, MONITORING AND BUDGET

8.1 PMP Implementation and budget

As stipulated in the above paragraph, the PMP will be implemented at national level by RAB/SPIU ECAATP. At site level, it will be coordinated by the Site Project staff (mainly Agronomist) in partnership with the officers responsible for agriculture in the District and farmers organizations.

The Budget for the implementation of this PMP will mainly consist on capacity building and the monitoring for compliance with PMP and ESMPs, especially the section regarding the mitigation of pesticides' impacts. The cost for mitigation measures will be included in PMP and ESMPs. The table below show the estimated cost for the implementation of the PMP for the proposed project.

Table 2: Estimated budget for the ECAATP PMP implementation

Component	**Broad Activities**	**Activities**	**Cost (US$)**	**Remarks**
Regional commodity programs	Collaborative development of TIMPs	Monitoring of PMP and ESMPs	50,000	Routine monitoring of PMP and ESMPs throughought the project period
		Capacity building of stakeholders	50,000	Trainings, workshops, study tours, demo plots on IPM approaches and proper use of pesticide for project staff, relevant district staff, farmers' organizations/ Cooperatives and farmers
Total			**100,000**	
Contingency (10%)			**10,000**	
Grand Total			**110,000**	

8.2 Monitoring plan of the PMP

This section sets out requirements for the monitoring of the environmental and social impacts of the ECAATP subprojects. Monitoring of environmental and social indicators will be mainstreamed into the overall monitoring and evaluation system for the project. In addition, monitoring of the implementation of this PMP will be carried out by RAB/SPIU ECAATP, REMA and all key implementing institutions of the project (Districts and farmers organizations).

8.2.1 Monitoring of Environmental and Social Indicators

Two opportunities will be taken to build a simple system for the monitoring and evaluation of environmental and social impacts/risks associated with the use of pesticides. The Environmental Specialist should consider the environmental and social criteria that require measurements (i.e. groundwater levels, soil status, number death or diseases cases related to pesticide use, etc); a list of initial proposals is given below;

Table 3: List of proposals of monitoring indicators

Type of impact/ issue	**Monitoring indicators**
Water quality and pollution	Presence of pesticides residues in water
Soil contamination and soil fertility reduction	Presence of pesticides residues in soil, nutrient content
Public health problems	Number of reported cases of deaths or chronic diseases due to pesticide poisoning
	Number of people adopting IPM or properly handling pesticides
	Awareness on safety measures at the site (Number of workers with protective equipement, etc)

Using this list of criteria, a set of indicators can be integrated into the screening forms used in the project approval process in each project site. This will ensure flexibility at the subproject design stage, integration of monitoring considerations throughout the subproject cycle, as well as a participatory approach to environmental and social monitoring.

The goals of monitoring are to measure the success rate of the project, determine whether interventions have resulted in dealing with negative impacts, whether further interventions are needed or monitoring is to be extended in some areas.

8.2.2 Monitoring of Participation Process

The following are indicators for monitoring of the participation process involved in the project activities.

- Level of decision making of pesticides dealers and users;
- Level of understanding of project impacts and mitigation;
- Effectiveness of local authorities to make decisions;
- Frequency and quality of public meetings;
- Degree of involvement of women or special groups (youth, elders, etc) in discussions.

8.2.3 Evaluation of Results

The evaluation of results of environmental and social mitigation can be carried out by comparing baseline data collected in the planning phases with targets and post-project situations. A number of indicators would be used in order to determine the status of affected people and their environment (quality of water compared to before, number of people suffering from pesticides effects, etc).In order to assess whether these goals are met, the ECAATP Environmental Specialist with technical support of the Advisor will indicate in the ESMP, parameters to be monitored, institute monitoring milestones and provide resources necessary to carry out the monitoring activities.

8.2.4 Monitoring of PMP Implementation

The Project will monitor the PMP implementation at site level and regularly produce progress reports. In addition to the Project Reports, an annual audit on PMP implementation will be prepared by the SPIU and delivered to REMA and the World Bank. The table below summarizes the above monitoring program:

Table 4: PMP Monitoring Program

Impact	Parameter to be Monitored	Indicator	Method	Frequency	Responsibility	Cost Estimates (US$)
Water Pollution	pH, N, P, pesticides residue	Test Results	Laboratory Analysis as per Standard Methods	Once a year	ECAATP/RAB REMA, RWFA	30,000
Soil Pollution	pH, N, P, pesticides residue	Test Results		As and when required	ECAATP/RAB REMA	15,000
Public health Problems	Number of reported cases of deaths or chronic diseases due to pesticide poisoning	Report	Census in the project area, Collection of data from health centers in the site vicinity	Once a year	ECAATP/RAB District	5,000
Low capacity of stakeholders	Number of extension staff, leader farmers trained, Field visits, study tours, demo plots done	Report	Training, field visits, study tours, demo plots	Regularly	ECAATP/RAB/ Cooperative Districts	50,000
Total						100,000
Contingency (10%)						10,000

Impact	Parameter to be Monitored	Indicator	Method	Frequency	Responsibility	Cost Estimates (US$)
Grand Total						**110,000**

8.2.5 Monitoring Roles and Responsibilities

A) Rwanda Environment Management Authority (REMA)

REMA will play the leading oversight role of monitoring the activities of this project. The REMA will carry out this role by ensuring that the environmental and social management plans (ESMPs) contained in the cleared ESIA and PMP are being implemented as specified therein.

REMA will monitor the reports on a regular basis, mostly annually. They will rely on a bottom up feedback system from the ground by going through the monitoring reports and making regular site visits to inspect and verify for themselves the nature and extent of the impacts and the success or lack off, of the mitigation measures.

B) Project support and coordination Unit (SPIU)

The ECAATP Monitoring and Evaluation Officer will be primarily responsible for ensuring compliance to the monitoring framework. Jointly with the Environmental Specialist, they will undertake review of the monitoring reports from the Project sites and will then upon approval submit these monitoring reports to REMA and the World Bank. The SPIU ECAATP will also provide overall coordination in monitoring including training coordinating of training in collection and analysis of monitoring data for data collectors. The critical role of the SPIU will include data analysis, maintenance of management information systems and all baseline data. Lately other than preparation of periodic reports, the SPIU will implement all the necessary modifications in the monitoring framework.

C) Districts

The district authorities will also be involved in the monitoring of the specific components of project that they are targeted to execute. The participating Districts will assist in mobilizing local communities in the project intervention areas for the adoption of IPM and proper pesticide use. Through the district Agronomist, the district will monitor on daily basis the implementation of safeguards measures reflected in the ECAATP PMP report.

D) Local Communities

Local communities will be useful agents in collection of data that will be vital in monitoring and as such they will play a role in the monitoring framework. Local communities in the project intervention areas will receive training and capacity building skills in data collection to be done by the implementing agencies so as to equip them with the ability to collect data.

8.2.6 Reporting

A monthly Site meeting will be organized during the **1st week of every month**. At least three training sessions at each demonstration site are expected per month unless specified during monthly planning.

This will initially be done during the beginning of the season and apply to all crops, but more focused on four annual crops (maize, rice, potato and tomato) which grow very fast. The cassava may be adjusted for one or two weeks as season progresses. The weekly plant growth changes and pest damage understanding is important lesson throughout the growing season.

The information on what was trained, observations made, pest damage, pest management decisions made and other related activities like study tours to farms with disease or pest problem of particular interest for farmers, farmers attendance and visits to demonstration, input use and costs, labour used as man's days and costs will be reported in the monthly report for each demonstration.

The pest damage may be clearly seen in other place and the trainers may need to take farmers to make observations in these fields. The trainers should be sensitive on how to make farmers understand properly pest problems and pesticide handling.

In case the farmers and farmers' organizations are found not to comply with environmental and social safeguards during pesticides application, the Project directly shall technically assist farmers through intensified trainings, workshops, study tours, field visits, etc to increase beneficiaries' awareness, ownership and therefore improve compliance with environmental and social safeguards.

Each IPM demonstration will be about 0.1 ha or less and parallel comparison as farmers own practices. The latter should be treated usually a day before IPM management applied where possible (e.g., fertilizer application). The Site extension staff compiles reports for all demonstrations and forwards to ECAATP with copy to participating Districts. The report should reach ECAATP not later than 5th of every month. This will give ECAATP time to attend to some of the constraints raised during the month. The Project will have a week period to respond to unresolved issues at the site. The extension staff will monitor the progress through established monthly reports and regular field visits to backstop them and give on- spot advice.

During every three months, all interested in IPM activities will meet to discuss the progress report and activities plan for the following three months. ECAATP may consider financing such quarterly planning meetings in every District.
The District extension staff, cooperative/association extension staff sponsored and none sponsored by ECAATP and representative of farmers responsible for IPM execution will give quarterly reports and planned activities for the following quarter, and should reflect the approved work program for each in association or cooperative. The ECAATP liaison officer (ECAATP Agronomist) should plan to make sure that this meeting is planned jointly with the monthly meetings. This should include:

- ✓ Name of crop and area under demonstration,
- ✓ Activities performed during the month,
- ✓ Number of farmers involved,
- ✓ Dates of various activities,
- ✓ Inputs used
- ✓ Pest and diseases observed and control methods
- ✓ Person hours or days spent on each activity
- ✓ Field days and number of people attended
- ✓ Farmer to farmer visits done and number of participants

- ✓ Leaders invited and attended any of IPM events
- ✓ Lessons learnt and problems during the month
- ✓ Other activities done by the group
- ✓ Future plans
- ✓ Observation and suggestions

At the end of the season, each group organizes end of season evaluation and planning meeting where all farmers in the groups participates and assess the production and yield. This is the day when they plan activities for the following season for the group basing on the ending season experience. The SHG leaders compile their group's success, constraints and plans for the following season into a comprehensive report. The Project Site staff will organize the end of season workshop where all group leaders will present their reports. These will be compiled as an end of season report and submitted to the ECAATP with copy to participating Districts. The Project Site Coordinator may plan to attend the district planning meetings. The two season reports will make up end of the year report for presenting at the National IPM Planning workshop.

At the end of every year, a senior agronomist/IPM will organize an evaluation and planning workshop where farmers will participate. The workshop will discuss the execution during the year, success and identify key problems met during the ending year. During the workshop, every Site Coordinator/ extension officer will give presentations on the progress, achievements and constraints met during the previous year and the plan for the following year.

During the second year, the representatives of farmers will also be invited and present their reports on their participation and views on performance of IPM extension service and improvement needed. The farmers report may be verbal, not necessarily written to enable participation of farmers who do not know how to write or read but are key people in the execution of IPM in their area to share their experiences with others.

It may also involve different stakeholders such as Research and High Education Institutes, NGOs, and Donors interested in IPM and environmental protection.
The proceedings from workshop are an important document, since it includes farmers experience and reports from all Districts in the country where ECAATP will be operating.

8.3 Disclosure of PMP

Subsequent to its preparation by the Ministry of Agriculture and Animal Resource (MINAGRI) and clearance by the World Bank, the ECAATP PMP will be disclosed by making copies available at the RAB/SPIU head office, Project website and to the local government agencies and other stakeholders. The Government of Rwanda will also authorize the World Bank to disclose this ECAATP PMP electronically through its external website.

CHAPTER NINE: CONCLUSION AND RECOMMENDATIONS

The Government of Rwanda (GoR) received funding for the establishment of a center of leadership on land husbandry in Rwanda and prepared the PMP for ECAATP that will be implemented across subprojects sites to ensure the project implementation is in full compliance with Rwanda and World Bank environmental and social safeguards policies with regards to pest management.

The document focused on policy, legal and institutional frameworks, current status on IPM and use of pesticides in the country, pest and diseases management practices relevant to ECAATP, environmental and social impacts associated with pesticides use as well as guidelines for their mitigation, implementation strategy and monitoring process. The public consultation and participation meetings conducted. The total cost for the implementation of proposed activities to comply with PMP is estimated at US $ 110,000 for 5 years project period. The monitoring cost is also estimated at US $ 110,000, making the total implementation and monitoring cost at US $ 220,000

Given the nature of the project, the potential adverse impacts associated with pesticides use are minimal and can be controlled through proposed mitigation measures. Successful implementation of this PMP will depend to a large extent on the involvement and participation of local communities. Specifically it is recommended that awareness and capacity building on IPM and proper use of pesticide be organized mostly to extension staff, cooperatives and farmers.

This PMP should be regularly updated to respond to changing local conditions. It should be reviewed and approved through the national approval process and by the World Bank prior to project negotiations. It should also incorporate lessons learned from implementing various Components of the project activities. This framework will apply to any project activity within the ECAATP.

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ANNEXES

Annex 1:Terms of reference for The Preparation Of Formulation Of The National Integrated Pest Management (IPM) For Eastern and Central Africa Agricultural Transformation Project (ECAATP)

Background

Agriculture in sub-Saharan Africa suffers from low productivity growth, mainly due to slow progress in the technology of production and inefficient use of available technology – and the low productivity growth has delayed structural transformation. While agriculture output growth in sub-Saharan Africa (SSA) has improved over the last several decades, productivity growth lags far behind other regions. The output growth gap between SSA and other developing regions has narrowed down tremendously, by about 83 percent between 1961-84 and 1984-2012. The output growth gap measured in terms of average annual output growth between SSA and other developing countries was 0.73 percentage points between 1961 and 1984 (1.91 percent in SSA versus 2.64 percent in other developing countries). More recently, the gap has been narrowed down to 0.12 percentage points between 1985 and 2012 (3.35 in SSA versus 3.47 in other developing countries). However, output growth in SSA has largely been driven by expansion in area under cultivation, while in other regions, output growth is mainly through productivity growth driven by input intensification and Total Factor Productivity (TFP) growth. For example, between 1985 and 2012 about 63 percent of annual output growth in SSA was due to area expansion while only 17 percent of growth in other developing countries was due to area expansion. On the other hand, input intensification and TFP growth played a major role in agricultural output growth in other developing countries, accounting for 32 percent and 51 percent of the growth. In contrast, input intensification and TFP growth accounted for a paltry 8 percent and 29 percent of agricultural output growth in SSA.

In addition to the TFP, climate change is another major challenge for agriculture in the region and the sector is also a major contributor to GHG emissions. Most global climate models project severe and adverse consequences for crops and livestock, especially for the most food-insecure regions.

The participating countries in the region have identified several important actions in agriculture in order to enhance productivity: first workout the Agricultural Total Factor Productivity (TFP); secondly prime the total market for food and beverages candidature in countries – Kenya,

Uganda, Tanzania, DRC, Burundi, Republic of Congo, and Rwanda – which is about US$60 billion[1]; and lastly to combat climate change.

Agricultural Total Factor Productivity in the region is lagging behind because: (a) the performance of new technology of production is not significantly different from that of oldtechnologies; and (b) farmers are less efficient in using available technology of production. Over the last few decades, agriculture in SSA has lagged far behind in TFP growth compared to Brazil, South Africa, and China. The significantly low progress on TFP growth can be attributed to: (i) weak technical progress in agriculture such that performance of new technologies is not significantly higher than old ones; and (ii) inefficient use of existing technology by farmers, mainly due to weak dissemination and advisory systems and sub-optimal adoption. There is an enormous opportunity to grow agriculture in SSA through input intensification and TFP growth – driven by research and development to generate new technology that dramatically out-performs old technologies, effective dissemination and advisory services, skilled labor force to apply the technologies correctly, and linkages with markets that reward better technology of production. Promoting TFP growth in agriculture is consistent with WBG Regional Strategy Update (2017) message that future growth in African countries will increasingly need to come from higher total factor productivity.

Food markets play a major role in meeting the food needs of both urban and rural consumers in Sub-Saharan Africa. It is estimated that about 60 percent of the food consumed in the region is purchased from both traditional and modern retail outlets . The share of food purchases is expected to growth even further. Most of the growth will come from urban consumers, with supermarkets capturing the segment for perishable and highly processed foods, while the remaining segments of food demand will largely be supplied through traditional channels.

Meeting the challenges of climate change requires investments to build the resilience of crop and livestock sectors to near-term shocks and adapting to long-term trends of the changing climate. Climate-smart agriculture (CSA) offers an appropriate strategic framework for responding to and reducing the adverse effects of climate change, because it aims to: (i) sustainably increase agricultural productivity and incomes; (ii) adapt and build resilience to climate change; (iii)

[1] Estimate for each country is a product of its current population and food and beverage consumption/capita extrapolated from 2010 to 2016

reduce and/or remove greenhouse gas (GHG) emissions, where possible ; (iv) climate-risk management such as crop insurance; and (v) re-orienting agricultural research and development towards climate resilient technologies and management practices, etc.

Project Description

The proposed Eastern and Central Africa Agricultural Transformation Project (ECAATP) meets all the eligibility criteria for Regional IDA. The eligibility criteria for regional IDA is met because: (i) the project includes more than three countries actually seven; (ii) the project generates goods of a public nature that will be shared widely among participating countries (and most probably beyond) while providing mechanisms to respond to common challenges (e.g. outbreaks of crop and animal pests and diseases and natural disasters such as drought); (iii) there is clear evidence of regional commitment to the project, building on the regional collaboration established in the first phase (EAAPP), and most recently demonstrated by very constructive consultations during the multi-country project identification mission workshop of April 2-13, 2017 which formed the basis for this concept note and where countries confirmed interest for the project and its proposed objectives and technical components; and (iv) the project will provide a platform for policy harmonization across the region to create an enabling policy and regulatory environment for regional collaboration in development, transfer, and exchange of technologies – as well as promote regional integration of markets for food commodities.

The proposed project will build from the success of the regional agriculture projects in Africa. Since 2008 the World Bank has supported three regional agriculture productivity projects: West Africa Agricultural Productivity Project (WAAPP); Agriculture Productivity Project for Southern Africa (APPSA); and East Africa Agricultural Productivity Project (EAAPP) – which was implemented in four countries (Ethiopia, Kenya, Tanzania, and Uganda) from 2009-2015. These projects have been quite successful in: (i) initiating and strengthening regional collaboration in development, transfer, and dissemination of agricultural technologies; (ii) training and capacity building; and (iii) increasing farmers' access to the technologies, innovations, and management practices.

The proposed project will focus on transformation of agriculture in the region. The aim of agriculture transformation is to improve the effectiveness of the sector in raising incomes, reducing poverty, improving nutrition outcomes, addressing the challenges of changing climate,

fostering regional integration of markets for food commodities and products, and providing better jobs – including to skilled youth and women. This is a strategic shift from previous regional agricultural projects that had focused primarily on productivity. The project's technical aspects will be guided by the following elements of agricultural transformation: (i) enhancing technology of production along the entire commodity value chains, including by providing farmers with access to technical knowledge and improved seeds and breeds; (ii) building resilience in primary agriculture to changing climate and promoting nutrition-sensitive agriculture and food safety; (iii) developing critical skills to meet the needs of current and future food systems, including skills required by private and public sectors; (iv) forming partnerships and alliances that connect farmers with markets and enable farmers to understand market needs and produce for the market, (v) regional integration of markets for technology of production, food commodities and food products; and (vi) facilitating a policy and regulatory environment that actively enables regional collaboration in developing solutions across the value chain and which encourages private-sector participation, including in technology development.

The project components identified to contribute to transformation of agriculture in the region include:

Component 1: Supports work on Regional Commodity Programs - The objective of this component is to enhance regional collaboration in the development of agricultural technologies, innovations, and management practices (TIMPS) for selected commodities and to facilitate exchange and dissemination of the TIMPS across national boundaries. Agricultural technologies are developed for agro-ecological conditions and not national boundaries. The component will focus on commodities that are important for regional food and nutrition security, and strategic regional value chains to create jobs and provide income generation opportunities. The component is organized into three sub-components: (i) establishment and strengthening of regional and national centers of leadership/excellence; (ii) collaborative development, transfer, and dissemination of agricultural technologies; and (iii) emergency response.

The expected results from component 1 include: (i) number of improved technologies, innovations and management practices (TIMPS) released by multiple countries (percentage climate smart); (ii) number of TIMPS released by country (percentage climate smart); (iii) time

and cost saved in technology development; (iv) number of farmers adopting improved technologies; (v) amount of GHG emissions reduced; (vi) increased crop and livestock productivity for selected commodities; (vii) number of networks for scientists established; and (viii) number of regional centers of leadership/excellence established or strengthened.

Component 2: Focuses on Agriculture Education, Skills Development, and Service Delivery - The objective of this component is to provide the current and future labor force with critical knowledge and skills that: (a) promote faster technical change in agriculture, especially in technology development, and innovations to improve access to markets; (b) meet the needs of private sector agribusinesses and the public sector – including policy analysis; (c) are likely to be employable by the food system now and in the future; and (d) encourage innovation and entrepreneurship in transforming agricultural value chains and linking primary agriculture with the emerging food system and formal markets. Three sub-components are proposed to contribute to this objective: (i) establishment of centers of leadership/excellence in key disciplines of agriculture education; (ii) enhancing skills of stakeholders along value chains; and (iii) promoting effective models for service delivery.

The expected results from component 2 include: (i) number of centers of leadership/excellence established for providing relevant education for the food system; (ii) number of stakeholder (labor force, farmers etc.) trained with critical skills for the food system; (iii) number of farmers accessing mechanization services; (iv) number of farmers accessing labor-reducing technologies (% women); (v) number of farmers accessing innovative ICT based extension and advisory services (% women); and (vi) innovative food and agricultural products.

Component 3: SupportsEnabling Policies and Agricultural Markets. The objectives of this component are: (i) to create an enabling policy and regulatory environment for regional collaboration in development, transfer, and exchange of technologies; and (ii) to improve smallholder farmer's access to regional and national markets for food commodities and products. Two sub-components are proposed: (a) enabling policies; and (b) linking smallholder farmers' access to markets to regional and national markets.

The expected results from component 3 include: (i) number of harmonized policies domesticated by countries; (ii) number of farmers accessing regional and national markets (% women); (iv)

volume and value of commodities marketed in various platforms (productive alliances, commodity exchanges, direct purchases etc.); (v) value of warehousing receipts issued, by commodity; and (vi) amount of private investment leveraged in de-risked agribusinesses.

Component 4: Supports Regional Coordination and Project Management. The objective of this component is to coordinate the project at the regional and national levels. Two sub-components support this objective: (i) regional coordination and learning; (ii) national project management and evaluation. The expected results from component 4 include: (i) timely implementation progress of regional and national sub-projects; (ii) effective dissemination and communication of project results and challenges; (iii) timely M&E reports; and (iv) Functioning MIS.

Overall objective of consultancy

To enhance Integrated Pest Management within ECAATP.

Specific Objective

(i) To assess the pest and disease status in the project in Rwanda.

(ii) To propose appropriate Integrated Pest Management strategies so as to reduce risks of pest attacks and associated damage.

(iii) To develop an integrated pest management/control strategy/regime that uses appropriate arrays of complementary methods – natural predators and parasites, pest-resistant tree/crop varieties, cultural practices, biological controls and other physical techniques.

(iv) To assess the capacity to design and implement IPM regimes.

(v) To define clear profile of the institutional or partnerships mandates in the implementation of IPM within the Project.

(vi) To define/outline outstanding relevant researchable areas.

(vii) To provide clear policy recommendations on how to address any risks related to pests that the project may stimulate, and

(viii) To develop a comprehensive pests monitoring and evaluation regimes.

Specific Tasks/Activities

The consultancy will be expected to undertake the following tasks:

(i) Review ECAATP documents as an input into this consultancy.

(ii) Review current pest and disease control strategies in the Project (including institutional, policy and

legal frameworks).

(iii) Review the impact of the current pest control measures.

(iv) Identify key pests and diseases of the major crops and livestock in the Project

(v) Quantify the losses attributed to these pests and diseases.

(vi) Propose appropriate Integrated Pest Management strategies for the major pests and diseases in the

Project.

(vii) Define appropriate implementation strategy for the proposed measures.

(viii) Propose a monitoring and evaluation framework for the IPM.

(ix) Prepare a final National IPM Report.

Methodology

The Consultant shall undertake the above tasks in close collaboration with the client. The consultancy will be done in two stages: an inception phase and the main stage.

During the inception stage, the Consultant shall:

(i) Carry out a preliminary assessment of available data by doing desk reviews on existing empirical and situational literature and case studies.

(ii) Produce an inception report.

(iii) In collaboration with the client, hold a stakeholders, inception workshop The purpose of the inception report will be threefold:

(i) To test the understanding of the terms of reference by the consultant.

(ii) To state clearly how the consultancy will be carried out, in terms of both the methodology and timelines, as well as the anticipated limitations/constraints; and

(iii) To state the progress which will have been made and problems/challenges if any.

During the main stage the consultant will:

(i) Consult with appropriate stakeholders, projects and programmes relevant to the assignment.

(ii) Use appropriate approaches for the study to review the study reports and identify the issues and propose in detail the needed interventions as specified.

(iii) Produce the *Mid-Term* and *Draft* Final Report.

(iv) In collaboration with the client, hold a Stakeholders Workshop for consideration of the *Draft* Final Report; and

(v) Incorporation of comments to produce and submit a Final Report.

Outputs from the consultant

The outputs shall be:

Inception report - 1 week from the date of signing the Contract

Mid Term Report - 3 weeks from the date of signing the Contract

Draft final report - 5 weeks from the date of signing the Contract

Final report - 6 weeks from the date of signing the Contract

All Reports will be submitted in both hard and soft copies (5 hard copies).

Duration of the Assignment

The duration of the consultancy will be executed within a period of one and half (1.5) months and the assignment a maximum time of 40-person days.

Qualifications and Experience

The consultant must have at least M.Sc/M.A/MBA in any of the following areas:

a) Pathology/Pharmacology/Parasitological.

b) Entomology.

c) Integrated Pest Management.

d) Environmental economics.

e) Ecology

f) Environmental Chemistry/ Applied

g) Environmental science.

h) Law.

i) Sociology

The consultant must have at least 10 years of relevant experience.

LANGUAGE

The Final report to be submitted in both electronic and hard copy and should be in English.

Payment Schedule

The client will pay ten percent (10%) of the contract price upon the signing of the contract, 20% upon submission of an acceptable inception report, (40%) on presentation of draft final report andthirty percent (30%) upon submission and acceptance of the final report.

Annex 2: **PMP development methodology and documents and people consulted**

a) Consult existing documents and reports

b) Consult RAB and extension staffs

c) Consult buyers

d) Consult inputs sellers

Annex 3: **Agricultural inputs and pesticides recommended in Rwanda**

(source: MINAGRI-RAB).

1. List of agricultural inputs

1.1. Fertilizers

*Agricultural lime

*Ammonium sulphate

*CAN

*Compound fertilizers; DAP 18-46-0; NPK 17-17-17; NPK 20-10-10; NPK 20-5-5

*Micro-nutrients fertilizers

*Nitrogen fertilizers: urea 46%

*Others fertilizers

*Phosphates fertilizers

*Potash fertilizers: KCL

1.2. Seeds and plant material

1.2.1. Insecticides and acaricides

* Abameclin

*Acephate

*Acrinathrin

*Alphacypemethrin EC

*Alphamethrin EC

*Amitraz EC

*Azocyclotin WP

*Beta-cyfluthrin 2.5% EC

*Betacypermethrine EC

*Bifentrhin 0.05%PP,80g/l

*Bromopropylate EC

*Carbofuran 2.5%, 5% Granules

*Chlorpyriphos-ethyl 48%EC, 5% Granules

* Chlorpyriphos-methyl 50%EC

*Clofentezine

*Clofenzine EC

*Confidor super

*Cyfluthrin EC

*Cyhalothrin (15g)+Chlorpyriphos(300g)

*Cypermethrin 10%EC

*Deltamethrin (12g) +Chlorpyrifos(300g)

*Deltamethrin 2.5% EC,WP, Tablets

*Detamethrin

*Dichlorvos EC

*Dienochlor WP

*Dimethoate 40% EC

*Fenazaquin SC

*Fenbutatin oxyde SC

*Fenitrothion EC

*Fenthion 50% EC

*Fenvalerate EC

*Fipronil 0.05 RB, 25g/IFS

*Flufenoxuron EC

*Flumethrin EC

*Hexythiazox WP

*Imidachlopride 200g/l SL, EC, 300g/l SL, EC

*Lambda-cyalothrin 50g/l EC

* Malathion, PP

*Methomyl 90 WP

*Methomy SL

*Nimbecidine

*Omethoate EC

*Permethrin 0.5%PP; 0.7%EC; 20%EC; 25%EC

*Phosphure d'aluminum(PH3):pillis, tablets and plates for fumigation

*Pyrimiphos-methyl 2%PP

*Tau-fluvalinate EC

*Tebufenpyrad WP

*Teflubenzuron SC

*Teradifon EC

1.3. Fungicides

*****Azoxystrobin SC

*Benalaxyl

*Benomyl 50%WP

*Bitertanol EC

*Bupimate EC

*Captan

*****Carbendazime+chlorothalonil EC

*Chlorothalonil

*Cuivre+chlorothalonil 250g/l WP

*Cuivre+propineb 37%+17%WP

*Cuivre de l'oxyde de cuivre cuivreux

*Cuivre hydroxyde WP

*Cymoxamil+propineb

*Dichlofluanid WP

*Difenaconazole EC

*Dimethomorphe+mancozeb 69%WP

*Dithianon SC

*Dodemorph

*Epoxiconazole+carbendazime EC

*Fenarimol

*****Flutriafol+thiabendazole EC

*Flutriafol 125g/SL, EC

*Fluzilazole EC

*Folpel 50WP

Folyoxin-al

*Fosetyl-aluminium WG

*Hexaconazole SC

*Iprobenfos 480g/EC

*Iprodione SC

*Kresoxim-methyl WG

*Mancozeb+metalaxyl 62.5% WP

*Mancozeb 80% WP

*Metiram WP

*Micronised Sulphur WG

*Oxychlorure de cuivre WP

*Penconazole EC

*Propamocarb hydrochloride SL

*Propineb 70% WP

*Pyrimethanil SC

*Tebuconazole WP, EC

*Thiabendazole EC

*Thiophanate methyl SC

*Thirame 80% WP

*Tricyclazole 75% WP

*Triforine EC

*Vinchlozoline 50% SL

1.5. Herbicides

*2,4 D(acide dichloro-2.4 phenoxy acétique)

*Acide organique halogéné: dalapon 85% WP

*Alachlor+Atrazine

*Amerthrym 50SC

*Diuron

*Diuron 80 SC

*Gluphosate 360 LC

*Glyphosate 360g/l SL, Granulés

*Lasso-atrazine,EC

*Methribuzin

*Metolachlor 960g/l EC

*Paraquat 40g/L SL

*Propanil 360 g/l EC

*Trietazine : Atrazine 500g/l SC, Ametryne 500g/SC

*Trifluraline+linuron EC

1.6. Rondenticides

*Brodifacoum

*Bromadialone

*Bromadialone+Cumatetralyl+Sulfaquinox

*Coumatetryl

*Difenacoum

1.7. Nematicides

*Aldicarbe

*Dazomet 98% G

*Phenamiphos

1.8.Molluscicides

*Mercaptodimethu

*Methaldehyde 5 G

1.9. Growth Regulators

*Daminozide 85% SP

*Substances à composition complexe : rootone ; speedone ;etc

1.10. Oil additive

*Alkyl phenol/ethylene

1.11. Biological control

** Bacillus thurengiensis*

List of pesticides prohibited in Rwanda

Name	Category
1. Aldrin	Organochloré
2. DDT	Organochloré
3. Dieldrin	Organochloré
4. 1-2 Dibromoethane	Dérivé bromé
5. Fluoroacetamine	Dérivés fluorés
6. H.C.H Gamma(lindane)	Organochloré
7. Choldimeforme	Organochloré
8. 2 , 4 , 5-T	Acide phénoxyacetique
9. Captafol	Phtalimide
10. Chlordane	Organochloré
11. Dinoseb et sels de dinoseb	
12.H.C.H (melandes d'isomeres)	Organochloré
13. Heptachlore	Organochloré
14. Hexachlorobenzene	Organochloré
15. Composés de mercure	Dérivés de mercure
16. Chlorobenzilate	Organochloré
17. Penchlorophenol	Chloronitrophenol
18. Monocrotophos	Organochloré
19. Methamidophos	Organochloré
20. Phosphamidon	Organochloré
21. Methyle-parathion	Organochloré

Annex 4: Development of an Integrated Pest Management (IP M) strategy in the frame of the ECAAT project in Rwanda.

I. Global concept and introduction remarks to IPM

I.a. General Consideration relative to biotic constraints

The main goal of agriculture is production of food for human beings and generation of incomes for those who operate mainly in this primary sector of economy. However, agricultural production is hampered by various limitation factors including (i) low soil fertility, (ii) soil erosion, ((iii) limited access to various production factor (seeds for example), (iv) use of inappropriate cropping practices, (v) damages caused by biotic constraints (pests and diseases). This last category of constraints (pests and diseases) is a high limitation to the agricultural development in Rwanda. In fact, it is considered that in the country, biotic constraints induce yield losses at levels reaching 25-30% before harvest and 20% at the post-harvest level. In the same frame, a progressive increase of the problems due to pests and diseases was in Rwanda. Some recent examples of pests and diseases which occurred in Rwanda as well as in the Eastern and Central African Region illustrate well how these constraints constitute a permanent threat for sustainable development based on agricultural production.

One example is the cassava mosaic disease (CMD) caused by several virus species belonging to the *Begomovirus* genus and inducing the typical symptoms of CMD. Maruthi *et al*. evoked existence of the following virus species induc ing the CMD: (1) *African cassava mosaic virus* (ACMV), (2) *East African cassava mosaic virus* (EACMV) and (3) *Indian cassava mosaic virus* (ICMV). Each of the previous viruses was considered to have a restricted specific geographical localization with ACMV and EACMV occurring respectively to the west and east of the African Rift Valley while ICMV is found in the Indian sub-continent.

Recent development of the disease in Rwanda affected most of the traditiona l clones leading thus to a very significant decrease of cassava production in the country. A second biotic constraint which is reaching high importance in Rwand a is the Banana xanthomonas wilt (BXW) caused by the bacterial agent *Xanthomonas vasicola* pv. *musacearum* (formerly *Xanthomonas campestris* pv. *musacearum*). This disease is already established in Rwand a where it is observed in different districts of banana production. Given there are no resistant varieties, control measures have to be adopted in view of limiting the widespread of the disease throughout the country.

A third significant example of biotic constraint which is posing serious production problems in Rwanda is the Passion fruit woodiness disease induced by a potyvirus agent PWV7. In fact, development of passion fruit production in Rwanda was considered as being a strategic aspect due to the high value added of passion fruit. Howev er, presence of woodiness disease in Rwanda was announced by ADAR/Chemonics to have been identified for the first time in May 2002.

All these previous examples illustrate how control of pests and diseases has to be considered as a main priority. For that, it seems interesting to highlight the different control methods prior to IPM consideration in relation with the different crops.

I.b. Various methods of pests and diseases control

To reduce and/or limit damages induced by pests and diseases in crop production, different methods can be exploited. The different control methods can be grouped in the following main categories (i) use of appropriate cropping practices, (ii) use of genetic host resistance, (iii) chemical control methods, (iv) physical methods and (v) biological methods.

Cropping practices.

By using the appropriate cropping measures, it is necessary to have a good understanding of the biotic agents (pests and/or pathogens) biology in view of reducing favorable conditions for them and thus making that plants escape their attacks. For example, crop rotation is a suitable cropping practice allowing limiting development of some specific pathogens and/or pests for a given crop. Its utilization can thus lead to a sustainable control of biotic constraints in a context of intensive production system. It is considered that the purpose of crop rotation is to provide optimal growing conditions for cultivated plants by means of timely sequencing or grouping together the cultivation of various types of crops suitable to the location. In fact, in systems where rotation of crops is not respected, there is a continuous selection pressure favoring development of pests and pathogens adapted for the crop of interest and this results rapidly in high levels of production losses.

Genetic resistance

The use of genetic host resistance relies on the choice of varieties presenting resistance against the biotic constraints prevailing in a given area. In this frame, it is important to notice the

existence of different types of resistance with specific resistance (vertical resistance) and non-specific resistance (horizontal resistance)10. These main categories of genetic resistance can be differentiated by the fact that specific resistance is efficient against some races within a given species of biotic constraint while the non-specific resistance is efficient against all the races within a given species of biotic constraint. By using a resistant variety, it becomes possible to easily control pests and/or diseases. This method of control seems to be very suitable in the context of farmers who have a limited access to the different production fact (pesticides for example). However, it is interesting to notice that specific resistance can be overcome through the process of resistance breakdown. An example of resistance breakdown is presently observed in different Asian countries where the banana variety 'Goldfinger' previously selected and widely used for its resistance against the Black Sigatoka disease has now lost its resistance properties leading to a very important development of disease symptoms.

Based on this particular example, it appears clear that resistance to biotic constraint can evolve and a variety presenting resistance in a given area can become highly susceptible after a more or less long period of cultivation. In these conditions, it is important to adopt measures which can prolong durability of a given resistance.

To ensure sustainable efficiency of resistance, durable management of resistant varieties can be achieved through some particular schemes like the use of multilines and/or mixtures of varieties11. Efficiency of these strategies of multilines and/or mixtures is due to three main effects known as (i) dilution phenomenon, (ii) barrier effect and (ii) induced resistance phenomenon. This explains the long efficiency in control of pests and diseases which is observed with common bean mixtures utilization in Rwanda and other countries in the Region.

Durable management of resistance has to take into consideration different data relative to the origin of inoculum (auto-infection or allo-infection) as well as to the pathogen (or pest) population evolution during the different successive cropping seasons.

Chemical control

Chemical control of pests and diseases consists in application of chemical plant protection agents belonging to different groups according to the plant enemies to combat (fungicides, insecticides, acaricides, nematicides, herbicides etc…). According to the effect of the chemical product

application, it is possible to differentiate (i) eradicative methods, (ii) protective methods and (iii) curative methods. For the eradicative methods, chemical plant protection agents are applied to destroy the damaging organisms outside or on host plants. In the frame of protective methods, plants are protected by having their surface covered by the chemical protection agent in view of preventing attack and invasion of the damaging organisms. Finally, for the curative methods , treatments of the already infested plants are achieved in view of ensuring that they are cured. In that context, the active ingredients of the chemical compounds must be capable of penetrating into the plant.

Whatever the type of protection offered by the different main types of methods using chemical protection agents, it is essential to notice that although the efficiency in pests and disease control, the use of chemical protection agents leads to several types of negative consequences in terms of (a) effect on the ecosystem, (b) development of resistance and (c) residue problems (residues in foodstuffs, possibility of accumulation in the ground and risks of accumulation via the food chain).

Now it is well established that intensive chemical plant protection results in negative effect on the ecosystem due to unbalanced and excessive application of the plant protection agents. This phenomenon was already observed for insecticides, acaricides, herbicides and fungicides. One of the effects of high utilization of chemical protection agents is the destruction of natural balances between the pests to be controlled and their natural enemies and/or indifferent organisms. This is unintentional removal of factors regulating populations.

On the level of development of resistance, there is possibility to observe a phenomenon of development of the ability in a population of damaging organisms to tolerate doses of a compound which are lethal to the majority of individuals in normal, untreated populations of the same species. In these conditions, it becomes necessary to change chemical plant protection agents but the most common consequence at the farmer level is the increase of doses applied or to increase the frequency of treatments.

Physical methods for control of pests and diseases.

Use of physical methods to combat damaging organisms in crop production remains limited. However, it is obvious that in some cases some physical treatments can be achieved to ensure control of pests and/or diseases. Physical methods can be subdivided into two main categories as following: mechanical methods and thermal methods . In mechanical procedures, the most known practice is the mechanical weeding which is widely in application under various tropical areas. Moreover, removal and destruction of diseased plants or part of plants from the field is a very common practice in different situations allowing limiting multiplication of inoculum in the field and thus limiting the importance of damages during the cropping season. Another example of mechanical action to control biotic constraint is in relation with flooding the ground . For example, to control damages induced by Panama disease in banana caused by *Fusarium oxysporum* f.sp. *cubense*, it can be proceeded to flooding the ground.

In the same area of physical methods, it is feasible to combat damaging organisms by adopting methods using high temperatures; these methods are known as thermal procedures. This is only possible if the cultivated plants or their parts in need of treatment react to these temperatures less sensitively than the damaging organisms (pests or pathogens). The method is widely used through thermotherapy treatment to eliminate virus from already infected material. This treatment method aiming at eliminating virus infections is combined with meristem tip culture. It is also interesting to mention the efficiency of low temperatures to eliminate some pathogenic infections in plants. Treatments aiming at using very low temperature to eliminate pathogen infections are known under the name of cryotherapy. For this method, shoot tips are briefly treated in liquid nitrogen by using cryopreservation protocols allowing eliminating pathogens like viruses, phytoplasmas and bacteria.

Biological control methods

This category of control methods consists in man-directed utilization of organisms (including viruses) and their performance or products to protect plants against stresses caused by biotic and abiotic factors. In that frame, it can be deduced that biological control of pests and diseases relies on the deliberate exploitation of living organisms in view of reducing inoculum and thus protect plants. One of the most impressive facts related to biological control is the phenomenon of

suppressive soils. It was observed that the pathogen populations are in competition with other living organisms playing a role of biological control agents. Biological control methods can be developed and used to combat pests, diseases and weeds.

Although the different advantages related to biological control methods, it is obvious that some limitations can reduce the efficiency of biological control methods. For example, the main limitation of biological control methods is due to the fact that the biological efficiency of biological organ isms is often highly dependent on environmental conditions. Moreover, it is also essential to notice that selection and development of a biological control agent is labour and time- consuming.

I.c. Necessity of IPM (integrated pest management)

Limitations of the classical control methods

In the previous paragraphs, we have briefly presented description of the main categories of pests and diseases control methods which are available for crop protection practitioners. It appears that a diversity of methods can be performed in view of limiting production losses provoked by the various biotic constraints. The common property among the different main control methods is their efficiency to limit or reduce the damages due to pests and diseases.

However, to each individual main category of pests and diseases control method different limitations are associated. For example, the use of genetic resistance is hampered by the long period required for the selection process leading to availability of resistant varieties. Moreover, given different crop species are affected by diverse biotic agents, it is impossible to select a unique variety presenting resistance against the different pests and diseases which can affect the species. On the other side, there is also the phenomeno n of resistance breakdown. A crop variety can present resistance for only a very limited period of time. This type of observation is already known by farmers in Rwanda more specifically with rice and potato. Resistance breakdown is mainly a result of selection pressure happening on pathogen and/or pest population leading to a significant increase of the frequency of some particular strains or races with ability to overcome the resistance properties of the variety.

If we consider the chemical control of pests and diseases, it is important to highlight the non-durability of efficiency of the control because of the possible development of resistant strains which can lead to excessive utilization of pesticides. Moreover, different other negative consequences are related to the large utilization of chemical control. In fact, toxicity of pesticides can affect health of workers and/or consumers via different ways like ingestion, inhalation and contact with skin. It is also possible that the pesticides destroy populations of other living organisms which are not damageable for crops. Finally, the costs of crop protection based on the use of pesticides is high and thus non accessible for most of the farmers in developing countries.
On the side of biological control methods, it was previously mentioned that their efficiency is highly dependent on environment conditions. For that, strict biological measures are not sufficiently effective when it is necessary to perform a rapid control of suddenly occurring population outbreaks of damaging organisms.

Concept and interests of integrated pest management (IPM) strategy

The diverse control methods presenting specific limitations which make them non sustainable, it is essential to develop control strategies giving rise to a more durable efficiency in the management of pests and diseases. For that, combination of the existing control methods in a manner allowing avoiding the disadvantages of each individual control method can be highly beneficial in terms of control efficiency, economic profit, environment protection (natural resources preservation) and human health quality. In fact, there are interactions and synergies between the different control methods which can be exploited through their integrated use for pests and diseases control.

For example, a suitable cropping system involving crop rotation, removal of infested debris and care in application of fertilizers result in reduction of the pathogen population and opportunities for infection. On the other side, when resistance genes are used, probability of selecting pathogen strains able to overcome the resistance can be limited by adopting good cropping practices. Finally, when pesticides are used, it is less likely that pesticide resistance problems arise if the pathogen population is reduced.

In this frame, the Integrated Pest Management (IPM) has different definitions whose the common sense is the beneficial combination of the different control methods. For example,

Heitefuss considers that ‘Integrated plant protection is a system in which all economically, ecologically and toxicologically suitable procedures are utilized in maximum harmony, for maintaining noxious organisms below the economic threshold; whereby the conscious exploitation of natural regulatory factors is of paramount importance’. On their side, Schumann and D’Arcy, Integrated pest management (IPM) is a site-specific, information-based, multitactic decision making process for the management of pests that is profitable for the grower and promotes health and environmental quality. The site specific aspect of IPM means that application of control measures with the IPM philosophy is not general and applicable in all the sites. Information from each site is essential and determines the way by which the control measures have to be achieved. The multitactic aspect states about the combination of more than one control method in view of taking a maximum of profit from the control strategy. It is thus essential to combine the different advantages related to each individual control method and by the same occasion overcoming the disadvantages of each individual control method.

Integrated pest management (IPM) is a control system that in the context of the associated environment and the population dynamics of the damages causal agents (pests and/or pathogens), utilises all suitable techniques and methods in as compatible manner as possible and maintains the biotic agent (pest or pathogen) populations at levels below those causing economic injury. In fact, it is important to notice that damages due to biotic constraints can be induced by pests and/or pathogens. These living organisms (pests and pathogens) are present in environment where crops are grown. Their interactions with crops are not stable, leading to evolution of pests and pathogens populations following the cropping practices which aim at producing foods and or other agricultural production.

IPM involves the integration of cultural, physical, biological, and chemical practices to grow crops with minimal use of pesticides. Monitoring, sampling, and record keeping are used to determine when control options are needed to keep pests below an economically damag ing threshold. Pest management, not eradication, is the goal of IPM. The well documented decision making process in relation with the control of pests and diseases generates multiple profits in relation with economic costs of control, environment quality, health of growers and consumers and finally sustainability of the control measures.

In summary, IPM is a sustainable approach to managing damaging agents (pests and pathogens) by combining biological, cultural, physical and chemical tools in a way that minimizes economic, health, and environmental risks.

Annex 5: Summary tables of the IPM document

Summary table 1. Unique features that calls for Rwanda to implement IPM

Item	Implication in relation to IPM
Upper end of the Region	Contamination by overuse of pesticides will have effectdownstream, away from the treated area. Therefore, care shouldtaken before it is too late.
Mountainous country	• Being mountainous means, heavy rainfall will cause runoff down the slopes into the valley. • Therefore, the contamination on the hill slopes will find its way down into the valley, rivers and inland lakes • Over use of pesticides should be monitored because it has transboundary effect.
High rainfall	• The high rainfall in Rwanda will cause runoff and carry pesticides, chemical fertilizers and erosion downstream.
Streams and rivers all over the country	• The river networks in the whole country, means the contamination in one part will have negative effect in large area downstream and finally into lake Victoria and Nile River.
Over 90% of the population involved in farming	• The involvement of large population into farming without alternative source of income is a problem, because it will put pressure on land, resulting into over use of pesticides, chemical fertilizers and over exploitation of marginal land leading to severe erosion. The IPM is about growing health plants which depends on good soil and land management.
Vision 2020	• Vision 2020 is supportive policy on both agriculture and environment and any suggestion for good agricultural practices is supported.
Well structured administration	• Rwanda is a small country with 416 sectors. This well distribution of administration structures is useful in extension and might be easy to apply IPM at lower level close to farmers.

	• The decentralization, coupled with result based management “imihigo” is beneficial in technology dissemination including IPM training.
Future invested in intensification	• The agriculture intensification policy will promote the production of health crop and hence better use of IPM tools in pest war.
Etc (just to mention a few areas)	• Lack of IPM policy and pesticides regulation makes the IPM execution weak and pesticides misuse uncontrolled.

Summary table 2. Proposed areas of intervention in IPM in Rwanda

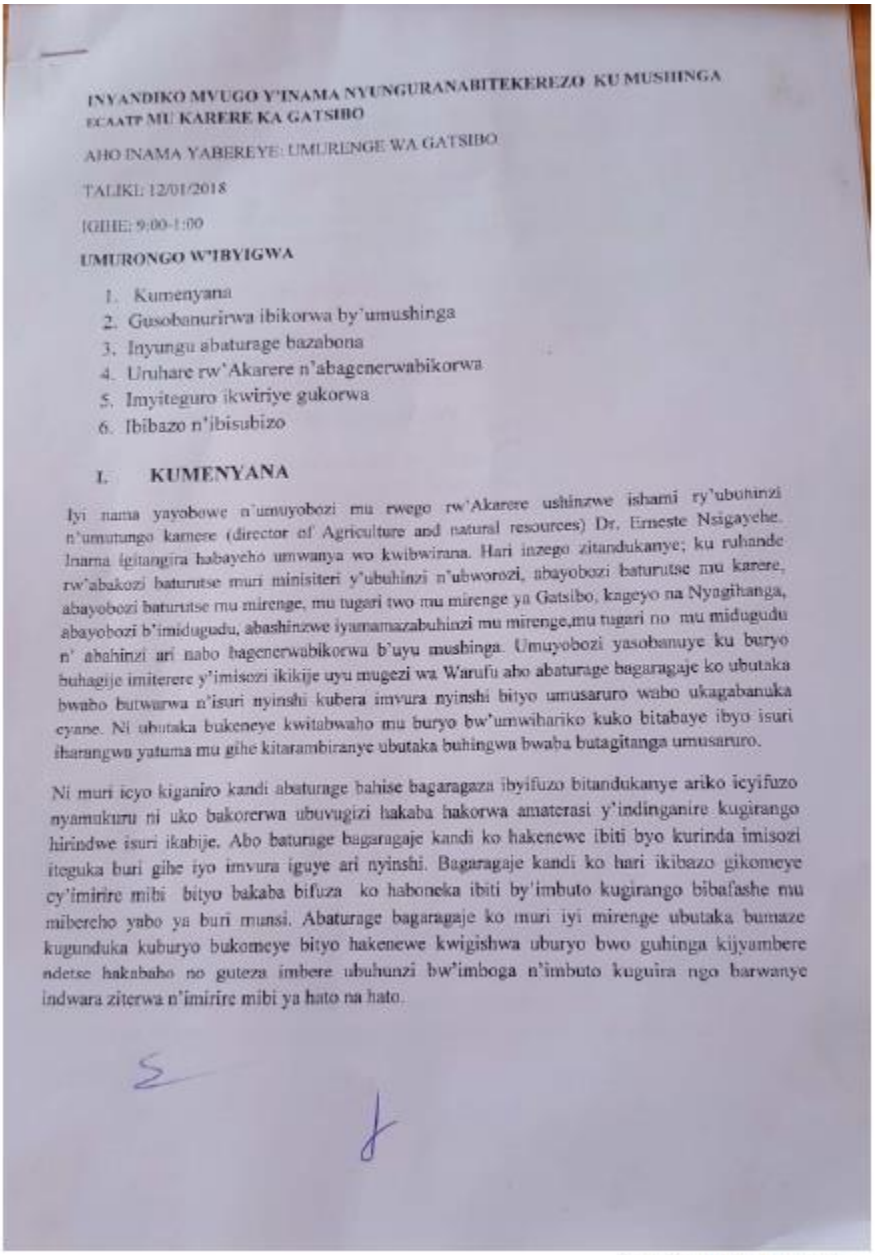
Nature of intervention	**Who should intervene**	**Expected gain**	**Conducive issues**	**Obstacles**
• Research to establish pests status in different agro-ecological zones	Research and Universities	• Focus on major pests for control • Monitoring the control practices • Monitor pests situation on different crops • Develop appropriate technologies	Availability of fund for carrying on research • Joint effort between Institutes	Lack of funding • Lack of qualified staffs
Training of Extension staffs and farmers on available IPM	• MINAGRI • MINALOC • Research • Universities	Farmers knowledge on IPM increased • Yield increased	• Funding availability • Coordination effort to network	• Lack of funding • Lack of qualified

technologies	• NGOs	due to reduced pests damage • Environment, human and animal health improved due to proper use of pesticides • Researchers and Academia experience increased	all actors • Sharing responsibilities according to proximate • Development of technical manual for all pests and diseases used by any actor • Making researchers and academia responsive to farmers needs as a part of their workload	staffs • Poor coordinatio n
Development of IPM materials	• MINAGRI • Research • Universities	• Technical IPM information available • Develop approval mechanism	• Funding for these materials development	• Lack of fund
Conducting adaptive research with farmers in	• Research, • Universities	Working technologies approved and	• Availability of fund • Willingness of	• Lack of approval mechanism

different agroecological zones		adopted by farmers • Dissemination of approved technologies	Research and Universities	• Lack of funding for adaptive research

Annex6: Minutes and attendance lists of consultation meetings in potential District

7.1 Gatsibo District



INYANDIKO MVUGO Y'INAMA NYUNGURANABITEKEREZO KU MUSHINGA ECAATP MU KARERE KA GATSIBO

AHO INAMA YABEREYE: UMURENGE WA GATSIBO

TALIKI: 12/01/2018

IGIHE: 9:00-1:00

UMURONGO W'IBYIGWA

1. Kumenyana
2. Gusobanurirwa ibikorwa by'umushinga
3. Inyungu abaturage bazabona
4. Uruhare rw'Akarere n'abagenerwabikorwa
5. Imyiteguro ikwiriye gukorwa
6. Ibibazo n'ibisubizo

I. KUMENYANA

Iyi nama yayobowe n'umuyobozi mu rwego rw'Akarere ushinzwe ishami ry'ubuhinzi n'umutungo kamere (director of Agriculture and natural resources) Dr. Erneste Nsigayehe. Inama igitangira habayeho umwanya wo kwibwirana. Hari inzego zitandukanye; ku ruhande rw'abakozi baturutse muri minisiteri y'ubuhinzi n'ubworozi, abayobozi baturutse mu karere, abayobozi baturutse mu mirenge, mu tugari two mu mirenge ya Gatsibo, kageyo na Nyagihanga, abayobozi b'imidugudu, abashinzwe iyamamazabuhinzi mu mirenge,mu tugari no mu midugudu n' abahinzi ari nabo bagenerwabikorwa b'uyu mushinga. Umuyobozi yasobanuye ku buryo buhagije imiterere y'imisozi ikikije uyu mugezi wa Warufu abo abaturage bagaragaje ko ubutaka bwabo butwarwa n'isuri nyinshi kubera imvura nyinshi bityo umusaruro wabo ukagabanuka cyane. Ni ubutaka bukeneye kwitabwaho mu buryo bw'umwihariko kuko bitabaye ibyo isuri iharangwa yatuma mu gihe kitarambiranye ubutaka buhingwa bwaba butagitanga umusaruro.

Ni muri icyo kiganiro kandi abaturage bahise bagaragaza ibyifuzo bitandukanye ariko icyifuzo nyamukuru ni uko bakorerwa ubuvugizi hakaba hakorwa amaterasi y'indinganire kugirango hirindwe isuri ikabije. Abo baturage bagaragaje kandi ko hakenewe ibiti byo kurinda imisozi iteguka buri gihe iyo imvura iguye ari nyinshi. Bagaragaje kandi ko hari ikibazo gikomeye cy'imirire mibi bityo bakaba bifuza ko haboneka ibiti by'imbuto kugirango bibafashe mu mibercho yabo ya buri munsi. Abaturage bagaragaje ko muri iyi mirenge ubutaka bumaze kugunduka kuburyo bukomeye bityo hakenewe kwigishwa uburyo bwo guhinga kijyambere ndetse hakabaho no guteza imbere ubuhunzi bw'imboga n'imbuto kuguira ngo barwanye indwara ziterwa n'imirire mibi ya hato na hato.

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II. GUSOBANURIRWA IBIKORWA BY'UMUSHINGA

Abayobozi baturutse mu rwego rwa minisiteri y'ubuhinzi n'umwuzuzi basobanuye uko umushinga uteye. Basobanuye ko mu magambo arambuye ari ***East and Central Africa for Agriculture Transformation Project(ECAATP)*** ukaba ari umushinga ugamije guteza imbere ubuhinzi ukoresheje uburyo bwiza bwo gufata neza ubutaka hagamijwe kongera umusaruro w'ubuhinzi n'ubworozi. Uwo mushinga ukazakorera muri site zatoranyijwe. Bibaba biteganyiiwe y'uko no mu karere ka Gatsibo wabakorera cyane ko hari n'igishanga cya warufu gihuriweho n'imirenge ya gatsibo, kageyo,nyagihanga.

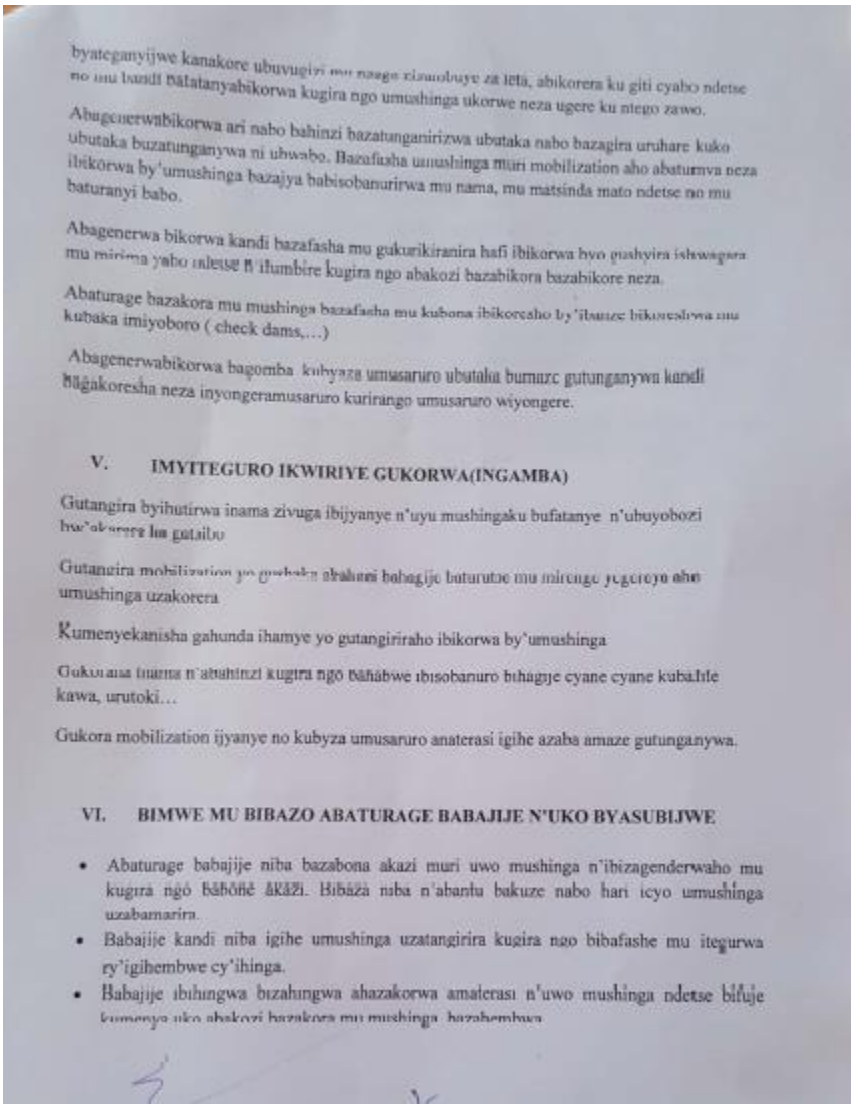
Basobanuye neza ko uyu mushinga utegurwa ushobora kuba igisubizo ku bibazo byabo nk'uko bari babigaragaje. Uwo mushinga ukazaba ugamije gukora materasi yindinganire ku mabanga y'imisozi ihereye mu murenge wa Kageyo na Gatsibo ifi Nyagihanga. Basabye abaturage kuzagira uruhare rugaragara mu ishyirwa mu bikorwa ry'uwo mushinga kandi bakazaba abambere mu gukora akazi bityo bikabafasha kwiteza imbere.

III. INYUNGU ABATURAGE BAZABONA

1. Ubutaka bw'abaturge buwarwaga n'isuri ya buri mwaka bukongera gutwarwa n'isuri igihe imvura iguye keretse habaye ibibazo bidasanzwe
2. Nyuma yo gukora amaterasi umushinga uzashyira ishwagara mu butaka kugira ngo ubusharire bwo mu butaka bugabanuke
3. Umushinga kandi uzageza ifumbire y'imborera mu butaka kandi wigishe n'abaturage kwikorera ifumbire y'imborera kugira ngo gukoresha ifumbire y'imborera bibe urnuco
4. Abaturage bazahugurwa kuri tekinike zose zikoreshwa mu buhuinzi mu buryo bwo kongera umusaruro kuri ha.
5. Ku bufatanye na RAB abahinzi bazajya bagezwaho imbuto n'inyongeramusaruro kugirango bahinge kuburyo bwa kijyambere kandi bugezweho
6. Abahinzi bazagezwaho ibiti bivangwa n'imyaka ndetse natezwe imbere ubuhinzi b'imbuto n'imboga
7. Abaturage bafite ubushake n'imbaraga bazabona akazi bityo imibereho yabo irusheho kumera neza.
8. Abahinzi bazahabwa amahugurwa atandukanye n'ingendo shuri, bigishwe ibyiza byo gukorera hamwe bityo bazashobore kwishyiriraho koperative nk'urwego rubahuza kandi rubavuganira mu zindi nzego

IV. URUHARE RW'AKARERE N'ABAGENERWABIKORWA

Urwengo rw'akarere kazakurikirana umunsi ku wundi imikorere y'umushinga. Akarere kazafasha umushinga mu gukurikirana abaturage bangiza ibikorwa remezo bizubakwa n'umushinga. Akarere kandi kazakora ubujyanama aho kabona hari ibidakorwa uko



byateganyijwe kanakore ubuvugizi mu nzego zinzobuye za leta, abikorera ku giti cyabo ndetse no mu bandi batatanyabikorwa kugira ngo umushinga ukorwe neza ugere ku ntego zawo.

Abageneerwabikorwa ari nabo bahinzi bazatunganirizwa ubutaka nabo bazagira uruhare kuko ubutaka buzatunganywa ni ubwabo. Bazafasha umushinga muri mobilization aho abaturnva neza ibikorwa by'umushinga bazajya babisobanurirwa mu nama, mu matsinda mato ndetse no mu baturanyi babo.

Abagenerwa bikorwa kandi bazafasha mu gukurikiranira hafi ibikorwa byo gushyira ishwagara mu mirima yabo ndetse n'ifumbire kugira ngo abakozi bazabikora bazabikore neza.

Abaturage bazakora mu mushinga bazafasha mu kubona ibikoresho by'ibanze bikoreshwa mu kubaka imiyoboro (check dams,...)

Abagenerwabikorwa bagomba kubyaza umusaruro ubutaka bumuzc gutunganywa kandi bagakoresha neza inyongeramusaruro kurirango umusaruro wiyongere.

V. IMYITEGURO IKWIRIYE GUKORWA(INGAMBA)

Gutangira byihutirwa inama zivuga ibijyanye n'uyu mushingaku bufatanye n'ubuyobozi bw'akarere ku gataibo

Gutangira mobilization yo gushaka abahinzi bahagije buturutse mu mirenge yegereye aho umushinga uzakorera

Kumenyekanisha gahunda ihamye yo gutangiriraho ibikorwa by'umushinga

Gukorana inama n'abahinzi kugira ngo bahabwe ibisobanuro bihagije cyane cyane kubafite kawa, urutoki...

Gukora mobilization ijyanye no kubyza umusaruro anaterasi igihe azaba amaze gutunganywa.

VI. BIMWE MU BIBAZO ABATURAGE BABAJIJE N'UKO BYASUBIJWE

- Abaturage babajije niba bazabona akazi muri uwo mushinga n'ibizagenderwaho mu kugira ngó bábóñé ákáži. Bibáza niba n'abantu bakuze nabo hari icyo umushinga uzabamariro.
- Babajije kandi niba igihe umushinga uzatangirira kugira ngo bibafashe mu itegurwa ry'igihembwe cy'ihinga.
- Babajije ibihingwa bizahingwa ahazakorwa anaterasi n'uwo mushinga ndetse bifuje kumenya uko abakozi bazakora mu mushinga bazahembwa

Mu bisubizo byatanzwe n'abakozi bo ku rwego rw'umushinga bafatanyije n'ubuyobozibw'inzego z'ibanze:

Hemejwe ko mu gutanga akazi ko gutunganya amaterasi y'indinganire abaturiye aho umushinga ukorera nibo bahabwa aho kazi. Aburuu bakuze bo bashobora gukora imirimo idakenye ingufu nyinshi nko gukora mu mapepiniyeri. Abaturage bazigishwa uburyo bwiza bwo gukora no kwizigamira kugira ngo babashe kwikura mu bukene.

Ku bijyanye n'ibihingwa bizitabwaho kurusha ibindi ari ibigori nibishyimbo ndetse hakabaho guteza imbere ibiti bivangwa n'imyaka. Ryongeye kandi ibihingwa nk'imbuto n'imboga nabyo bizitabwaho. Ibijyanye no guhemba abakozi basobanuwe ko abakozi bazajya bahembwa nyuma y'iminsi 15 (quainzaine) ariko kandi basabwe ko iyo umuntu ashaka akazi agomba no kugira ibyangombwa nk'indangamuntu ndetse na konti muri sacco cyangwa mu bigo by'imari.

Inama yosojwe abitabiriye inama bose bishimiye ibyavuzwe kandi bashishikajwe no gukora bagakomeza kwiteza imbere nk'uko icyivugo cy'akarere ka Gatsibo kibivuga neza kiti:

ISHEMA RYA GATSIBO:::: IBAKWE MU ITERAMBERE

TOGETHER:::: WE CAN DO BETTER.

Umwanditsi w'inama: MANIRIHO Pierre Damien

I WHISPER GATSIBO

Umuyobozi w'inama: NSIGAYEHE Erneste

Director of agriculture and natural resources

Gatsibo District

MURENGE WA GATSIBO na NYAGIHANGA

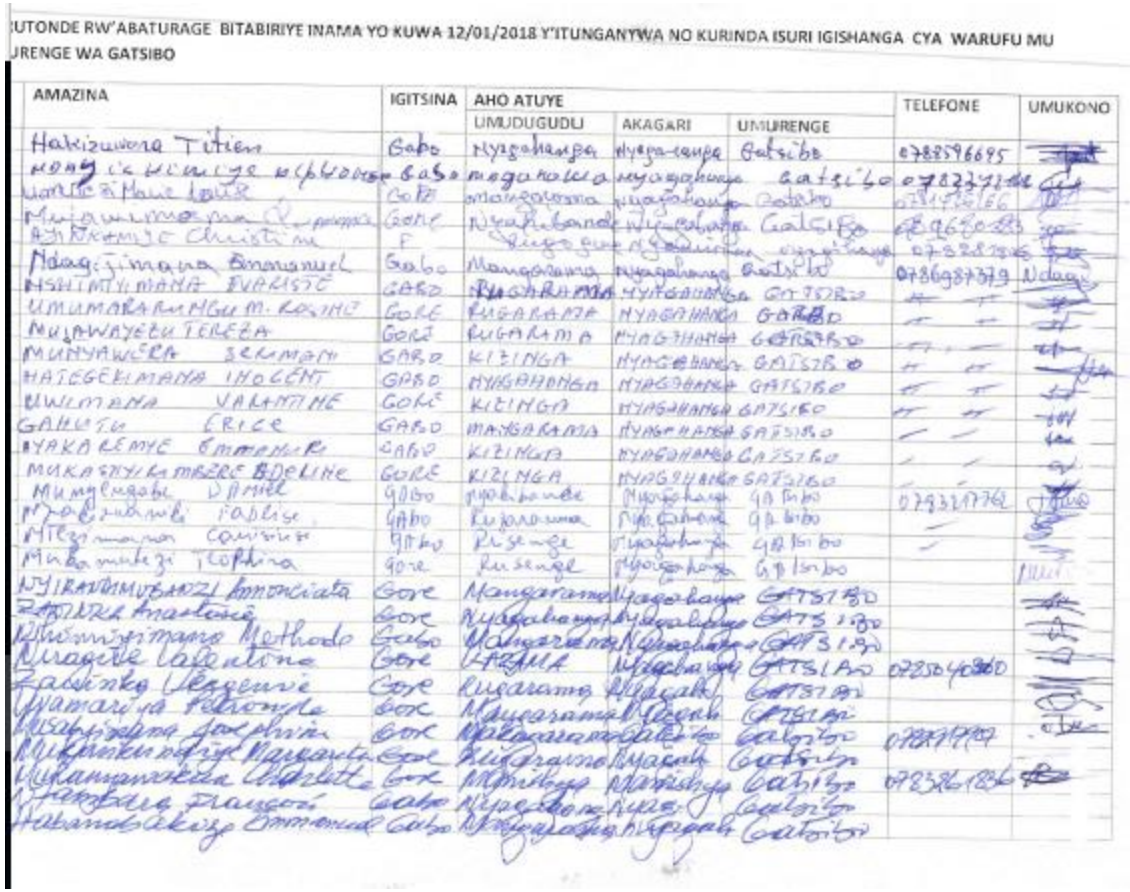
N°	AMAZINA	IGITSINA	AHO ATUYE			TELEFONE	UMUKONO
			UMUDUGUDU	AKAGARI	UMURENGE		
1	Biramahire Jean Baptiste	M	Rugarama	Ramishya	Gatsibo	0785397988	
2	Habarugaguhunga Joseph	M	Nyakibanda	Nyagahanga	"	0789064967	
3	Habamuka J. de Dieu	M	"	"	"	0789680169	
4	Ruguriza J. Bosco	M	Rugarama	"	"	-	
5	Ruguriza	M	Gitega	"	"	-	
6	Habimana Leonidasse	M	Nyagahanda	Ramishya	"	0789203166	
7	Bayingana Clode	M	Kitenga	Nyagahanga	"		
8	Bayingana Telephone	M	Kitenga		"	-	
9	Rukundo Kitito	M	Kitenga		"	-	
10	Nyirabiraduga Takuata	F	Rangarama		"	-	
11	Nikabiregeya	F	Rangarama		"	-	
12	Hareliimana Serestin	M	Ramishya		"	-	
13	Ndahimana Eric	M	Rugarama	Nyagahanga	"	-	
14	Habarugira Evariste	M	Nyagahanga	Nyagahanga	"	-	
15	Bapfa Kubwa Joseph	M	Nyagahanga	Nyagahanga	"	-	
16	Habyarimana Joseph	M	Rugarama	"	"	0783721284	
17	Kayinga Jean	M	Rangarama	"	"	-	
18	Ishimwiyimana Yahaya	M	Rangarama	"	"	0785547560	
19	Ruheke / Joseph	M	Rangarama	"	"	-	
20	Nikamuhayeneza Diothe	F	Nyagahanga	"	"	-	
21	Nyiramadine Valisiline	F	"	"	"	-	
22	Nyamarere Faustin	M	Rangarama	"	"	-	
23	Uwase Eliyosiya	F	Rangarama	"	"	-	
24	Bizimungu Jean Clode	M	Ramishya	Ramishya	"	-	
25	Habineza J. Clode	M	Nyarukoto	"	"	-	
26	Nizeyimana Clode	M	Karama	Nyagahanga	"	0785826356	
27	Ruburo J. Damien	M	Rangarama	"	"	-	
28	Ruzigamana Clistin	M	Rangarama	Nyagahanga	"	0784219940	
29	Habineza J. Baptiste	M	"	"	"	0784207145	
30	Tuyisenge Theogene	M	Ramishya	Nyagahanga	Ramishya	0784613968	

URUTONDE RW'ABATURAGE BITABIRIYE INAMA YO KUWA 12/01/2018 Y'ITUNGANYWA NO KURINDA ISURI IGISHANGA **CYA WARUFU MU MURENGE WA GATSIBO**

N°	AMAZINA	IGITSINA	AHO ATUYE			TELEFONE	UMUKONO
			UMUDUGUDU	AKAGARI	UMURENGE		
1	NTAWIHEBA Emmanuel	M	MANGARARA	NYAGAHANGA	GATSIBO	0784431610	
2	GASASIRA Jovenal	M	KARAMA	NYAGAHANGA	GATSIBO		
3	BANGAMWABO Andre	M	KIZINGA	NYAGAHANGA	GATSIBO		
4	HAKIZIMANA Stephane	M	NYAKIBANDE	NYAGAHANGA	GATSIBO	0726537377	
5	RYAMUTERA Claudien	M	MANGARARA	NYAGAHANGA	GATSIBO		
6	NTIVUGURUZWA Pacifique	M	NYAGAHANGA	NYAGAHANGA	GATSIBO		
7	NGENDAHAYO Paul	M	KIZINGA	NYAGAHANGA	GATSIBO		
8	UTEGISHEMEZA Claude	M	RUGARAMA	NYAGAHANGA	GATSIBO		
9	MYIRAHABIMANA Marie	M	KARAMA	NYAGAHANGA	GATSIBO		
10	MUKARUKUNDA Rivera	F	NYAGAHANGA	NYAGAHANGA	GATSIBO		
11	NYIRAMANA Mediatrice	F	NYAKARAMBI	NYAGAHANGA	GATSIBO		
12	MUTESI Claudine	F	NYAGAHANGA	NYAGAHANGA	GATSIBO		
13	NYIRAMANA Gaudence	F	NYAGAHANGA	NYAGAHANGA	GATSIBO	0733342900	
14	NGABITSINZE Epreza	M	NYARUKOMO	GATSIBO	GATSIBO	0726503737	
15	UKORUNDIZA Sylvestre	M	RUGARAMA	NYAGAHANGA	GATSIBO	0783655	
16	Mukamugema Germaine	F	Rugarama	Nyagahanga	Gatsibo		
17	Mukahirwe Verediana	F	Rugarama	Nyagahanga	Gatsibo		
18	Nayubu Etienne	M	Rugarama	Nyagahanga	Gatsibo	0782577269	
19	Kabigende Innocent	M	Nyagahanga	Nyagahanga	Gatsibo		
20	Habakiyaho Leonille	M	Nyagahanga	Nyagahanga	Gatsibo		
21	Bizimungu Faustin	M	Rugarama	Nyagahanga	Gatsibo		
22	Mugesera Sagaki	M	Nyakibande	Nyagahanga	Gatsibo		
23	Uwabagirimana Verediana	F	Kizinga	Nyagahanga	Gatsibo		
24	Ntabahinganyimana Tomas	M	Kizinga	Nyagahanga	Gatsibo		
25	Mukandamutsa Cecile	F	Kizinga	Nyagahanga	Gatsibo		
26	Mutamashyaka Jean	M	Kamuhanga	Ramiro	Gatsibo	0726176279	
27	Mudakikwa Etienne	M	Rugarama	Nyagahanga	Gatsibo		
28	Mukandanga Immaculee	F	Rugarama	Nyagahanga	Gatsibo		
29	Gazana Cleophatre	M	Rugarama	Nyagahanga	Gatsibo		
30	Basimba	M	Cyepa	Nyagahanga	Gatsibo		

URUTONDE RW'ABATURAGE BITABIRIYE INAMA YO KUWA 12/01/2018 Y'ITUNGANYWA NO KURINDA ISURI IGISHANGA CYA WARUFU MU MURENGE WA GATSIBO

N°	AMAZINA	IGITSINA	AHO ATUYE			TELEFONE	UMUKONO
			UMUDUGUDU	AKAGARI	UMURENGE		
1	Mushimimana Clémentine	F	Gasharago	Gitinda	Ngarama	0785726668	
2	Uwamahoro Joanne	F	Cyarubuga	Nyamirama	Ngarama	—	
3	Mukangirimana Jacqueline	F	Gasharago	Gitinda	Ngarama	—	
4	Nshimiyimana Aphrodis	M	Nyagatovu	Nyagatovu	Gatsibo	—	
5	Mukandahiro Agnès	F	Kabuga	Nyagatovu	Gatsibo	0783830391	
6	Uwimpaye Jean de Dieu	M	Nyagatovu	Nyagatovu	Gatsibo	0785092545	
7	Mukamukiza Marguerite	F	〃	〃	〃	—	
8	Muhawenimana Espérance	F	〃	〃	〃	0736246292	
9	Mukamwiza Angelique	F	〃	〃	〃	—	
10	Gaga Dieu-Merci	M	Ku Isinga	〃	〃	—	
11	Mukeshimana Gloriose	F	Gasharago	〃	〃	—	
12	Mukabuhoro Domitille	F	Nyagatovu	〃	〃	0788769445	
13	Nyirabageni	F	Kabuga	〃	〃	—	
14	Gasana Augustin	M	Nyagatovu	〃	〃	—	
15	Ishimwe Emmanuel	M	Nyagatovu	〃	〃	—	
16	Rudahunga Fortunat	M	Kabuga	〃	〃	—	
17	Uwamahoro Béatrice	F	Mukarange	〃	〃	—	
18	Mukamana Fatuma	F	Nyagatovu	Ku Mbogo	〃	0784984724	
19	Mugabo Jean Claude	M	Nyagatovu	Gasharago	〃	—	
20	Mukeshimana Grace	F	〃	〃	〃	0786728644	
21	Mukasafari Jeanne	F	Rwangoma	Nyamirama	〃	0723732861	
22	Nkulikiyinka Patrice	F	Rugarama	Nyagatovu	Gatsibo	〃	
23	Uwamahoro Ivana	F	Rugarama	Nyagatovu	Gatsibo	〃	
24	Kwizera Marie	F	Rugarama	Nyagatovu	Gatsibo	〃	
25	Nkubiyiriza	F	Rugarama	Nyagatovu	Gatsibo	〃	
26	Mukeshimana Jeanne	F	Nyagahinga	Nyagatovu	Gatsibo	0729291832	
27	M. Maria - Jeanne	F	MANISHYA	NYAGATOVU	GATSIBO	0782476623	
28	Mukandikumana Alice	F	Nyagahinga	Nyagatovu	Gatsibo	0781597434	
29	Mukeshimana Jolène	F	Manishya	Manishya	Gatsibo	—	
30	Nyabyenda Eugène	F	Nyagahinga	Manishya	Gatsibo	〃	

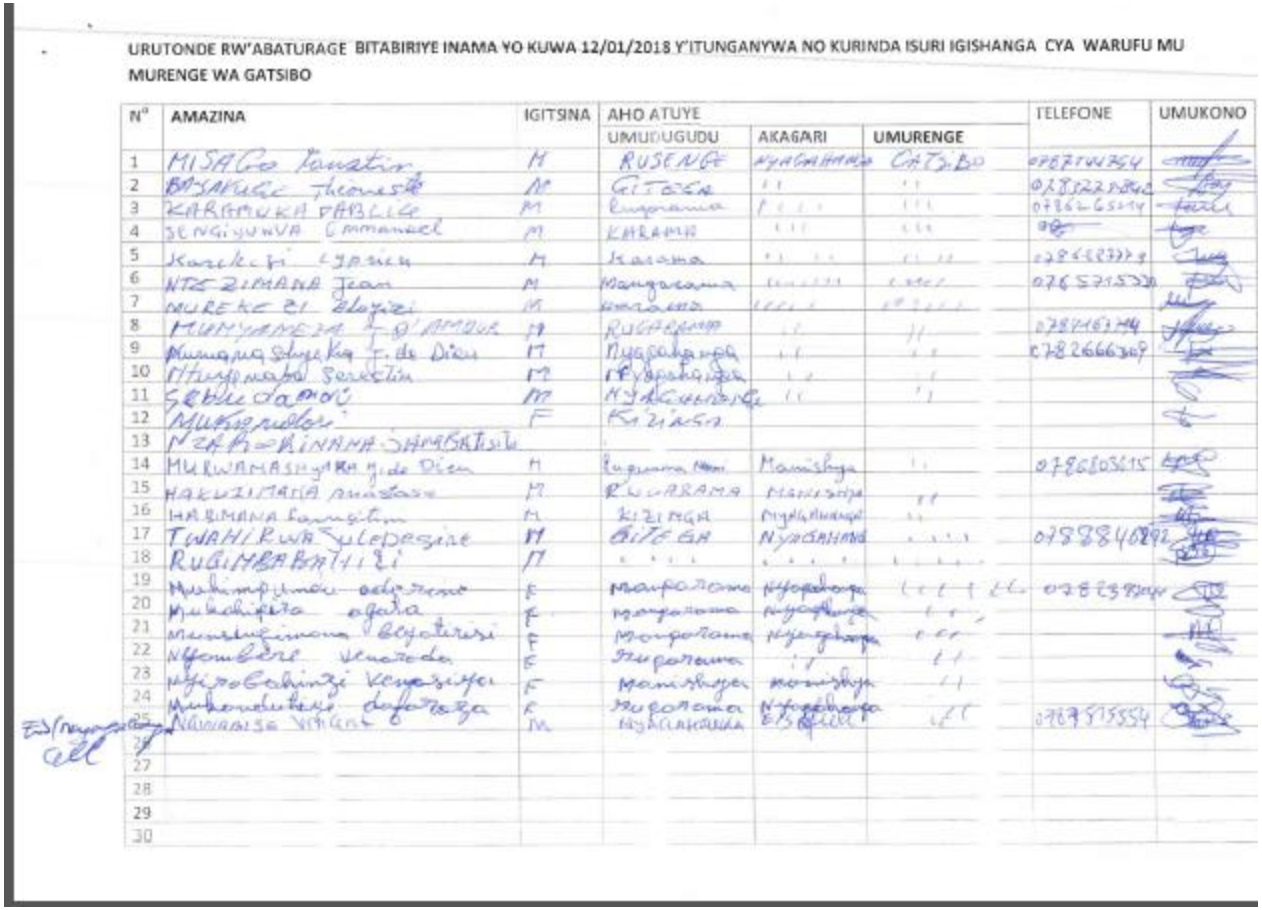


UTONDE RW'ABATURAGE BITABIRIYE INAMA YO KUWA 12/01/2018 Y'ITUNGANYWA NO KURINDA ISURI IGISHANGA CYA WARUFU MU
JRENGE WA GATSIBO

AMAZINA	IGITSINA	AHO ATUYE			TELEFONE	UMUKONO
		UMUDUGUDU	AKAGARI	UMURENGE		
Hakizuwera Titien	Gabo	Nyagahanga	Nyagahanga	Gatsibo	0788596695	
[illegible]	Gabo	Mugahokela	Nyagahanga	Gatsibo	0782371[illegible]	
[illegible] Marie Louise	Gore	Mangarama	Nyagahanga	Gatsibo	0781[illegible]	
Mujawimana [illegible]	Gore	Nyabubande	Nyagahanga	Gatsibo	[illegible]	
Ayinkamiye Christine	F	Rugogwe	Nyagahanga	Nyagihanga	07328[illegible]	
Ndagijimana Emmanuel	Gabo	Mangarama	Nyagahanga	Gatsibo	0786987379	Ndag
NSHIMIYIMANA EVARISTE	GABO	RUGARAMA	NYAGAHANGA	GATSIBO	— —	
UMUMARARUNGU M. ROSINE	GORE	RUGARAMA	NYAGAHANGA	GATSIBO	— —	
MUJAWAYEZU TEREZA	GORE	RUGARAMA	NYAGAHANGA	GATSIBO	— —	
MUNYAWERA SELEMANI	GABO	KIZINGA	NYAGAHANGA	GATSIBO	— —	
HATEGEKIMANA INOCENT	GABO	NYAGAHANGA	NYAGAHANGA	GATSIBO	— —	
UWIMANA VALENTINE	GORE	KIZINGA	NYAGAHANGA	GATSIBO	— —	
GAHUTU ERICE	GABO	MANGARAMA	NYAGAHANGA	GATSIBO	— —	
NYAKAREMYE EMMANUEL	GABO	KIZINGA	NYAGAHANGA	GATSIBO	— —	
MUKASHYIRAMBERE ADELINE	GORE	KIZINGA	NYAGAHANGA	GATSIBO	— —	
Mumyeregabe Daniel	Gabo	Nyabubande	Nyagahanga	Gatsibo	0783217762	
[illegible] Fabrice	Gabo	Rujonowona	Nyagahanga	Gatsibo	—	
Ntezimana Conisius	Gabo	Rusenge	Nyagahanga	Gatsibo	—	
Mukamuhezi Teophila	Gore	Rusenge	Nyagahanga	Gatsibo		
NYIRANDIMUBANZI Annonciata	Gore	Mangarama	Nyagahanga	Gatsibo		
Zaninka Anastasie	Gore	Nyagahanga	Nyagahanga	Gatsibo		
Nshimiyimana Methode	Gabo	Mangarama	Nyagahanga	Gatsibo		
Nyiragitte Valentina	Gore	Kazama	Nyagahanga	Gatsibo	0725040960	
Zaninka Vegenie	Gore	Rugarama	Nyagahanga	Gatsibo		
Nyamariya Felomina	Gore	Mangarama	Nyagahanga	Gatsibo		
Musabyimana Josephine	Gore	Mangarama	[illegible]	Gatsibo	0788[illegible]	
Mukankundiye Margarita	Gore	Rugarama	Nyagahanga	Gatsibo		
Mukamana [illegible] Charlotte	Gore	Mangarama	Nyagahanga	Gatsibo	0783261856	
Ntambara Francois	Gabo	Nyagahanga	Nyagahanga	Gatsibo		
Habanabakize Emmanuel	Gabo	Nyagahanga	Nyagahanga	Gatsibo		

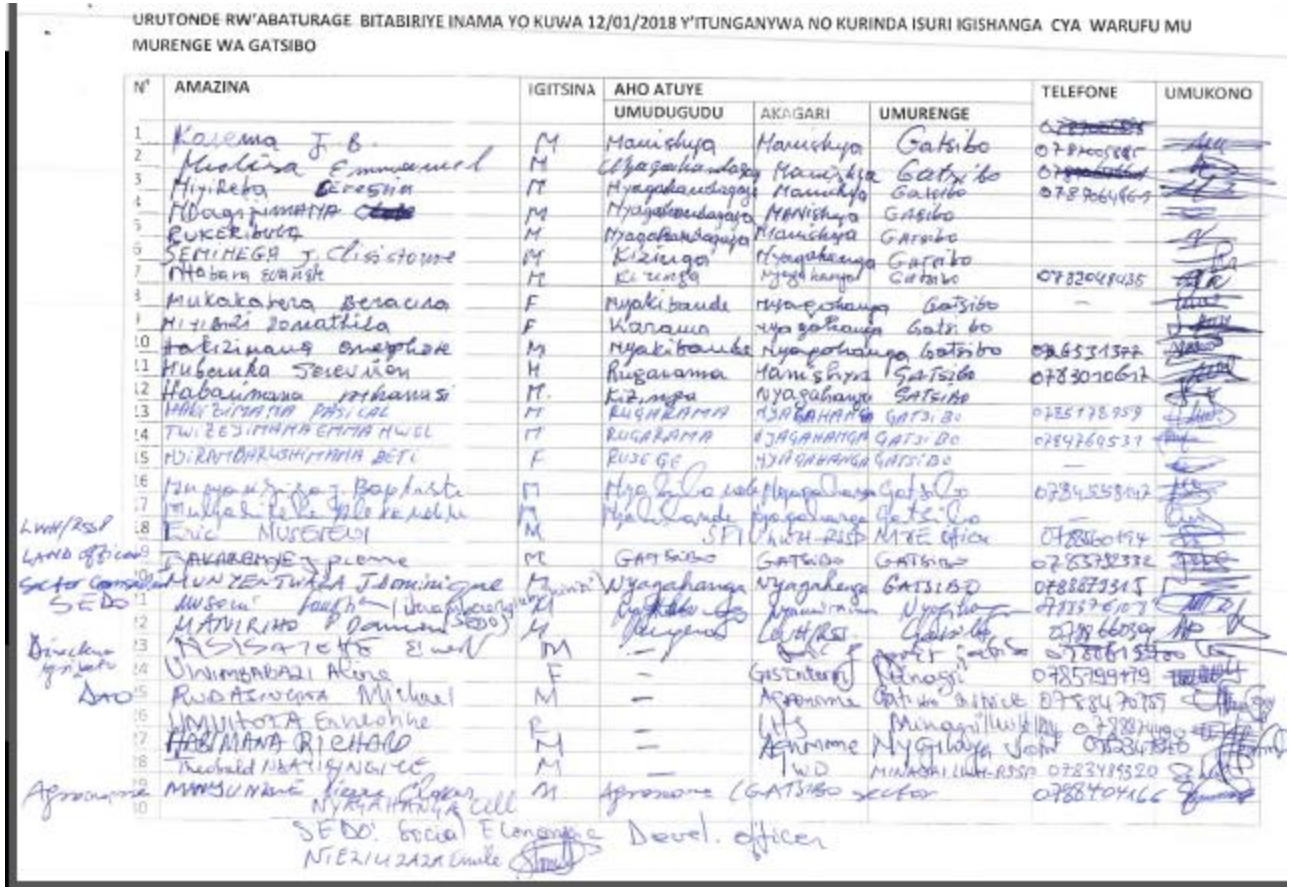
URUTONDE RW'ABATURAGE BITABIRIYE INAMA YO KUWA 12/01/2018 Y'ITUNGANYWA NO KURINDA ISURI IGISHANGA CYA WARUFU MU MURENGE WA GATSIBO

N°	AMAZINA	IGITSINA	AHO ATUYE			TELEFONE	UMUKONO
			UMUDUGUDU	AKAGARI	UMURENGE		
1	Ndakaboka Emmanuel	G	Rupfarama	Nyagahanga	Gatsibo		
2	Gakuru Jean	G	Nyagahandagaza	Kanishya	" "	0784586968	
3	Hitimana Vicenti	G	Rupfarama	Nyagahanga	" "	0789857463	
4	Nsabimana (Munaniza)	G	Ranparama	Nyagahanga	" "	0783561579	
5	Mibonyumuya J. Clode	G	Gitega	" "	" "		
6	Kayinamura Sedistari	G	Rusenge	" "	" "		
7	Hakorimana Epide	G	Rupfarama	" "	" "		
8	Nunyabagaza J. Clode	G	Ranparama	" "	" "		
9	Twabimana Nodezite	G	Ranparama	" "	" "	0787745955	
10	Nsengiyumva Claveri	G	Gitega	" "	" "		
11	Ntirimiga	G	Rupfarama	" "	" "		
12	Bizimana Theophile	G	Ranparama	" "	" "		
13	Habumugisha J. Paul	G	Nyakibande	" "	" "	0782397030	
14	Ndidendeza Jean	G	Rupfarama	" "	" "		
15	Ndejeje Andreya	G	Kigenga	" "	" "		
16	Mutabaruka Protasi	G	Nyagahandagaza	Kanishya	" "		
17	Nshokeyuke Alexandre	G	Burara	Kibare	Nyagahanga	0788638818	
18	Hategekamana Theogene	G	Rupfarama	Nyagahanga	Gatsibo		
19	Nsabimana Balbedi	G	Rupfarama	" "	" "		
20	Rukumba Protasi	G	Rupfarama	" "	" "		
21	Nuhire Celestin	G	Nyagahandagaza	" "	" "		
22	Twiyizonge Theophile	G	Nyakibande	" "	" "		
23	Ntampuhwo J. Clode	G	Gitega	" "	" "		
24	Nyakana J. Bosco	G	Rupfarama	" "	" "		
25	BAZAN Alphonse	G	KIZIMYO	NYAGAHANGA	GATSIBO	0788758772	
26	Ukuriyinyana Donatien	G	Gitega	" "	" "	0787239032	
27	Sandrine Idephonce	G	Gitega	" "	" "		
28	Mpambazo Alphonse	G	Karama	" "	" "		
29	Ndoreno Andreya	G	Ranparama	" "	" "		
30	NIYIBIZI Alexis	G	Rupfarama	Nyagahanga	Gatsibo	0786200717	
31	HABIMANA VINCENT	G	RUBARAMA	" "	" "	0787367935	



URUTONDE RW'ABATURAGE BITABIRIYE INAMA YO KUWA 12/01/2018 Y'ITUNGANYWA NO KURINDA ISURI IGISHANGA CYA WARUFU MU MURENGE WA GATSIBO

N°	AMAZINA	IGITSINA	AHO ATUYE			TELEFONE	UMUKONO
			UMUDUGUDU	AKAGARI	UMURENGE		
1	MISAGO Tanatin	M	RUSENGE	NYAGAHAMA	GATSIBO	0787104754	
2	BOSAKUGU Theoneste	M	GITOGA	"	"	0785222842	
3	KARAMUKA PABLO	M	Rugarama	"	"	0786265414	
4	SENGIYUMVA Emmanuel	M	KARAMA	"	"	[illegible]	
5	Kazeke Ji Claude	M	Karama	"	"	0784527725	
6	NTEZIMANA Jean	M	Mangarama	"	"	0765715530	
7	MUREKE Bi Blaise	M	Karama	"	"		
8	MUNYANEZA J. D'Amour	M	RUGARAMA	"	"	0781467744	
9	Mwungura Steve Kig J. de Dieu	M	Nyagahanga	"	"	0782666369	
10	Ntunguwabo Serecin	M	Rubashanga	"	"		
11	Sebuca Damo	M	NYAGAHANGA	"	"		
12	Mukagudori	F	Karama				
13	NZABONIMANA Jhabarisi						
14	MURWANASHYAKA Jide Dieu	M	Rugarama	Manishya	"	0786805615	
15	HAKUZIMANA Anastase	M	Rwarama	Manishya	"		
16	HABIMANA Lamgitun	M	KIZINGA	Nyakahanga	"		
17	TWAHIRWA Yuledesire	M	BITEGA	NYAGAHANGA	"	0788846892	
18	RUBIMBABAZI	M	"	"	"	"	
19	Mukimpuwo odette	F	Mangarama	Nyagahanga	"	0788[illegible]	
20	Mukabigeta agata	F	mangarama	nyagahanga	"		
21	Mukabucimana Beyateresi	F	Mangarama	Nyagahanga	"		
22	Nyamubere Venerande	F	Rugarama	"	"		
23	Nyirambabazi Venansiya	F	Manishya	manishya	"		
24	Mukandutabera dofaroza	F	Rugarama	Nyagahanga	"		
25	Ndayambaje Vincent	M	NYAGAHANGA	BISAMBU	"	0769515554	
26							
27							
28							
29							
30							



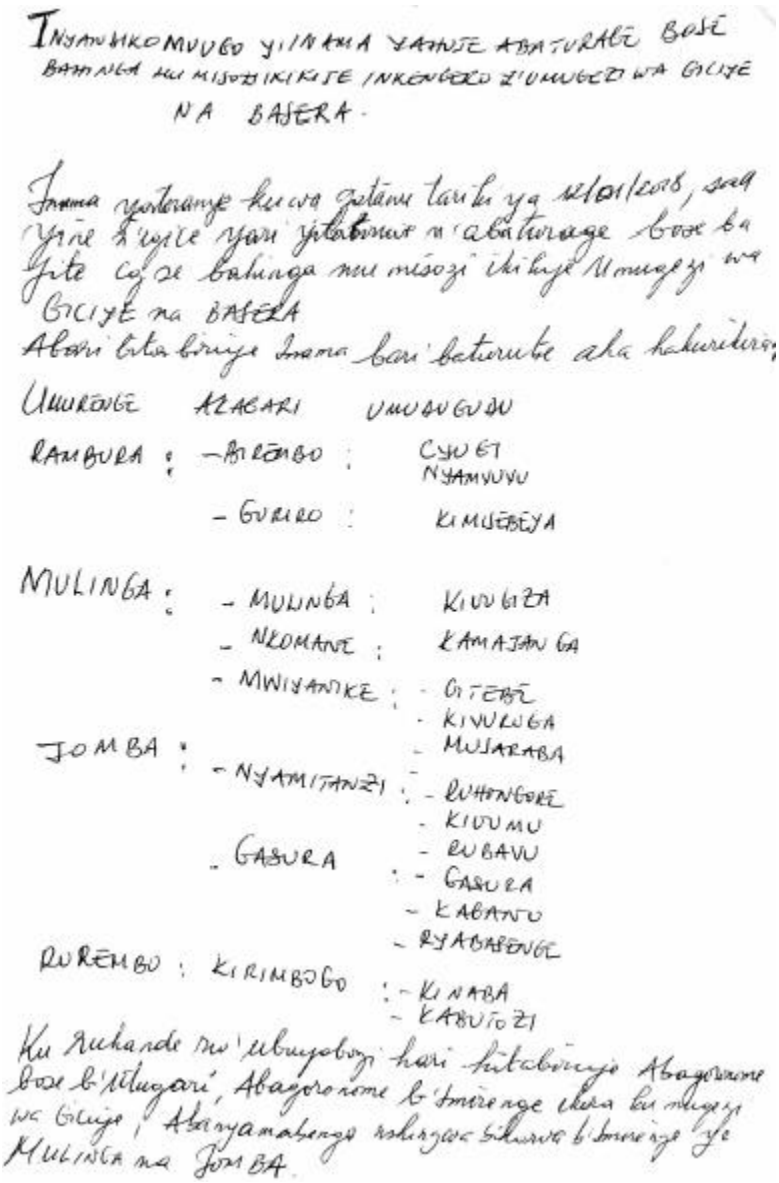
URUTONDE RW'ABATURAGE BITABIRIYE INAMA YO KUWA 12/01/2018 Y'ITUNGANYWA NO KURINDA ISURI IGISHANGA CYA WARUFU MU MURENGE WA GATSIBO

N°	AMAZINA	IGITSINA	AHO ATUYE			TELEFONE	UMUKONO
			UMUDUGUDU	AKAGARI	UMURENGE		
1	Kayiranga J. B.	M	Manishya	Manishya	Gatsibo	078[illegible]	
2	Mukiza Emmanuel	M	Ubuhahamuhaga	Manishya	Gatsibo	078[illegible]	
3	Niyibeho Beatrice	F	Nyagahandagaza	Manishya	Gatsibo	0788764869	
4	Mbanjumuhire [illegible]	M	Nyagahandagaza	Manishya	Gatsibo		
5	Rukeribuga	M	Nyagahandagaza	Manishya	Gatsibo		
6	Semihigo J. Chrisostome	M	Kizinga	Nyagahanga	Gatsibo		
7	Nkabera Evariste	M	Kizinga	Nyagahanga	Gatsibo	0783048435	
8	Mukakarera Beracira	F	Nyakibande	Nyagahanga	Gatsibo	—	
9	Niyibizi Jonathila	F	Kiyanga	Nyagahanga	Gatsibo		
10	Habimana Stephane	M	Nyakibande	Nyagahanga	Gatsibo	0786531372	
11	Hubumuka Jerevizo	M	Rugarama	Manishya	Gatsibo	0783010617	
12	Habumuremyi Athanase	M	Kizinga	Nyagahanga	GATSIBO		
13	MANIZIMANA PASCAL	M	RUGARAMA	NYABAHANGA	GATSIBO	0785778959	
14	TWIZEYIMANA EMMANUEL	M	RUGARAMA	NYAGAHANGA	GATSIBO	0784769537	
15	NDIRAMBARUKIMANA BETI	F	RUSEGE	NYAGAHANGA	GATSIBO	—	
16	Uzamukunda Baptiste	M	Nyakibande	Nyagahanga	Gatsibo	0784558102	
17	Mukakibibi Philomène	F	Nyakibande	Nyagahanga	Gatsibo	—	
18	Eric MUSEREKA	M		SEDO	MAE Office	0788604194	
19	NKAKABENDE Pierre	M	GATSIBO	GATSIBO	GATSIBO	0783782332	
20	MUNYENTWARI Dominique	M	Nyagahanga	Nyagahanga	GATSIBO	0788673315	
21	Museke [illegible]	M	[illegible]	[illegible]	[illegible]	0733576107	
22	MANIRIHO Damien	M	[illegible]	[illegible]	[illegible]	0788660594	
23	NSENGIYUMVA Edouard	M	—	[illegible]	[illegible]	0788615500	
24	Uwimbabazi Alice	F	—	Gasizeroga	Kinogi	0785799479	
25	Rwabuhungu Michael	M	—	Agronome	Gatsibo Bureau	0788470787	
26	Umutoniwase Emelyne	F	—	[illegible]	[illegible]	[illegible]	
27	HABIMANA Richard	M	—	Agronome	Nyagihanga	[illegible]	
28	Rachid NDAYISHIMIYE	M	—	WD	MINAGRI/LWH-RSSP	0783495520	
29	MANIRAKIZA Pierre Claver	M	Agronome	GATSIBO	SECTEUR	0788404166	
30							

LWH/RSSP
LAND Officer
Secteur Comptable
SEDO
Directeur Agricole
DAO
Agronome

NYAGAHANGA Cell
SEDO: Social Economique Devel. officer
NTEZIMANA Emile

7.2 Nyabihu District

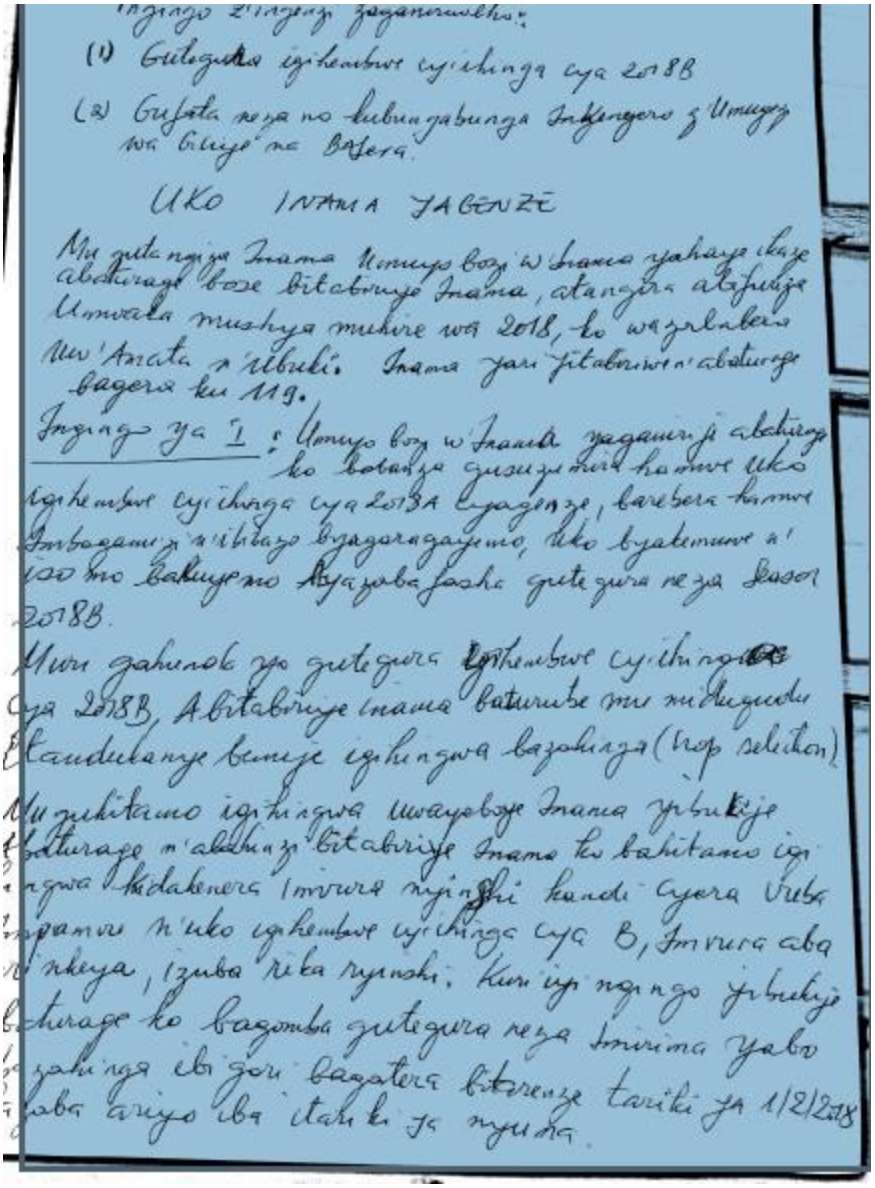


INYAMUKOMUGO YIINAMA YAHUJE ABATURABE BOSE
BAHINGA AMAMISOZI IKIKIJE INKENGERO Z'UMUGEZI WA GICIYE
NA BASERA.

Inama yateranye kuwa gatanu tariki ya 26/01/2018, saa
yine z'igitondo yari yitabiriwe n'abaturage bose ba
Gito co ze bahinga mu misozi ikikije Umugezi wa
GICIYE na BASERA
Abari bitabiriye inama bari baturutse aha hakurikira;

UMURENGE	AKAGARI	UMUDUGUDU
RAMBURA	- RURENGE	CYUGA
		NYAMUVU
	- GURURU	KIMUSEBEYA
MULINGA	- MULINGA	KIVUGIZA
	- NKOMANE	KAMAJANGA
	- MWIYANIKE	- GITEBE
		- KIVULUGA
JOMBA	- NYAMITANZI	- MUSARABA
		- RUHONGORE
	- GASURA	- KIVUMU
		- RUBAVU
		- GASURA
		- KABANTU
		- RYABABENGE
RURENGE	KIRIMBOGO	- KINABA
		- KABUTOZI

Ku Muhanda no'Umuyobozi hari hitabiriye Abagoronome
bose b'Umurenge ukaba ku mugezi
wa Gicuje, Abanyamabanga nshingwabikorwa b'Umurenge ye
MULINGA na JOMBA.



Ingingo Zingenzi zaganirweho:

(1) Guteganya igihembwe cyigihinga cya 2018B

(2) Gufata neza no kubungabunga Imbangukiragutabara z'Umuryango wa Gatagara na Bafata.

UKO INAMA YAGENZE

Mu guteganya Inama Ubuyobozi bw'Ishuri yahaye ikaze abahagarariye bose bitabiriye Inama, atangaza abafungura Umwaka mushya muhire wa 2018, ko wazirabaho Nuw'Amata n'Ubuki. Inama yari yitabiriwe n'abaturage bagera ku 119.

Ingingo ya I: Ubuyobozi bw'Ishuri yagaragaje abaturage ko babonye gusezererwa kwiwe uko igihembwe cyigihinga cya 2018A cyagenze, bavebera kumwe Imbogamizi n'ibibazo byagaragaye, uko byakemuwe n'icyo bakeneye kugaba kugira gute gutegura neza Season 2018B.

Muri gahunda yo gutegura igihembwe cyigihinga cya 2018B, Abitabiriye Inama baturutse mu midugudu batandukanye bemeje igihingwa bazahinga (crop selection)

Mu gukitaho igihingwa Umuyobozi Inama yibutsije Abaturage n'abahinzi bitabiriye Inama ko bakitaho igihingwa bakakorera Imirwa nyinshi kandi cyera Kuba Ingano n'uko igihembwe cyigihinga cya B, Imvura aba nkeya, izuba riba ryinshi. Kuri iyi ngingo yibutsije Abaturage ko bagomba gutegura neza Imirima yabo bagahinga ibigori bagatera bitarenze tariki ya 1/2/2018 kuba ariyo iba itaruke ya nyuma.

Ubukingwe bwemejwe kobuzabukingwa ni Ubuyozi, Imizano.

INGINGO ya 2: Kubunga bunga ubukingwe z'Umuryango wa GAUJE na BASERA

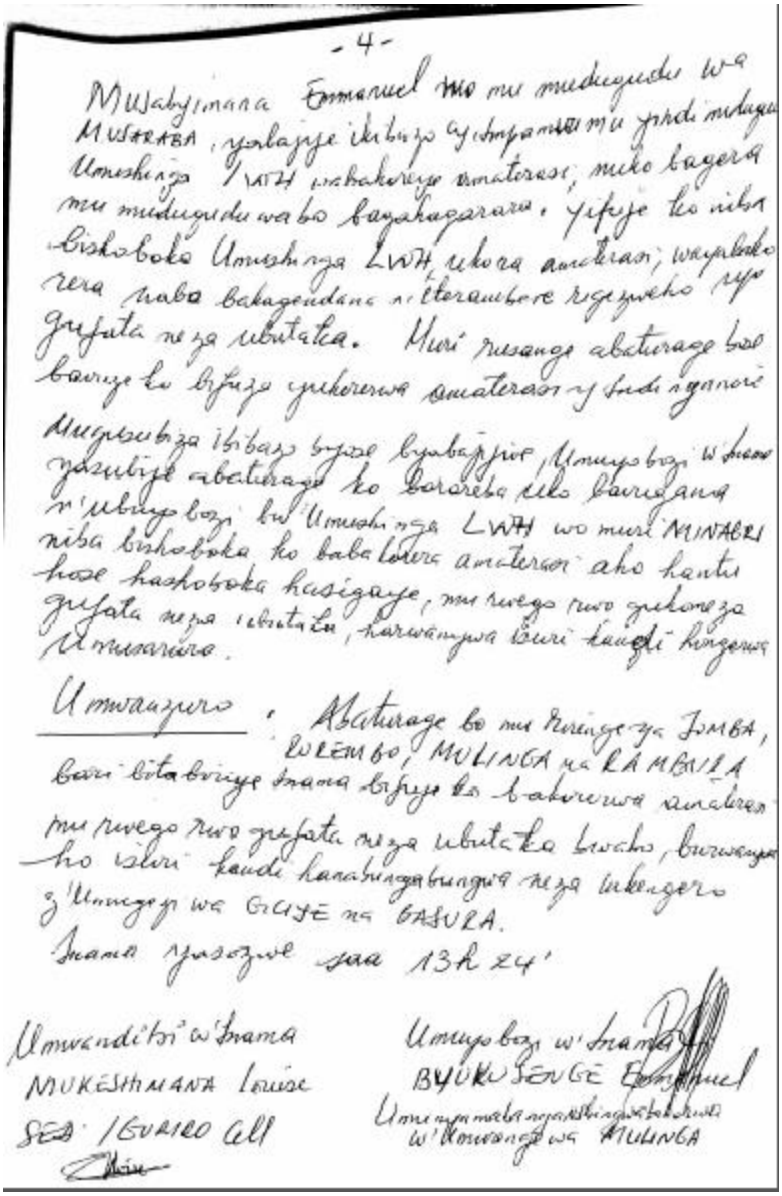
Umuryobozi w'Inama yasabije abatumirwa, barimwo abo mu nzego z'ubuyozi wa GAUJE na BASERA ko bagomba gufatanya n'abatuye, baburanganyaho ibiri, balubura ibiranganya biri kandi baterabo ubwabo bw'amatungo kimwe ingo mizanganyaho.

Umuryobozi w'Inama kandi yabasabije abaturage ko bagomba gufata neza Kubunga bunga Imizano yatewe mu nkengero z'Umuryango wa GAUJE na BASERA kimwe kuzagira no amatungo. Yabasabije ko ugafatwa ayo hamba n'amategeko, kuko kuzereza amatungo bitemewe.

Umuryobozi w'Inama yahaye abaturage ngo babaze ibibazo bagabo naze Umwiwa:

ULAYENZA Marie claudine, abaye ikibazo cyerekeranye no kubunga bunga ubukingwe za GAUJE na BASERA ko bugiye ngo bikorwe n'iza kandi mu buryo buranye bakoresha amaterasi yi Indinga nire mu rwego rwo guca burundu isuri ikwira ubutaka.

Nabo KABERUKA Gilbert wo mu Murenge wa Jomba nawe yabajije ikibazo agaragaza ko ubwabo muri Jomba nta materasi barabonye ko nayabonye yakozwe nabo mu 2003 ko babonye amaterasi agejejwe kuyabefasha kubunga bunga no gufata neza ubutaka bwabo.



-4-

MUsabyimana Emmanuel wo mu mudugudu wa MUSARABA, yabajije ikibazo cy'impamvu mu gihe ndagu Umushinga LWH wabakoreye amateresi, nuko bagera mu mudugudu wabo bagahagarara, yifuje ko niba Bishoboka Umushinga LWH ukora amachirasi; wagaruka vera naho bakagendana n'ibyerambere rigezweho ryo gufata neza ubutaka. Muri rusange abaturage bose barije ko bifuza gukererwa amaterasi y'indinganire

Mugisubizo ibibazo byose byabajijwe, Umuyobozi w'Umu yazubije abaturage ko bororeba uko barigana n'ubuyobozi bw'Umushinga LWH wo muri MINABRI niba bishoboka ko babakorera amaterasi aho kuntu hose hashoboka kuzigaye, mu rwego rwo gukomeza gufata neza ubutaka, harwanywa isuri kandi kongera Umusaruro.

Umwanzuro: Abaturage bo mu Midugudu ya JUMBA, KUREMBO, MULINDA na RAMBAULA bari bitabiriye inama bifuje ko bakorerwa amaterasi mu rwego rwo gufata neza ubutaka bwabo, burwanya ho isuri kandi hanabungabungwa neza imikoreshereze y'Umugezi wa GIKUBE na KABUGA.

Inama yasojwe saa 13h 24'

Umwanditsi w'Inama
MUKESHIMANA Louise
SEB /GUARO all

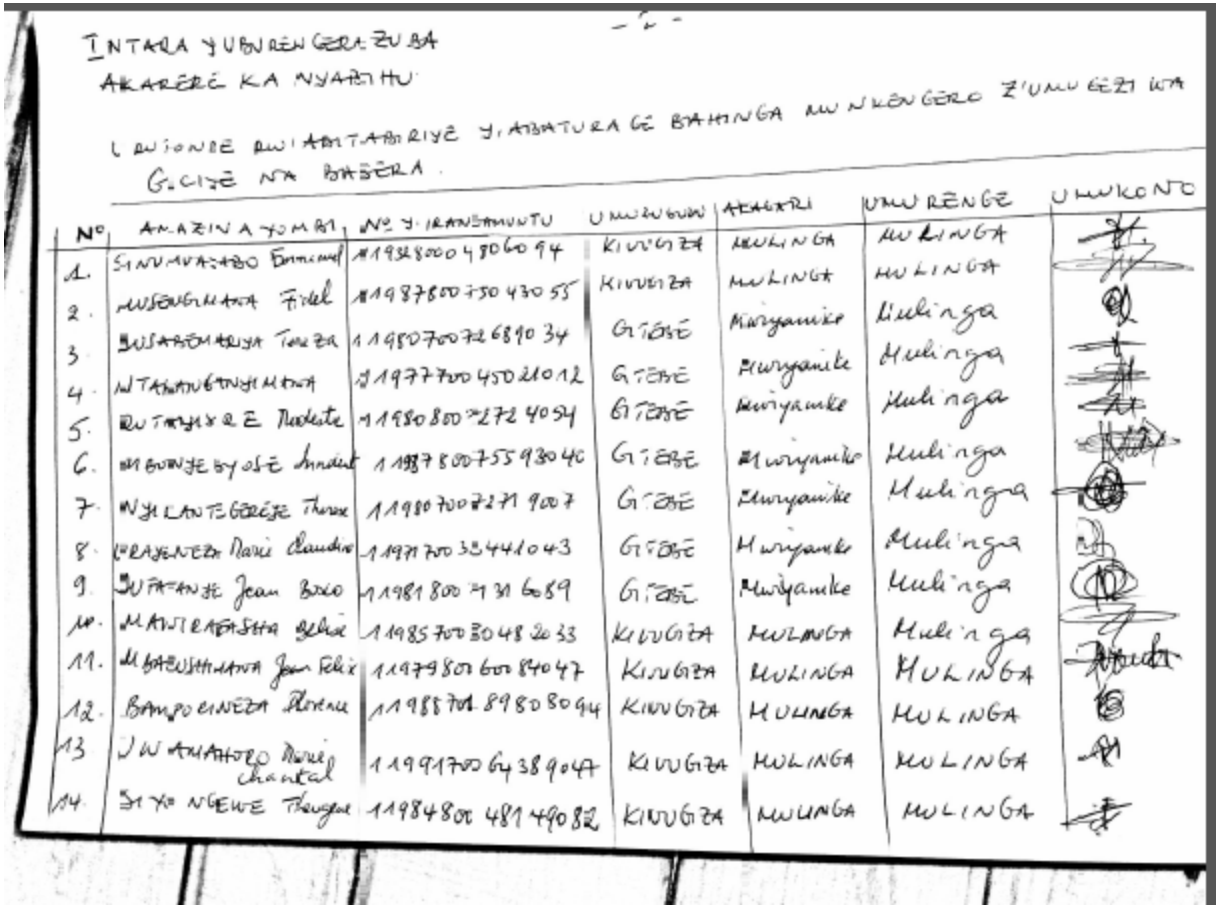
Umuyobozi w'Inama
BYUKUSENGE Emmanuel
Umuyobozi wabo wungirije bakoreshereze
w'Umudugudu wa MULINDA

INTARA Y'UBURENGERAZUBA -1-

AKARERE KA NYABIHU

URUTONDE RW'ABITABIRIYE INAMA Y'IBIBAZO BIMENGA MU NKENGERO Z'UMUGETI WA GICIYE NA BASERA.

№	AMAZINA YOMBO	№ Y'IRANGAMUNTU	UMUBUGUZI	AKAZARI	UMURENGE	UMUKONO
1.	IRAGUHA Jean Claude	1196800297570 32	CYUGI	BIRAMBO	RAMBURA	
2.	SEBAGABO Evariste	1197080038968012	NYAMUYU	BIRAMBO	RAMBURA	
3.	DUSABUMUREMYI Vedaste	1198370075920045	KIMISAGARA	GURERO	RAMBURA	
4.	SENZIRA Theogene	1198380078017029	Kimisagara	GURERO	RAMBURA	
5.	NKURIKINGOMA Sylvere	1198780075480085	CYUGI	BIRAMBO	RAMBURA	
6.	YAJENEZA Claudine	1198270087488087	CYUGI	BIRAMBO	RAMBURA	
7	NYIRAKOBWA Eugenie	1198870076692033	NYAMUYU	BIRAMBO	RAMBURA	
8.	UWERA patience	1199170177896118	NYAMUYU	BIRAMBO	RAMBURA	
9.	NYIRANSENGIYE	1199270193231092	NYAMUYU	BIRAMBO	RAMBURA	
10	SEMABARA	1199080076218025	KIMISAGARA	GURERO	RAMBURA	
11	NKURE Joselyne	1198370078014075	KIMISAGARA	GURERO	RAMBURA	
12.	NYIRANGURANDO	1197870060090 89	KIMISAGARA	GURERO	RAMBURA	
13.	HABIYAREMYE Jackson	1198680077791029	GICIGE	KUGATARE	Rukiga	
14.	NZITUBU ZE Epiphanie	1197730044378018	CYUGI	BIRAMBO	RAMBURA	
15	NYIRABAHIRE Debora	1977700481630 27	CYUGI	BIRAMBO	RAMBURA	

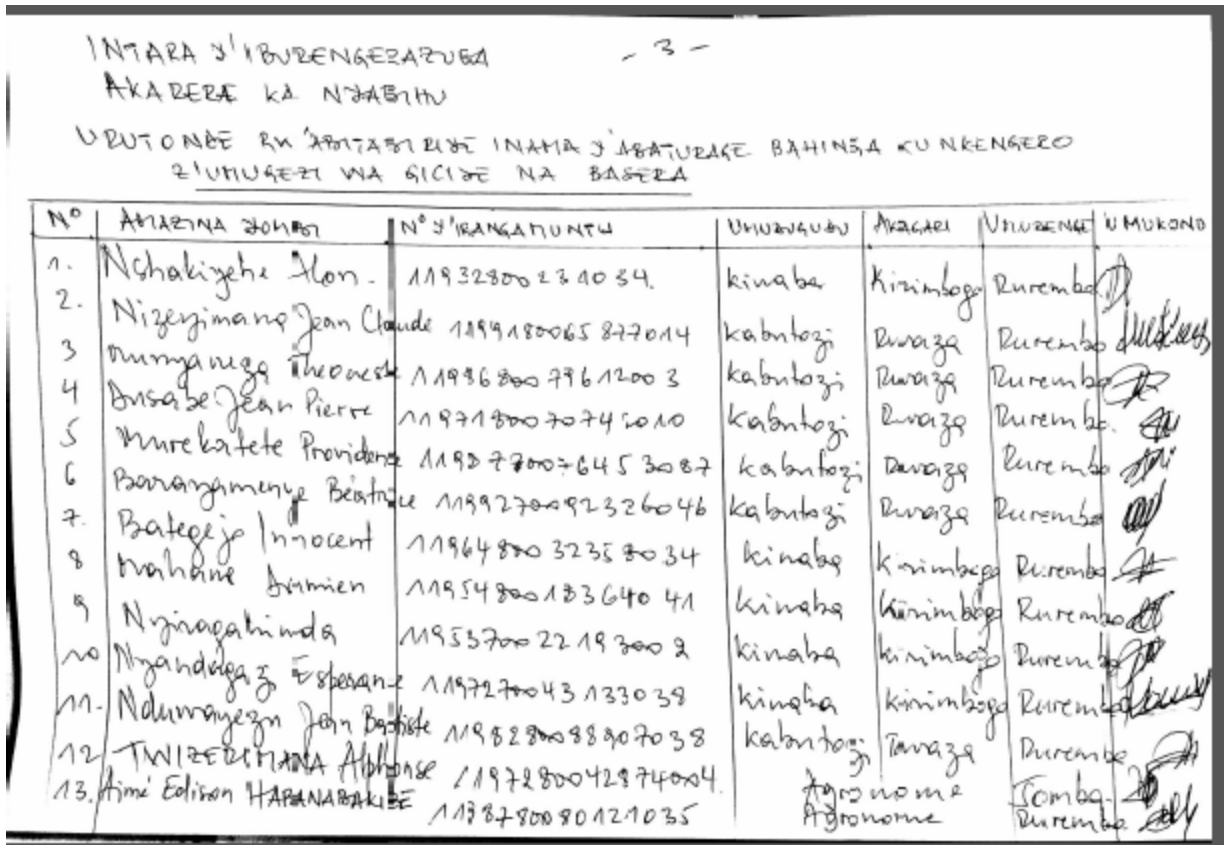


INTARA Y'UBURENGERAZUBA

AKARERE KA NYAMATA

LISIONDE RYIBARITSE Y'ABATURAGE BAHINGA MU NTARENGERO Z'UMURENGE WA GACIYE NA BARERA.

N°	AMAZINA YOMURI	N° Y'IRANGAMUNTU	UMUDUGUDU	AKAGARI	UMURENGE	UMUKONO
1.	SINAMAZAMBO Emmanuel	1193800049060 94	KIVUGIZA	MULINGA	MULINGA	
2.	MUSENGIMANA Fidel	1198780075043055	KIVUGIZA	MULINGA	MULINGA	
3.	BUSABOMANA Tonia	1198070072689034	GITEBE	Muryamiko	Mulinga	
4.	NTAHONTUNGIMANA	1197770045021012	GITEBE	Muryamiko	Mulinga	
5.	RUTAYISIRE Nadette	1198080027240541	GITEBE	Muryamiko	Mulinga	
6.	MUGUNGE Byose Innocent	1198780075593040	GITEBE	Muryamiko	Mulinga	
7.	NYILANTEGEREJE Thaddée	1198070072719007	GITEBE	Muryamiko	Mulinga	
8.	KARAYENEZA Marie Claudine	1197700338441043	GITEBE	Muryamiko	Mulinga	
9.	NTAKIRUTIMANA Jean Bosco	1198180031316089	GITEBE	Muryamiko	Mulinga	
10.	MANIRAKIZA Félix	1198570030482033	KIVUGIZA	MULINGA	Mulinga	
11.	MBARUSHIMANA Jean Felix	1197980060084047	KIVUGIZA	MULINGA	MULINGA	
12.	BAMPOKINEZA Florence	1198870189808094	KIVUGIZA	MULINGA	MULINGA	
13	UWAMAHORO Muriel Chantal	1199170064389047	KIVUGIZA	MULINGA	MULINGA	
14	NIYONGENDE Theogène	1198480048149082	KIVUGIZA	MULINGA	MULINGA	



INTARA Y'IBURENGERAZUBA - 3 -
AKARERE KA NYABIHU

UBUTONDE BW'ABAHAWE INAMA Y'ABATURAGE BAHINGA KU NKENGERO Z'UMUGEZI WA GICISI NA BASERA

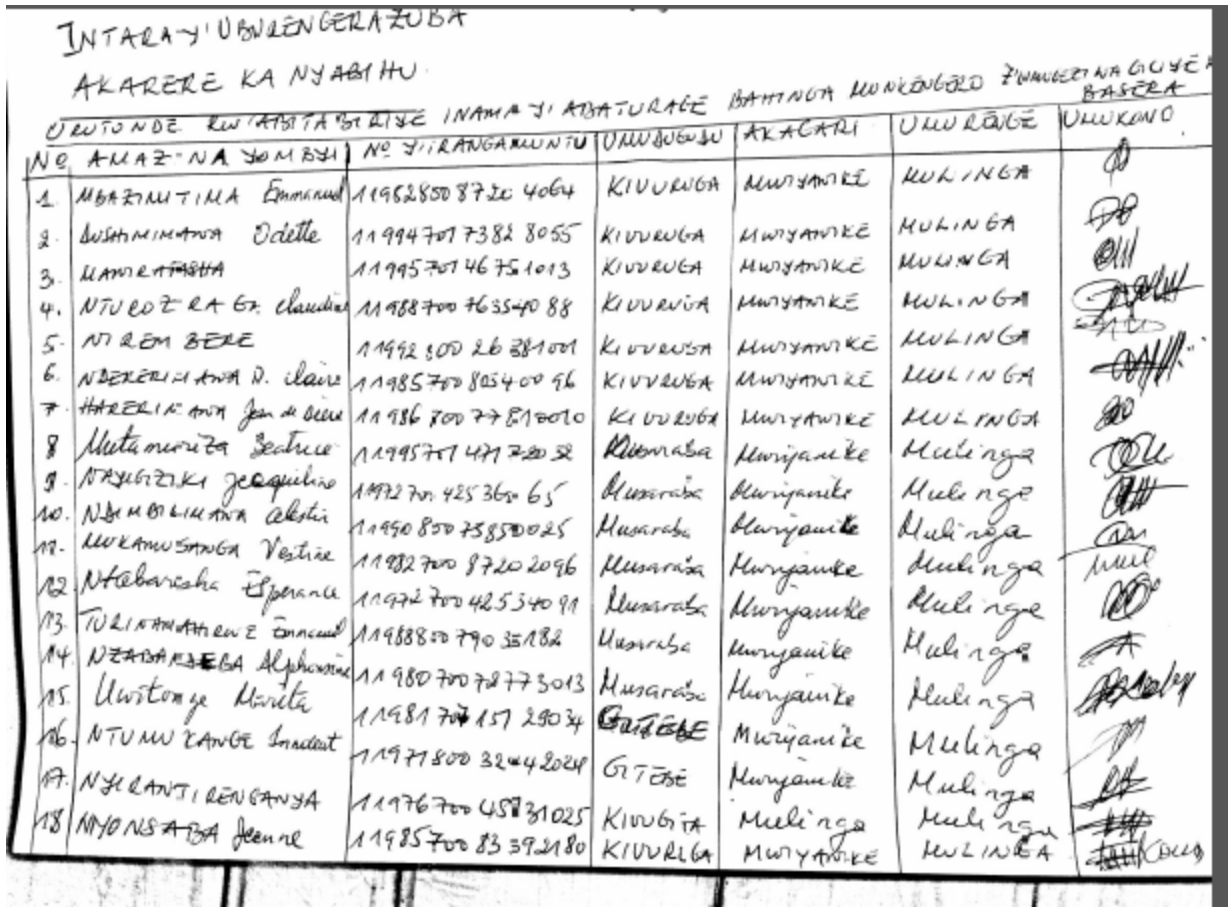
N°	AMAZINA YOMBI	N° Y'IRANGAMUNTU	UMUDUGUDU	AKAGARI	UMURENGE	UMUKONO
1.	Nshakiyeho Alon.	1193280023 40 54.	kinaba	Kirimbogo	Rurembo	
2.	Nizeyimana Jean Claude	1199180065 877014	kabutozi	Ruraza	Rurembo	
3	Rumanuza Theoneste	1199680079 61200 3	kabutozi	Ruraza	Rurembo	
4	Ansabe Jean Pierre	1197180070 74 2010	kabutozi	Ruraza	Rurembo.	
5	Murekatete Providence	1198 7700 7645 3087	kabutozi	Ruraza	Rurembo	
6	Barangamenye Béatrice	1199270092326046	kabutozi	Ruraza	Rurembo	
7.	Bategeje Innocent	1196480032358034	kinaba	Kirimbogo	Rurembo	
8	Nahimana Damien	1195480013364041	kinaba	Kirimbogo	Rurembo	
9	Nyiragakinda	1195370022193002	kinaba	kirimbogo	Rurembo	
10	Nyandwaga Esperance	1197270043133038	kinaba	kirimbogo	Rurembo	
11.	Ndumuyezu Jean Baptiste	1198280088907038	kabutozi	Taruza	Rurembo	
12	TWIZERIMANA Alphonse	1197280042974004	Agronome		Rurembo	
13.	Aimé Edison HABANABAKIZE	1198780080121035	Agronome		Rurembo	

INTARA Y'IBURENGERAZUBA -4-

AKARERE KA NYABIHU.

Urutonde rw'abitabiriye inama y'abahinzi bahinga ku nkengero z'umugezi mu Gidye na Basera.

N°	Amazina yombi	N° y'irangamuntu.	Umudugudu	Akagari	Umurenge	Umukono
1	HAKIZAMUNGU Joseph	1196480031181021	Ruhongore	Nyamiteng	Jomba	
2.	MUKAGATARE Jacqueline	1197870058448036	Ruhongore	Nyamiteng	Jomba	
3	MUKARUBUGA Pascalie	1195470019296081	Kimmu	Nyamiteng	Jomba	
4.	HABYARIMANA Alphonse	1197380041168046	Ruhongore	Nyamiteng	Jomba	
5.	MUTUNDABWAKA Ephrem	1198280085317022	Ruhongore	Nyamiteng	Jomba	
6	ABIYINGOMA Claude	1197880058407094	Kimmu	Nyamiteng	Jomba	
7.	NYIRANTAMATI Speciose	1196170023478010	kimmu	Nyamiteng	Jomba	
8.	MUKABUFATANYE Florence	1197270041653014	Rubavu	Nyamiteng	Jomba	
9.	NYIRAHABIMANA francine	1197670044278084	Rubavu	Nyamiteng	Jomba	
10.	NZABAHABWANIMANA Jean Bosco	1198480082541062	Rubavu	Nyamiteng	Jomba	
11.	BANGAYANDUSHA Jovena	1196180023490003	Rubavu	Nyamiteng	Jomba	
12.	NDORIMBOTSYA Gerome	1197880059434093	Rubavu	Nyamiteng	Jomba	
13.	NSENGIYUMVA Patrick	1196080030556079	Rubavu	Nyamiteng	Jomba	



INTARAY'UBWRENGERAZUBA

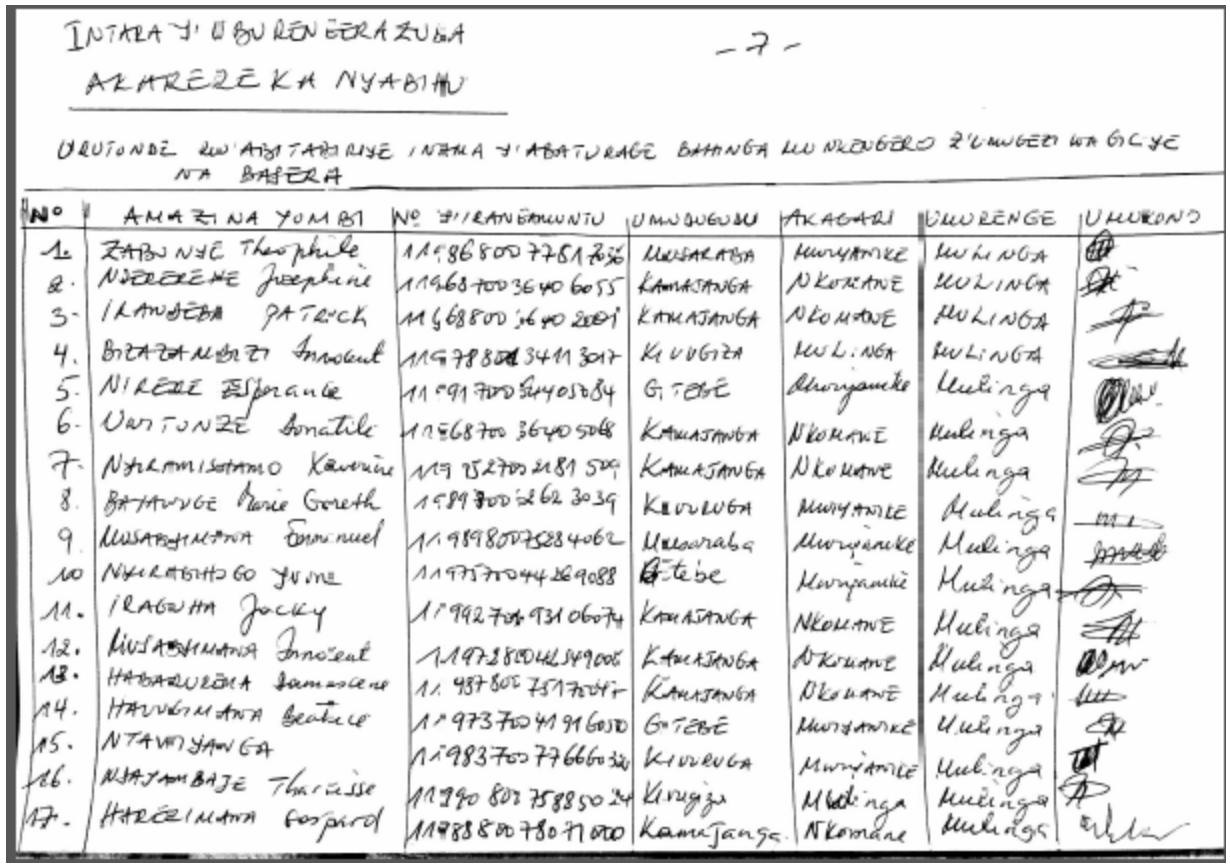
AKARERE KA NYABIHU

N°	AMAZINA YOMBYI	N° Y'IRANGAMUNTU	UMUDUGUDU	AKAGARI	UMURENGE	UMUKONO
1.	MBAZIMUTIMA Emmanuel	1196285087206 4064	KIVURUGA	MWIYANIKE	MULINGA	
2.	UWIHANGANYA Odette	1199470173828055	KIVURUGA	MWIYANIKE	MULINGA	
3.	HAMARAMPAKA	1199570146751013	KIVURUGA	MWIYANIKE	MULINGA	
4.	NTUKOZERA Gr. claudine	1198870076354088	KIVURUGA	MWIYANIKE	MULINGA	
5.	NTIREMBERE	1199280026881001	KIVURUGA	MWIYANIKE	MULINGA	
6.	NDEKERIMANA D. claire	1198570080400 46	KIVURUGA	MWIYANIKE	MULINGA	
7.	HABERIMANA Jean de dieu	1198670077810010	KIVURUGA	MWIYANIKE	MULINGA	
8	Mutamuriza Beatrice	1199577147122032	Musaraba	Mwiyanike	Mulinga	
9.	NAYIGIZIKI Jacquiline	1197270142536065	Musaraba	Mwiyanike	Mulinga	
10.	NSHIMIYIMANA Alexis	1195085075850025	Musaraba	Mwiyanike	Mulinga	
11.	MUKAMUSONGA Vestine	1198270087202096	Musaraba	Mwiyanike	Mulinga	
12	Ntabareba Esperance	1197270042534091	Musaraba	Mwiyanike	Mulinga	
13.	TUZIMANIMANA Emmanuel	1198885079035182	Musaraba	Mwiyanike	Mulinga	
14.	NZABARIBA Alphonsine	1198070078773013	Musaraba	Mwiyanike	Mulinga	
15.	Uwitonze Marita	1198170715729034	GATEBE	Mwiyanike	Mulinga	
16.	NTUMUKANGE Innocent	1197180032042024	GITEBE	Mwiyanike	Mulinga	
17.	NYIRANTIRENGANYA	1197670045831025	KIVUGITA	Mulinga	Mulinga	
18	NYONSABA Jeanne	1198570083392180	KIVURUGA	MWIYANIKE	MULINGA	

NTARA Y'IBURENGERAZUBA
AKARERE KA NYABIHU.

URUTONDE RW'ABATABIRIZE INAMA Y'ABATURAGE BAHINGA KU MKENGERO Z'UMUGEZA WA GICIYE NK BASERA

N°	Amazina yombi	N° y'irangamuntu	Umudugudu	Akagari	Umurenge	Umukono
1	Akimanimpaye Protais	1198550029770052	Rubaba	Nyamiteng	Jomba	
2.	Ziganamunsi JMV	1195080016740008	Ruhongore	Nyamiteng	Jomba	
3	Twinamahirwe Theophile	1196900324440062	Ruhongore	Nyamiteng	Jomba	
4	Habinshuti Emmanuel	1198180070229659	Kirimu	Nyamiteng	Jomba	
5	Ngezimbabazi Theogene	1198030070986063	Kirimu	Nyamiteng	Jomba	
6.	Kanzigiye Veredhiane	1195170012478042	Ruhongore	Nyamiteng	Jomba	
7.	Nyiramahoro Beatrice	1197970059043033	Ruhongore	Nyamiteng	Jomba	
8.	Kanyamanza Cesmile	1198680075863048	Kirimu	Nyamiteng	Jomba	
9	Nibishaka Speciose	1196170023336032	Gasura	Nyamiteng	Jomba	
10	Mukamusoni Liberata	1196870036582010	Gasura	Gasura	Jomba	
11.	Nzayisenga Fidèle	1197780046975015	Gasura	Gasura	Jomba	
12	Kabanyana Gilbert	1198380075851001	Kagano	Gasura	Jomba	
13	Bagabaganwa Xaverine	1196070030468057	Kagano	Gasura	Jomba	
14	Bakizamabiki Séraphine	1195470019230092	Kagano	Gasura	Jomba	
15	Bagamanza Jean Baptiste	1197070037999090	Kagano	Gasura	Jomba	



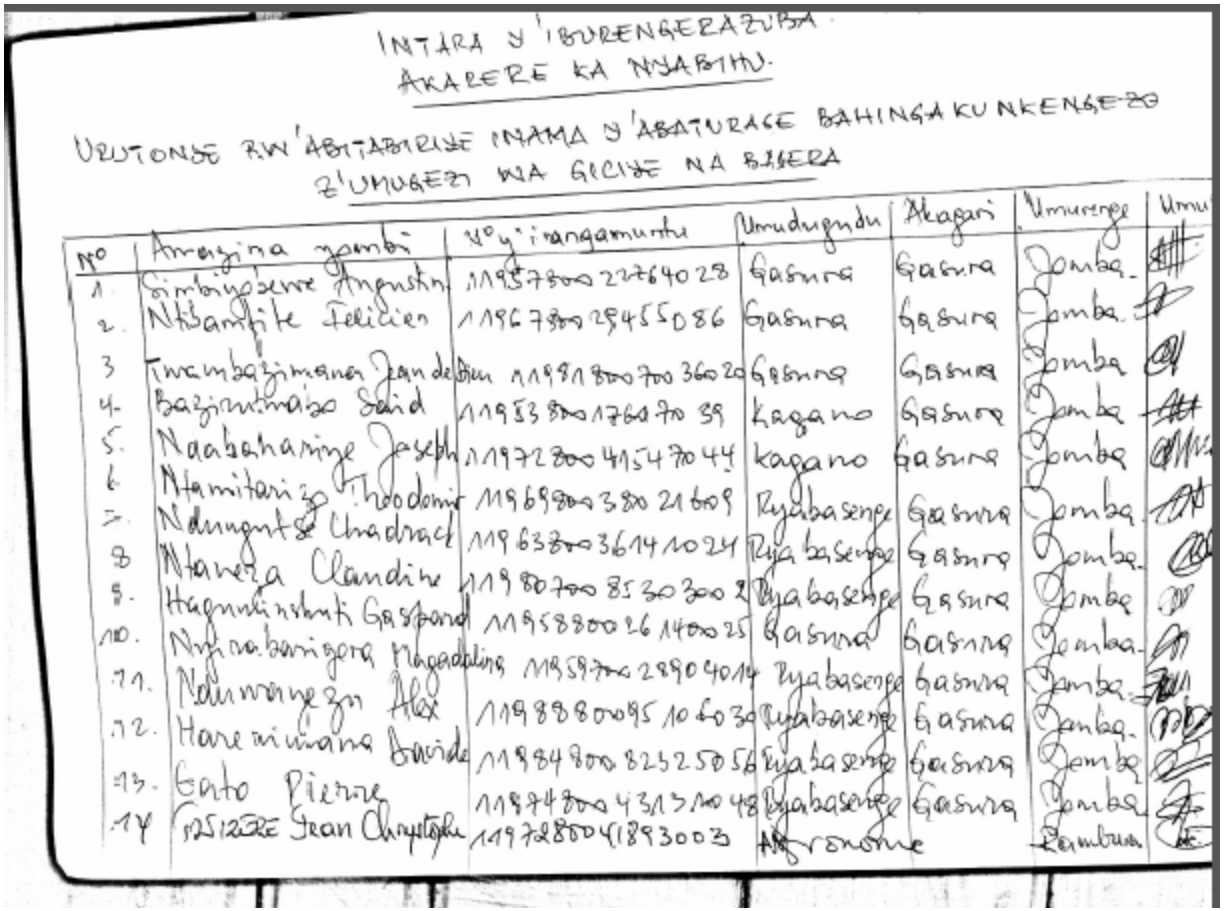
INTARA Y' UBURENGERAZUBA

AKARERE KA NYABIHU

-7-

URUTONDE RW'ABISTABIRIYE INZARA Y'ABATURAGE BAHANGA UMURENGE WA GICYE NA BAFERA

N°	AMAZINA YOMBI	Nº Y'IRANGAMUNTU	UMUDUGUDU	AKAGARI	UMURENGE	UMUKONO
1.	ZABUNYE Theophile	1199868007781236	Mukaraba	Muryamike	Muringa	
2.	NDEREYE Josephine	1196870036406055	Kamajanga	Nkomane	Muringa	
3.	IRANGEZA PATRICK	1196880036402001	Kamajanga	Nkomane	Muringa	
4.	BIZIMANA Innocent	1197880034113017	Kivugiza	Muringa	Muringa	
5.	NIREREZE Esperance	1199700524053084	Gitebe	Muryamike	Muringa	
6.	UWITONZE Bonatile	1196870036405068	Kamajanga	Nkomane	Muringa	
7.	Nyirahabimana Kavuke	1197527002181509	Kamajanga	Nkomane	Muringa	
8.	Bayavuge Marie Goreth	1198900262303G	Kivuruga	Muryamike	Muringa	
9.	Mukarahima Emmanuel	1198900758840621	Mukaraba	Muryamike	Muringa	
10	Nyiramigisha Go Yvine	1197570044269088	Gitebe	Muryamike	Muringa	
11.	IRAGENA Jacky	1199270493106074	Kamajanga	Nkomane	Muringa	
12.	Mukamahirwa Innocent	1197880044549006	Kamajanga	Nkomane	Muringa	
13.	Habarurema Damascene	1198780275176017	Kamajanga	Nkomane	Muringa	
14.	Hakuzimana Beatrice	1199370041916030	Gitebe	Muryamike	Muringa	
15.	NTAWIYANGA	1198370077666020	Kivuruga	Muryamike	Muringa	
16.	Nyiyambaje Therese	1199080275850024	Kivugiza	Mudinga	Muringa	
17.	HAREREMANA Gaspard	1198880078071000	Kamajanga	Nkomane	Muringa	



INTARA Y'IBURENGERAZUBA
AKARERE KA NYABIHU.

URUTONDE RW'ABITABIRIYE INAMA Y'ABATURAGE BAHINGA KU NKENGE-20
Z'UMUGEZI WA GICIYE NA BISERA

N°	Amazina yombi	N° y'irangamuntu	Umudugudu	Akagari	Umurenge	Umu
1	Simbinyavuze Augustin	1195780022764028	Gasura	Gasura	Jomba	
2	Ntibampiye Felicien	1196780025455086	Gasura	Gasura	Jomba	
3	Twambazimana Jean de Dieu	1199180070036020	Gasura	Gasura	Jomba	
4	Bazimutwaho Said	1195380017607039	Kagano	Gasura	Jomba	
5	Nabahanyuze Joseph	1197280041547044	Kagano	Gasura	Jomba	
6	Ntamitariho Theodomir	1196980038021609	Ryabasenge	Gasura	Jomba	
7	Ndungutse Chadrack	1196380036141021	Ryabasenge	Gasura	Jomba	
8	Mukeza Claudine	1198070085300028	Ryabasenge	Gasura	Jomba	
9	Hagumukiza Gaspard	1195880026140025	Gasura	Gasura	Jomba	
10	Nyirabarinyera Magdalena	1195970028904014	Ryabasenge	Gasura	Jomba	
11	Ndumunyu Alex	1198980009510630	Ryabasenge	Gasura	Jomba	
12	Harerimana Bonifide	1198480082525856	Ryabasenge	Gasura	Jomba	
13	Gato Pierre	1187480043131048	Ryabasenge	Gasura	Jomba	
14	NSENGE Jean Chrysologue	1197280041893003	Agronome		Rambura	

7.3 Gisagaraand Huye Districts

INYANDIKOMVUGO Y'INAMA NYUNGURANABITEKEREZO KU MUSHINGA ECAATP

MUKARERE KA GISAGARA

GAHUNDA Y'INAMA

-Gutanga ikaze no kwakira abitabiriye inama(Ubuyobozi bw'akararere)

-Gusobanurira abitabiye inama gahunda y'umushinga gahunda ya EC ATP

-Kugaragaza uruhare rwaburi ruhande

-Kugaragaza ibyitezwe kuro uyu mushinga

- Ibibazo nibitekerezo

-Ingamba

-Utuntu nutundi

1. **Gutanga ikaze no kwakira abitabiriye inama(Ubuyobozi bw'akarare)**

Umuyobozi w'akarere wungirije unshinzwe iterambere ry'ubukungu niwe watanze anakira abitabiriye inama.NZUNGIZE Gustave. Abari munama bibwiranye kugirango inama itangire abantubose baziranye

Umuyobozi w'inama yasabye abari munama kwisanzura kandi bagakurikira neza ibijyanye n'umushinga ECAATP kugirango babashe gutanga ibitekerezo aho bikenewe.

2.Gusobanurira abitabiye inama gahunda yumushinga ECAATP

Uwaje ahagarariye umushinga yatangiye asobanura ECAATP asobanura ko mumgambo arambuye ECAATP ari "East and Contrarl Africa for Agriculture transformation Project" , Uyumushinga rero ukuba ari umushinga ugamije kurwanya isuri kumabanga

Umushinga uzakorera ahantu hatandukanye bitewe nuko Site zizatoranywa, ariko nakarere ka Gisagara kakaba gafite amahirwe yo gutangiririrwamo. Aho biteganijwe ko akarere ka Gisagara karamutse gatoranijwe hazabungabungwa amabanga yimisozi kubuso burenga hegitari 1000.

Yavuze ko kandi nyuma yo gutunganya ubutaka bukorwaho amaterasi, umushinga uteganya ko hazahingwa ibihingwa bitandukanye bizatoranywa byumwihariko imyumbati.

Yakomeje asobanura ko umusaruro uzashakirwa isoko, haba hagati mugihugu haba ndetse no hanze y'igihugu

Yasobanuye ko, iyo Amaterasi amaze gucukurwa, ubutaka buba butakaje bimwe mubishobora kongera umusaruro akaba ariyo mpamvu mu mushinga hateganijwe ko nyuma yo gukora amaterasi hajya hatangwa inyongeramusaruro zisubiza ubutaka uburumbuke bwabwo arizo.Inyongera musaruro ziteganijwe ni:Ishwagara, Imborera, ibiti bivangwa nimyaka , gusa bigatangwa mu igihembwe kimwe cyihinga.

Aha yongeyeho ko kugirango izo nyongera musaruro ziza komeza gutangwa. Umushinga unateganya nubundi guha amahugurwa abahinzi kubijyanye no gukora Compost bazajya bakoresha igihe Umushinga ntayo uzaba ukibaha.

-3 Kugaragaza uruhare rwaburi ruhande

Kugirango Umushinga Uzabashe gushyirwa mu bikorwa neza, abari munama basabye ko Inzego zose zabigiramo uruhare. Aha twavuga inzego z'ibanze,Umushinga ndetse nabikorera

Ibikorwa bigakurikiranwa umunsi kumunsi kandi abantu bagasangira amakuru haba kubitagenda ndetse nibigenda neza.

Inama nyishi zizajya zikorwa, ndetse na mbere yuko Umushinga utangira gushyirwa mubikorwa ningombwa ko Akarere ,umushinga , abaturage ndetse nabikorera bajya inama murwego rwo kubisobanurira abafatanyabikorwa bose imiterere yumushinga nuburyo ujyiye gushyirwa mubikorwa

Ba nyiri amasambu azatunganywa. Uruhare rwabo mumigendekere myiza yuyu mushinga ruzagaragarira mubintu bikurikira;

-Gutunganya amaterasi nkabakozi ba Nyakabyizi (Manpower)

-Gutanga ubufasha mukubona umubare munini w'abakozi bakora imirimo yo guca amaterasi

-Gutanga ubufasha mugusobanurira abaturage bazaba binangiye

-Gutanga bimwe mubikoresho bizifashishwa nko mugukora cg kubona za Chekdams aho ari ngombwa

-Kubahiriza ingengabihe yibikorwa by'umushinga hirindwa ko hazagira ibyangirika

-Gukurikirana imirimo yo gutunganya no gushyira inyongeramusaruro mu mirima yabo

-Kubyaza umusaruro imirima yabo nyuma yo kuyitunganya.

4. Kugaragaza ibyitezwe kuro uyu mushinga

Umuyobozi winama yagaragarije abitabiriye inama ko bimwe mubyitezwe kuri uyu mushinga ari ibi bikurikira:

-Kubona akazi kubaturage

-Ubutaka burwanyijeho isuri

-Amahugurwa atandukanye

-Umusaruro uziyongera

-Isoko ry'umusaruro

5.Ibibazo nibitekerezo

Ibibazo byagarutswe nabitabiriye inama ni ibi bikurikira:

-Nigute tuzabasha kubona imbuto?

-Ese aho ntituzajya dutinda guhembwa?

Kuhagera tugatakaza seasons tuzatungwa niki?

-Ese imyaka yacu izaba iri mumurima ntimuzayirandura?

-Kukibazo cyambere , anbahinzi basobanuriwe ko umushinga ufatanije na ministeri y'ubuhinzi bizabafasha kubona imbuto kandi kugihe..

-Abazakora mumatersi bazajya bahwmbwa nyuma y'iminsi 15.

–Ingengabihe yo gukora izajya yita ku gihembwe cyihinga kuhjyira hatazagira igihombo cyibaho.

-Abahinzi bijwjwe ko ntamyaka iri mumurima izangizwa

Ikindi basobanuriwe nuko n tangurane izatangwa ahakozwe amaterasi . Basabwa ko bagomba no gutamngira kubahiriza gahunda yo gutura mumidugudu.

6.INGAMBA

-Gushyiraho gahunda ihamye yo gutunganya ubutaka

-Ubukangurambaga bwimbitse kugirango imirimo yihute

-Inama nyinshi n'abahinzi, ikindi ahazaba hagaragara imyaka imara igihe mumurima kandi imeze neza(urutoki, ikawa n'ibindi)ntizakurwaho ahubwo bakagirwa inama yo kuhatunganya neza.

-Guhemba abakozi kugihe.

-Ubukangurambaga bwimbitse mukubyaza umusaruro ubuso bwatunganijwe

-Gufata ingamba hakiri kare ngo hatazajyira ubutaka butabyazwa umusaruro bitewe nuko banyirayo batari hafi aho cyangwe bafite ubuso bunini

7 Utuntu nutundi

Ubuyobozi bw'Akarere bwasabye ko kugirango uyu mushinga ubashe gutanga umusaruro witezweho, Umushinga wakorana byahafi n'ubuyobozi bw'akarere, hatangwa amakuru yishyiramubikorwa ry'umushinga kugihe,ndetse na zaraporo zitandukanye z'imigendekere y'akazi.

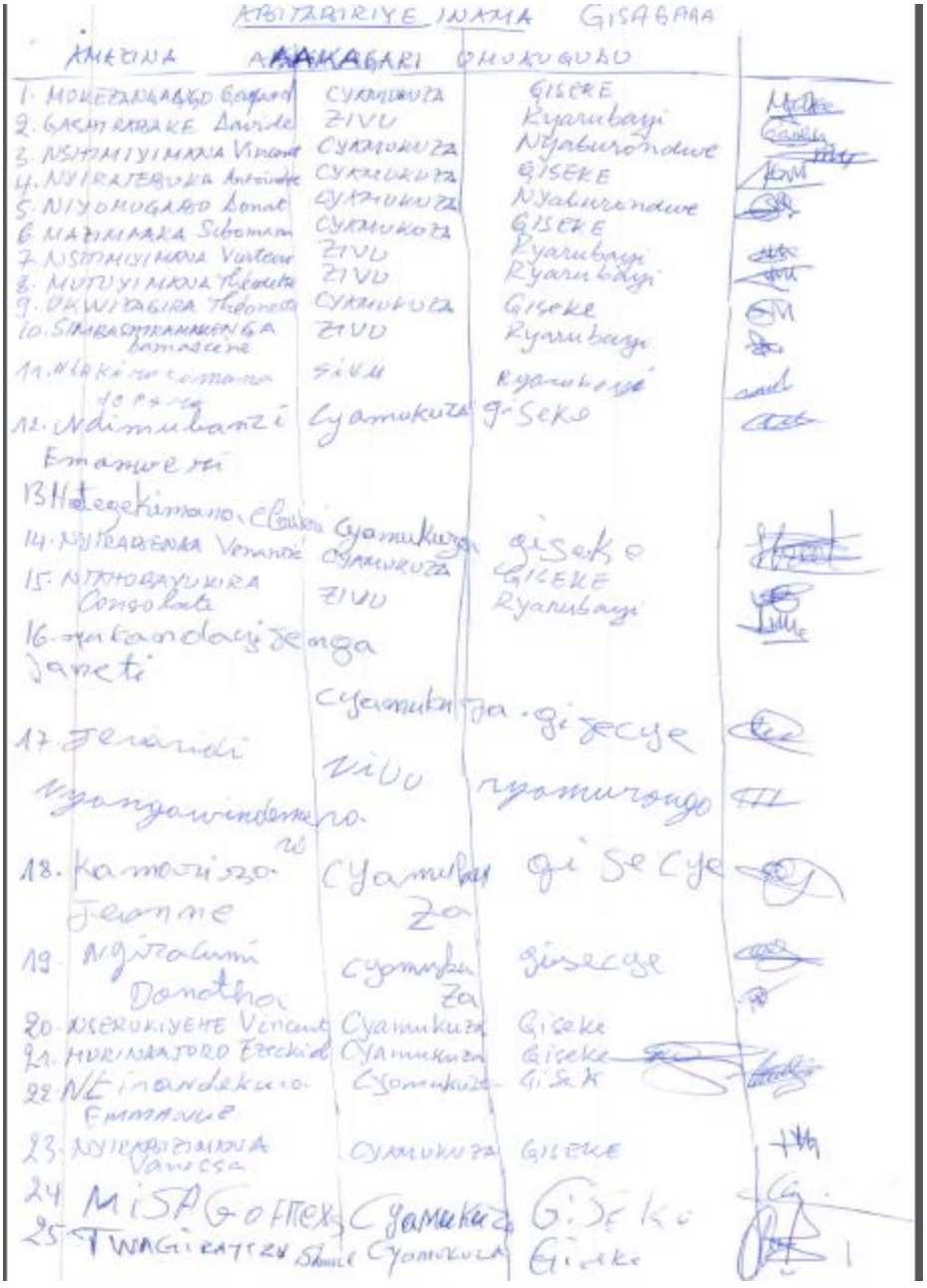
Abagerwabikorwa babonetse uwo munsi babaye bake kuko amasaha yarakuze abenshi bavuye mumirima yabo.

Icyari kigamijwe kwari ukubaganiriza kubikorwa biteganijwe ndetse no kubabaza bo ubwabo uko bumva umushinga wazabagirira akamaro ndetse no kubasaba ko babiganiriza bagenzi babo batabashije kuboneka.

Umuyobozi winama yasoje ashimira abitabiriye, abasaba kugeza ubutumwa kubitabiriye,abizeza ko abazakorerwa mumirimo aribo bazaherwaho bahabwa akazi anabasaba

Emile NSENGIMANA

Umwanditsi w'inama.

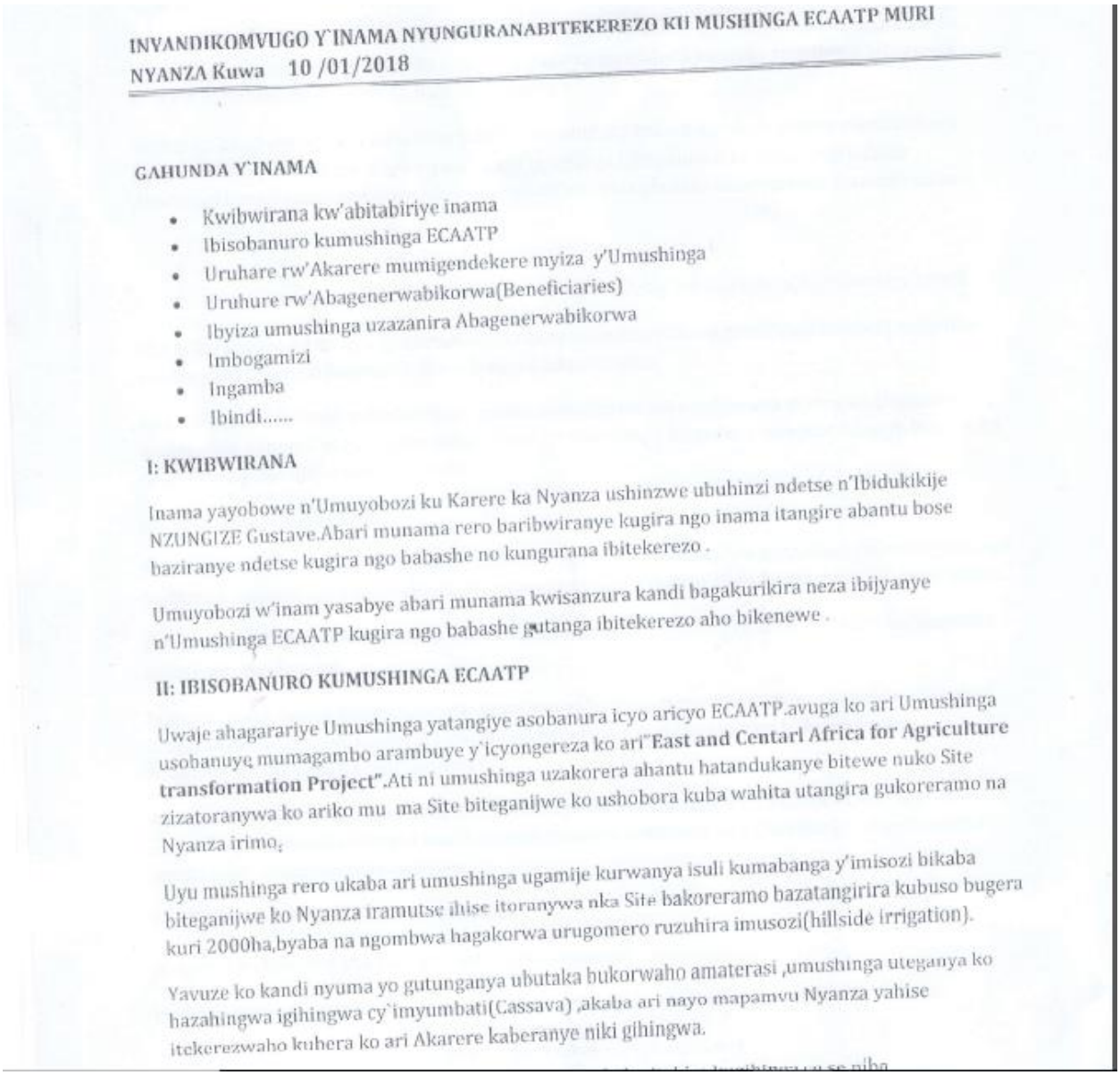


ABITABIRIYE INAMA GISABARA

AMAZINA	AHO AKAGARI	UMUKUGURU	
1. MUKESHIMANA Eugenie	CYAMUKUZA	GISEKE	
2. GACINTABANA Daniel	ZIVU	Ryarubanji	
3. NSHIMIYIMANA Vincent	CYAMUKUZA	Nyaburondwe	
4. NYIRAJYERUKA Antoinette	CYAMUKUZA	GISEKE	
5. NIYOMUGABO Donat	CYAMUKUZA	Nyaburondwe	
6. MAZIMAKA Sebomana	CYAMUKUZA	GISEKE	
7. NSHIMIYIMANA Vuvuzeri	ZIVU	Ryarubanji	
8. MUTUYIMANA Ebenezer	ZIVU	Ryarubanji	
9. UWIZEYIMANA Theonesta	CYAMUKUZA	Giseke	
10. SINARAGIRAMAHORO GA Damascene	ZIVU	Ryarubanji	
11. Nkakiruremana Jean Pierre	ZIVU	Ryarubanji	
12. Ndimubanzi Emanuel	Cyamukuza	giseke	
13. Habeshimana Claude	Cyamukuza	giseke	
14. NYIRABERA Venantie	CYAMUKUZA	GISEKE	
15. NTAHOBAYUKIRA Consolata	ZIVU	Ryarubanji	
16. Nkundabagenga Janeti	Cyamukuza	giseke	
17. Benimana Nyamwinsanganzo	Zivu	nyamurango	
18. Kamanzi Jeanne	Cyamukuza	giseke	
19. Nyiramana Donatha	Cyamukuza	giseke	
20. NSENGIYUMVA Vincent	Cyamukuza	Giseke	
21. HARERIMANA Ezechiel	Cyamukuza	Giseke	
22. Ntirandekura Emmanuel	Cyamukuza	Giseke	
23. NYIRAZIMANA Vanessa	CYAMUKUZA	GISEKE	
24. MISAGO Alex	Cyamukuza	Giseke	
25. TWAGIRAYEZU Silas	Cyamukuza	Giseke	


ABITABIRIYE INAMA
1. NIYONSABA Pierre
2. MUHAREMYI Liliane
3. UWIZEYIMANA Jean Paul
4. UWIMBABAZI Alvine
5. NIYOKENGA Samuel
6. UMUHOZA Ernestine
7. Mumeno Clarisse
8. HABONIMANA Ismael
9. MUHIRE Augustin
10. HANIRAGABA Jean Baptiste
11. HANGANIMANA Paul
12. Emile NSENGIMANA
Agronome/Save
District Agronomist
B/S CYAMUKUZA CCSP
Gis intern LWH/RSSP
Irrigation Engineer LWH/RSSP
LWH/RSSP
Contract Agronomist
CYAMUKUZA/GISENYI
CYAMUKUZA/GISENYI
H Supervising Engineer
Vice Mayor ED
LWH/RSSP Ag DPC

7.4 Nyanza District



INVANDIKOMVUGO Y'INAMA NYUNGURANABITEKEREZO KU MUSHINGA ECAATP MURI NYANZA Kuwa 10 /01/2018

GAHUNDA Y'INAMA

- Kwibwirana kw'abitabiriye inama
- Ibisobanuro kumushinga ECAATP
- Uruhare rw'Akarere mumigendekere myiza y'Umushinga
- Uruhure rw'Abagenerwabikorwa(Beneficiaries)
- Ibyiza umushinga uzazanira Abagenerwabikorwa
- Imbogamizi
- Ingamba
- Ibindi.....

I: KWIBWIRANA

Inama yayobowe n'Umuyobozi ku Karere ka Nyanza ushinzwe ubuhinzi ndetse n'Ibidukikije NZUNGIZE Gustave.Abari munama rero baribwiranye kugira ngo inama itangire abantu bose baziranye ndetse kugira ngo babashe no kungurana ibitekerezo .

Umuyobozi w'inam yasabye abari munama kwisanzura kandi bagakurikira neza ibijyanye n'Umushinga ECAATP kugira ngo babashe gutanga ibitekerezo aho bikenewe .

II: IBISOBANURO KUMUSHINGA ECAATP

Uwaje ahagarariye Umushinga yatangiye asobanura icyo aricyo ECAATP.avuga ko ari Umushinga usobanuye mumagambo arambuye y'icyongereza ko ari"**East and Centarl Africa for Agriculture transformation Project"**.Ati ni umushinga uzakorera ahantu hatandukanye bitewe nuko Site zizatoranywa ko ariko mu ma Site biteganijwe ko ushobora kuba wahita utangira gukoreramo na Nyanza irimo;

Uyu mushinga rero ukaba ari umushinga ugamije kurwanya isuli kumabanga y'imisozi bikaba biteganijwe ko Nyanza iramutse iluise itoranywa nka Site bakoreramo bazatangirira kubuso bugera kuri 2000ha,byaba na ngombwa hagakorwa urugomero ruzuhira imusozi(hillside irrigation).

Yavuze ko kandi nyuma yo gutunganya ubutaka bukorwaho amaterasi ,umushinga uteganya ko hazahingwa igihingwa cy'imyumbati(Cassava) ,akaba ari nayo mapamvu Nyanza yahise itekerezwaho kubera ko ari Akarere kaberanye niki gihingwa.

Yakomeje anasobanura ko umusaruro uzashalórwa isoko,haba hagati mugihugu haba ndetse no hanze y'Igihugu aho biteganijwe ku ushobora kuzajya ugurishwa ku isoko ry'ibihugu bibarizwa mugace k'Iburasirazuba(East African Community)

Yagize ati kandi,iyo Amaterasi amaze gucukurwa,abutaka buba bwatakaje bimwe muhishobora kongera umusaruro akaba ariyo mpamvu mu mushinga hateganijwe ko Nyuma yo gukora Amaterasi hazajya hatangwa inyongeramusaruro zisubiza ubutaka uburumbuke bwabwo arizo:

- ✓ Ishwagara
- ✓ Ifumbire y'Imborera
- ✓ Ndetse hakanaterwa uduti turumbura ubutaka ndetse tukanabufata(Agroforestry trees).

Aha ariko yavuze ko izi nyongeramusaruro zitangwa inshuro imwe gusa(Season imwe),hanyuma nyuma yaho abahinzi bakabyishakira(Seasons zikurikiraho).

Aha yongeyeho ko kugira ngo izo nyongeramusaruro zizabasbe gukomeza gutangwa,Umushinga unateganya ubundi guha amahugurwa abahinzi kubijyanye no gukora compost bazajya bakoresha igihe Umushinga ntayo uzaba uhibaha.

III: URUHARE RW'AKARERE

Murwego rwo kugira ngo Umushinga Uzabashe gushyirwa mubikorwa neza,Abari munama basabye ko Inzego zose zahigiramo Uruhare.Aha twavuga Inzego z'Ibanze ,Umushinga ndetse Private Sector.

Ibikorwa bigakurikiranwa umunsi kumunsi kandi abantu bagasangira amakuru haba kubitagenda ndetse nibigenda neza.

Inama nyinshi zizajya zikorwa,ndetse na mbere yuko Umushinga utangira gushyirwa mubikorwa ningombwa ko Akarere ndetse n'Umushinga babijyanamo murwego rwo kubisobanurira Abagenerwabikorwa(Ba Nyiri mirima).

Akarere kandi Razatanga ubufasha aho Abaturage bazaba binangiye cg batumva neza ibijyanye numushinga.Bazanakurikirana kandi umunsi kumunsi kubufatanye n'Umushinga abantu bazaba bangiza ibikorwaremezo bizakorwa.

IV URUHARE RW'ABAGENERWABIKORWA

Abagenerwabikorwa aha bavugwa niba Nyiri amasambu azatunganywa.

Uruhare rwaho mumigendekere myiza yuyu mushinga ruzagaragartra mubintu bikurikira:

- Gutunganya materasi nk'abakozi ba Nyakabyizi(Manpower)
- Gutanga ubufasha mukubona umubare munini w'abakozi bazakora imirimo yo guca amaterasi
- Gutanga ubufasha mugusobanurira abaturage bazaba binangiye.(Bazaba batumva ingaruka nziza z'umushinga)
- Gutanga bimwe mubikoresho bizifashishwa nko mugukora cg kubona za Checkdams

- Kuvana imyaka mumurima hakiri kare kugira ngo bitazagongana nikorwa ry`amatersi imyaka ikiri mumurima
- Gukurikirana ishyirwa mumurima ry`ishwagara na compost kugira ngo abakozi bazaba babishyiramo batabishyiramo nabi.
- Kubyaza umusaruro imirima yabo nyuma yo kuyitunganya,bahingira igihe kandi bakanahinga igihingwa cyatoranijwe aricyo imyumbati.
- Kwirinda gusiga ibisambu mumirima izaba yaratunganijwe.

V: IBYIZA UMUSHINGA UZAZANIRA ABAGENERWABIKORWA

Abari munama basanze Uyu mushinga hari byinshi uzazanira Abagenerwabikorwa n`abaturage b'akarere ka Nyanza muri rusange aribyo:

- Kubona akazi kubaturage ba Nyanza
- Mituelle zizatangwa kubwinsi kubera akazi
- Ubutaka burwanyijeho isuli
- Amahugurwa atandukanye
- Umusaruro uziyongera
- Isoko ry'umusaruro
- Igabanuka ry'inzererezi

VI: IMBOGAMIZI

Abari munama bagaragaje ko kandi hashobora kuzaboneka imbogamizi zitandukanye arizo:

- Imyaka izaba iri mumulima igihe cyo gutunganya amaterasi
- Abana bashobora kuzata ishuli bakajya gukora imirimo yo mumaterasi
- Kwijujuta kw'abahinzi igihe bazajya batinda guhembwa
- Gutinda gukora cg gutunganya ubutaka bityo ugasanga hari abamaze igihe kinini badahinga
- Abantu batahaba bashobora kuzatuma hari ahazatunganywa ntihahingwe
- Abakozi bashobora kuzabura igihe imirimo izaba itangiye.

VII: INGAMBA

- Kuzatangira mobilization yo gushaka abakozi hakiri kare,hakaniyambazwa abaturage baturutse mutundi turere.
- Gushyiraho gahunda ihamye yo gutunganya ubutaka
- Inama nyinshi n'abahinzi ,ikindi ahazaba hagaragara imyaka imara igihe mumulima kandi imeze neza (Urutoki,Ikawa n'ibindi) nizakurwaho ahubwo bazagirwa inama yo kuhatunganya neza.

IBINDI

Abari munama bahagarariye Akarere basabye ko kugira ngo uyu mushinga ubashe gukorwa kandi uzagere kunshingano zawo,Umushinga ugomba kubakorera ibi bikurikira:

- Gutanga amakuru kumigendekere y'Umushinga
- Gutanga impapuro zose zirebana n'Umushinga
- Gushyiraho gahunda ihamye y'ishyirwamubikorwa ry'umushinga.

Inama yarangiye saa saba nigice(13h30)hanyuma Ikipe yaturutse ku Mushinga ijyana na Agronome wa Busasamana kuri terrain kubonana n'Abaturage bamwe mubazakorerwa Amaterasi.

IBYAVUYE MUBIGANIRO BY`INAMA YABAREYE KURI TERRAIN N'ABAHINZI

Abahinzi cg Abagenerwabikorwa babonetse uwo munsi babaye bake kuko amasaha yarakuze abenshi bavuye mumirima yabo.

Icyari kigamijwe kwari ukubaganiriza kubikorwa biteganijwe ndetse no kubabaza bo ubwabo uko bumva umushinga wazabagirira akamaro ndetse no kubasaba ko babiganiriza bagenzi babo batabashije kuboneka.

Uwaruhagarariye Umushinga yasubiyemo neza ikigamijwe abasobanurira ibijyanye n'Umushinga.abereka ibigamijwe,igihe nyacyo umushinga ushobora gutangirira ndetse anababwira ibyiza umushinga uzazana aribyo:

- Kurwanya isuli
- Gutanga akazi kumubare munini wabazatunganya ubutaka
- Guha abazaba batunganirijwe imirima inyongeramusaruro(Ishwagara ndetse na Compost)
- Amahugurwa
- Kubafasha kongera kubona imbuto y`imyumbati no kuyihinga neza
- Isoko ry'umusaruro n'ibindi.

Abahinzi nabo babajije ibibazo bikurikira kugira ngo babashe gusobanukirwa neza.

- Ese imbuto izaturuka he?
- Ese aho ntituzajya dutinda guhembwa?
- Ese nimuduseba kudahinga kugira ngo hakorwe amaterasi mwarangiza mugatinda kuhagera tugatakaza seasons tuzatungwa niki?
- Ese imyaka yacu izaba iri mumulima ntimuzayirandura?

Mukubasubiza Yaba ari Agronome w'umurenge wa Busasamana n'Abahagarariye Umushinga basubije mu buryo bukurikira:

- Minisiteri y'Ubuhinzi mu rwego rwo kongera umusaruro,ibinyujije muri RAB izahonera abahinzi imbuto nziza kugira ngo nubundi umusaruro uzabe mwiza kandi imbuto izavaho nayo ikwirakwizwe mubandi bagenerwabikorwa.
- Kubijyanye no gutinda guhembwa basobanuriwe ko amalistes azajya akorwa hakiri kare bityo bakajya bahembwa buri minsi 15.
- Hazashakwa umubare munini w'abakozi bityo ntawe uzararanya seasons 2 adahinze.
- Banasobanuriwe ko ntamyaka imeze neza izakurwa mumulima(Urutoki ,Kawa..)ko ahubwo hazasabwa kuyikorera neza.
- Abahinzi kandi basabwa kuba intumwa nziza bakamenyesha abatabashije kugera aho inama yabereye igikorwa giteganijwe ndetse no kuzatanga ubufasha mugushakisha abakozi bazakora amaterasi.
- Abahinzi kandi banasobanuriwe ko hari bimwe mubikoresho bazajya bitangira mugihe cyo gukora materasi cyane cyane nkibyo gukora checkdams n'ibindi.Banasobanurirwa kandi ko aribo bambere bazaherwaho bahabwa Akazi ko gukora imirimo yo guca amaterasi.

Ikindi basobanuriwe nuko ntangurane itangwa ahakozwe amaterasi.Basabwa ko bagomba no gutangira kubahiriza gahunda yo gutura mu midugudu.

Umwanditsi w'Inama :

MUGAMBIRA Bonfils

LIST OF CONSULTED PERSONS DURING RPF CONSULTATION IN NYANZA

NO	NAMES	INSTITUTION	POSITION	SIGNATURE
1	MUGARIBIRA Bonfils	LWH/RSSP	District project Agronomist	
2	USENGIMANA Philbert	NYANZA DISTRICT	District Environment officer	
3	MUSABYEMUNGU Jean d'Amour	Nyanza District	District Cash Crops officer	
4	NZUNGIZE Gustave	Nyanza District	District DMO	
5	KANAMI Enan	BUSASAMANA Sector	Sector Agronomist	
6	SALAMA Julius	LWH/RSSP	MAE NYANZA	
7	RWAMUCYO Prosper	Kinazi Sector	Executive Secretary	
8	IKARAMBAZA Emmanuel	Kinazi Sector	Agronomist	
9	NSANZIMANA Thaogene	Sazange Cell	SEDO	
10	NDAGIJIMANA Emmanuel	SAZANGE Cell	Executif Secretary	
11	Nsengiyumva christophe	NYANZA Cell	umuhinzi	
12	BIMENYIMANA Damascène	Nyanza	umuhinzi	
13	INGABIRE Innocent	Akagari ka Nyanza	Umuhinzi	
14	Munyaneza Aaron	Nyanza	umuhinzi	
15	Nshimiyimana yohani	Nyanza	umuhinzi w'umusozi wa gatagara	
16	Bimenyimana Damascène	Nyanza	umuhinzi nyumwe	