Consortium for the improvement of agriculture-based livelihoods in Central Africa

Musa Sub-Sector Strategic Plan for the Democratic Republic of Congo: 2006–2011

"Addressing the challenges of integrating bananas into the market economy"

April 2007

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FOREWORD

This strategic plan for the *Musa* sub-sector was developed for the Consortium for the Improvement of Agriculture-based Livelihoods in Central Africa. CIALCA brings together national, regional and international partners to focus their resources on improving the livelihoods of people recovering from decades of civil conflicts. CIALCA is implemented by the National Agricultural Research Systems (NARS) of Rwanda, Burundi and the Democratic Republic of Congo, in collaboration with three Consultative Group for International Agricultural Research (CGIAR) centres (Bioversity International, the International Institute of Tropical Agriculture-IITA and the *Centro Internacional de Agricultura Tropical*-CIAT).

CIALCA also draws in the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA) in the framework of the Banana Research for Eastern and Southern Africa (BARNESA) and mirrors the Institute de Recherche Agronomique et Zootechnique (IRAZ), which brings together the NARS of the three Central Africa countries. With the recent revival of the Economic Community of the Great Lakes Countries, IRAZ's role in coordinating sub-regional efforts to address agricultural productivity will be enhanced. Moreover a number of NGOs and private sector organization are operating across the borders of the countries of the sub–region. Such a large number of partners working within the agriculture sector of the sub-region would benefit from a regional strategic plan to facilitate their collaboration, share information and technologies and exploit synergies and institutional comparative advantages within and between them.

It is against this background that the sub-regional players were brought together to analyse and prioritize the contraints on banana productivity at the sub-region level, before identifying and prioritizing them at the country level. The approach also reflects the understanding that the majority, and sometimes the most important constraints, such as banana Xanthomonas wilt (BXW), Banana Bunchy Top Virus (BBTV), fusarium wilt, weevils and nematodes, as well as a host of socioeconomic problems, cut across borders. In addition it was also realized that there was a lot of similarity in terms of demographics, farming systems and socio economic fabric with potential for cross-border synergies that need to be exploited to address any agreed research for development priorities effectively. It was also perceived that identifying, prioritizing and addressing sub-regional constrains in a coordinated way would add value to the national level efforts to address the same.

As the sub-regional level, a number of challenges need to be addressed by research and development:

- Improving transfer of appropriate banana technologies;
- Adding value and improving post-harvest handling;
- Broadening the genetic base of bananas;
- Addressing the major pests and diseases;

Furthermore, another set of very important constraints were rated as medium priority because of the perceived probability of success in the face of the limited resources.These include:

- Improving soil fertility and water management.
- Enhancing the nutritional quality of bananas for income and food security.
- Intensification of the existing production systems.

- Promoting transboundary banana/plantain trade between Uganda, Rwanda, Burundi and DR Congo.

The country priorities mirror the sub-regional priorities, further supporting the need for looking at the larger picture at the sub-regional level, where resources can be aggregated to create greater impact at national levels.

The sub-regional priorities will serve as a guide for resource allocation and sharing of responsibilities between countries and will form a basis for the development other associated policies aimed at improving the livelihoods of the people of the sub region. The document will facilitate discussions at national, sub-regional and international levels where partners may need guidance on resource investment and potential impacts. It will also guide the development of cooperation and collaborations mechanisms with respect to comparative advantages and roles in the collaboration. The priorities however must be construed as dynamic and requiring constant analysis to ensure synergies are exploited, lessons are learnt and critical and timely changes are made to maximize investment by all the interest groups from grassroot organizations to policy makers. To this end CIALCA (along with IRAZ and other sub-regional platforms) will play important roles in strengthening the sub-regional cooperation on agricultural research for development, while enhancing the linkages for information and technology access/exchange between the sub-region and the wider global fora with interests in the region.

INTRODUCTION

Banana is an important staple and cash crop in the Democratic Republic of Congo (DR Congo). In Eastern Congo, bananas account for about 40% of total household income. The largest portion of the production is sold in local markets. An unknown volume is exported to Uganda and Rwanda. Only plantain is exported to Uganda from North Kivu, while beer bananas are the main export to Rwanda.

Bananas are ranked first among staple crop in South and North Kivu as far as acreage and production are concerned. They cover 1.35 million hectares and the annual production is 3.7 million tons (Ministry of Agriculture, 2002). Bananas are usually intercropped with bean, arrow root, yam and cassava, but are also grown as a monocrop. Banana yields are generally low, and vary from 3 tons/ha to 6 tons/ha/year. Bananas are cultivated up to approximately 2300 m.

The cultivars grown vary with the altitude. At the lower altitudes, (below 1200 m in the western part of the country) plantains constitute the main types, followed by Kisubi and dessert bananas. At mid and high altitude (1200 to 2000 m in Eastern Congo, South Kivu, North Kivu and Ituri), the East African highland banana types predominate. Dessert bananas, Kalole and Kisubi are also present. However, above 2000 m, in the eastern part of the country, bananas do not perform well due to the low temperature.

Research and development on bananas is conducted at the universities and INERA. INERA has a germplasm collection at Mulungu Station in South Kivu.Some socio-economic studies are being done by local NGOs such as DIOBASS.

PRIORITY SETTING FOR THE *MUSA* SUB-SECTOR

The process of developing a strategic plan started by identifying the constraints and priority research interventions in order to make decisions on the allocation of investments.

The Project Strategic Planning Workshop followed the seven-step priority setting process recommended by the International Service for National Agricultural Research (ISNAR) and the International Food Policy Research Institute (IFPRI) and adopted by the Association for Strengthening Agricultural research in East and Central Africa (ASARECA). A Network Committee comprising the Bioversity-ESA Regional Coordinator, the Director of the Monitoring and Evaluation and Planning Unit of NARO, and an Associate Scientist at Bioversity-ESA was established (Step 1) to review the banana sub-sector or research domain (Step 2), evaluate existing results (Step 3). For the fourth step, a second committee, a Workshop Process Management Committee (Annex 1), comprising the head of the National Banana Research Programme, eminent scientists and the Network Committee was established to develop/analyse the individual constraints (Step 4) into a set of research alternatives and consolidated into research for development sub-themes (Step 5). Subsequently, a priority setting workshop (Step 6) involving stakeholders was held during the first three days of the Workshop.

Steps 1 to 5 were conveyed to participants by way of presentations and discussions during the workshops. Work in groups and plenary discussions were also used. Presentations were delivered in both French and English, when necessary. Templates and background material were presented in French and English.

Step 6 involved the priority setting workshop itself. The process can be summarized into four key stages:

1. Presentation of the results obtained by the Network Coordination Committee and the Workshop Process Committee were delivered to participants through presentations. The

regional sub-thematic areas for the Great Lakes Region were delivered by the Head of the National Banana Programme to the stakeholder representatives.

2. Group work exercises (and plenary discussions) were utilized to:

    a. verify the key constraints and research areas proposed by the Process Management Committee,

    b. agree on the criteria at country level and determine their relative weight,

    c. score the research areas.

3. The Workshop Process Management Committee synthesized and classified the results into high, medium or low priority research areas.

4. Stakeholder approval of the final results.

IDENTIFICATION OF CRITERIA

The priority-setting process used the weighted scoring method. The method ensures that adjustments can be made as priorities and circumstances change. Application of the weighted scoring method included identifying relevant criteria representative of national goals and research for development thematic areas. The team modified the BARNESA criteria (Annex 2) as indicated in Table 1. The total had to add up to 100.

Table 1. Weight given by the stakeholders to the criteria used to identify the priorities.

Criteria	Weight
Increasing household income	
Creating employment	8
Adding value to banana products	7
Increasing banana products on the market	6
Introducing new and profitable technologies along the chain	8
Improving product quality	6
Increasing household food security	
Increasing banana yields and products	9
Reducing losses at all levels along the chain	6
Introducing demand-driven technologies	5
Improving nutritional value of banana and banana products	5
Maintaining the sustainability of the natural resource base	
Reducing use of chemical additives	3
Reducing soil fertility loss	7
Improving air and water quality	4
Conserving banana-based biodiversity	6

Criteria	Weight
Strengthening institutional capacity	
Improving linkages and partnerships	2
Improving the skills of stakeholders	2
Strengthening financial resource base	2
Improving infra-structure	2
Improving the policy environment	
Strengthening advocacy at the grassroots	2
Generating policy data/information	2
Improving linkages between policy organizations	2
Facilitating information exchange and utilization	
Increasing information generation	2
Increasing information dissemination	2
Increasing information utilization	2

IDENTIFICATION OF CONSTRAINTS

The situation was analysed to identify the main constraints that need addressing and how they interact. Opportunities were also highlighted. The potential impact of resolving a constraint or addressing an opportunity was borne in mind while establishing priorities.

The process began with the strategic management committee consulting with a wide range of stakeholders. The committee synthesised the results of the consultation in a list of key constraints and opportunities. A causal structure among the constraints was used to establish the problems rather than the symptoms.

From the analysis of the constraints, it was established that the banana cropping system and the marketing of banana are much constrained by biotic and abiotic factors leading to low productivity and institutional weaknesses. The following constraints were identified.

Production constraints

Productivity has declined in recent times thereby failing to benefit from increased market opportunities and further threatening food security. The decline in output is due to several factors which include; low genetic base, poor access to improved planting materials, low external inputs, declining soil fertility, pests and diseases, and non adoption of improved technologies by the farmers.

Low genetic base: In view of the fact that bananas are constrained by a lot of biotic factors, there is a need for a diverse genetic base from which to draw genes to breed for resistance or tolerance against such factors. Unfortunately, the genetic base of bananas in DR Congo is low. This puts a big challenge to the scientists in developing germplasm that can stand the pressure of pests and diseases and that can meet the demand of stakeholders.

Poor access to improved planting materials: To compound the problem of a low genetic base, the few improved planting materials in the country and region cannot be easily accessed. For some places are very distant and the roads are very bad. The regionally available materials require some complex mechanisms to access. In this strategic plan measures for improving access are presented and will have to be explored to improve the situation.

Low external inputs: Like many other African countries, DR Congo is not an exception in using few external inputs, especially fertilisers. In most cases, inorganic fertilisers are not applied. The use of manure too is negligible. Nutrients are mined from the gardens by harvesting the bananas and taking them to markets without replenishing soil nutrients. Mulch is occasionally applied but in insufficient quantities to cause any significant replenishment.

*Low and declining soil fertility***:** Low soil fertility in the main banana production areas limits its extension. Soils in the eastern highlands are acidic and low in bases. Magnesium deficiency is also common. Bananas are grown around homesteads and fail to grow and produce where soils are not improved by house refuses. Poor soil conservation measures have also contributed to loss of fertility through erosion. The use of organic fertilizers is very limited given the small number of livestock. Cooking bananas is more sensitive to soil fertility levels and it is one of the reasons it is not the dominant type of banana grown in the country. The soil without any major productivity problem are those of volcanic origin and the alluvial soils, extensive in north Kivu.

Pests and diseases: The main banana diseases are present: fusarium, black and yellow Sigatoka, bacterial wilt and bunchy top. The common pests, which cause considerable damage, are weevils and nematodes.

The emerging threat is bacterial wilt spreading in North Kivu where banana production is highest thanks to fertile soils. All varieties are infected, and 5% of banana field is estimated to be infected in Rutshuru and Masisi territories. This disease require mobilisation of all and urgent action, if not there is risk that all banana be wiped out. There are some evidences of the diseases spreading to South Kivu.

Improved production technologies not used by farmers: Generally, the standards of farm management are low, which leads to low productivity. There is limited use of manure or mulches due to lack of resourcesTraditionally, banana is intercropped with annual crops (predominantly beans).

Marketing constraints

Markets and marketing can play a big role in improving livelihoods but the major constraints are poor infrastructures, price fluctuations and inadequate market information.

Poor road infrastructure: The road infrastructure in DR Congo is very poor. The roads are almost impassable during the rainy seasons. Lorries get stuck in the mud for days during which time bananas ripen. The bulky nature of bananas makes their transportation difficult.

*Low banana farm gate prices***:** Banana farm gate price is very low in most remote zones because of bad road conditions. As a consequence, in these zones, farmers take less care of bananas. Only the middlemen benefit from the crop, although the price on the market in large cities is quite high, particularly for the cooking (i.e. plantain) and dessert types.

Subsistence-oriented banana production: Integrating bananas into the market economy will require a shift in agricultural methods. It has been a characteristic of the banana growers to do it for susbsistance. This has to change so that they can do for income generation and preferably on a commercial scale. During the next five years, programmes for commercial-oriented banana production will be developed and implemented.

Lack of market information for business planning: There is no formal mechanism for scanning the environment to establish market opportunities for the farmers to sell their produce. This is worsened by the fact that the skills for market intelligence are lacking in the communities. Without appropriate market information farmers cannot decide quickly where and when to sell.

Post-harvest constraints

Many losses are incurred after harvest. The situation is worse with bananas because of being highly perishable. There is a need to invest in post-harvest technologies to improve the value of the crop right from harvest up to consumption. The major factors are poor handling, low value addition, high production costs for some products and poor planned harvests.

Narrow range of banana products: Cooking bananas are mainly sold as bunches or hands. Deserts are sold when ripe. The most common banana products are juice and beer. There are many more products that can be developed from bananas and yet this knowledge is lacking. A wide range of products will act as catalyst in improving productivity.

Poor product quality: It has been observed that the quality of the products on the market is poor. The shelf life of some products is low. There is need to improve the quality, especially critical if the plan is to supply regional markets.

Insufficient post harvest technologies: Improving the quality of banana products and widening the range of the products, it requires application of appropriate post-harvest technologies. Unfortunately, such technologies are insufficient. This can be attributed to insufficient human resources and financial resources for technology generation and development. There will be deliberate efforts to invest in increasing the availability of appropriate post-harvest technologies.

Institutional constraints

The major institutional constraints are; low human resource capacity in terms of numbers and skills, absence of policy to promote banana sector, poor integration of research system, no access to credit, inefficient extension systems leading to low technology use, and low priority given to the banana sector. There is need for government and development partners to address the above institutional constraints. This will create an enabling environment for all the other constraints to be easily addressed as they greatly hinge on prevailing institutional environment.

IDENTIFICATION OF RESEARCH AREAS

Based on the overview of the banana sector, the following list of research areas was generated:

- Collecting and/or introducing, characterizing and conserving germplasm in Eastern DRC.
- Improving marketing and marketing information opportunities.
- Developing integrated pest management strategies.
- Developing sustainable and profitable soil fertility management options (such as cover crop, legume integration, farm yard manure, compost).
- Identifying, adapting and promoting appropriate post-harvest technologies.
- Developing efficient seed systems for clean planting material.
- Developing and promoting market-led banana varieties.
- Developing strategies for conflict prevention.
- Human resource development (such as marketing, value addition, M&E, policy analysis).

PRIORITY RESEARCH AREAS

The participants discussed the contribution of the research areas to meeting the identified criteria. Each research area was scored according to its estimated impact on a given criterion, from -5 for a very significant negative effect (if, for example, it had a negative impact on the

environment, gender equity or employment) to +5 for an extremely positive effect. A score of 0 implied that the research area would contribute nothing to that criterion. The scores given by the participants were averaged and multiplied by the weight given to each criterion. The standard deviation was used to separate the research areas into three groups: high, medium and low priority.

This exercise is to help managers decide to which projects allocate resources. All high being equal, the high priority projects will be allocated more resources than the ones ranked medium and low. The results of the priority exercise are presented in Table 2. Participants were given the opportunity to review the results of their scoring so as to identify outlier scores. If resources are very limiting, the high priority areas will be considered first.

Table 2. Priority given to each research area for DR Congo.

Research areas	Priority
Identifying, adapting and promoting appropriate post-harvest technologies. Human resource development (such as marketing, value addition, M&E, policy analysis). Developing and promoting market-led banana varieties. Developing sustainable and profitable soil fertility management options.	High
Developing efficient seed systems for clean planting material. Developing integrated pest management strategies. Improving marketing and marketing information opportunities. Developing strategies for conflict prevention.	Medium
Collecting and/or introducing, characterizing and conserving germplasm in Eastern DR Congo.	Low

STRATEGIC PLAN FOR THE *MUSA* SUB-SECTOR

Stakeholders recognise the fact that bananas are a very important commodity in the livelihoods of the people and that the production-to-consumption chain does not effectively meet the stakeholders' expectations. The need to improve production and productivity of bananas has become so apparent that research has to be conducted in a different way from what it has been. The overriding goal here is to contribute to poverty eradication. To this effect the paradigm shift in banana research will be geared towards increasing household income, improving household food security, maintaining the sustainability of the natural resource base, strengthening institutional capacity, improving the policy environment and facilitating information exchange and utilisation.

VISION AND MISSION

The vision is for research to create a profitable and sustainable *Musa* sub-sector, whereas the mission is to generate and disseminate appropriate technologies that will result in improving the banana cropping system for increased contribution to the well-being of the population of DR Congo.

CHALLENGES

The ultimate goal of this strategic plan is to have bananas fully integrated into the market economy but appropriate strategies and approaches need to be implemented in order to address the following challenges:

- *Improving marketing and marketing information opportunities.* Characterizing domestic and regional markets and market chains should reveal opportunities and potentially marketable banana products. Establishing effective and sustainable partnerships between the private sector, farmer organizations and policy makers should also help address this challenge. Other activities include; promoting banana in the media and at trade fairs, and training stakeholders on quality standards. Farmers groups should be strengthened to increase their bargaining power and market information should be more accessible.

- *Identifying and promoting appropriate post-harvest technologies.* Possible activities include identifying and documenting existing value added technologies and assessing their profitability, evaluating with farmers and other end-users techniques for reducing losses due to handling and transportation, developing promotional materials (posters, brochures) and medias briefs, evaluating processing technologies and assessing their profitability, and training partners in these technologies.

- *Developing sustainable and profitable soil fertility management options.* Soil erosion control strategies adapted to banana production systems should be identified, evaluated and disseminated. Integrating livestock to the system would provide manure.

- *Developing integrated pest management strategies.* Research should help develop and promote environmentally-friendly pest and disease management strategies. The spread of pests and diseases should be monitored, especially the one of BXW.

- *Developing efficient seed system for clean planting materials.* Appropriate policies and facilities producing clean planting materials should be developed.

- *Developing and promoting market-led banana varieties.* Banana varieties can be evaluated in participatory trials to see if they meet market requirements, consumer preferences and local agro-ecological conditions.

- *Improving the adoption of new banana varieties.* Limited access to improved technologies, an inadequate supply of planting materials, and few opportunities to observe the performance of the new varieties are said to be responsible for the low adoption rate of the latter in Africa. Multiplication facilities, demonstration trials in farmer field schools and promotional activities should improve the adoption of improved banana varieties.

- *Building human and physical capacity.* Gaps were identified in the areas of marketing, value addition, monitoring and evaluation and policy analysis. Training programmed based on the identified needs should be developed and the physical infrastructure improved.

STRATEGIC OBJECTIVES AND OPPORTUNITIES

The strategic objectives that will be pursued in the coming years are:

- Improving the current banana yield from 5-8 tones/ha to 30 to 40 tones/ha by the sustainable appropriate technologies use;
- Adding value to banana products;

- Strengthening physical and human capacity of the stakeholders;

- Generating information to enable policy formulation;

In addressing the strategic objectives, the main opportunities to take advantage of are:

Presence of NARIs, universities and NGOs. These are important partners in the implementation of the research agenda. The NARIs and Universities are potential sources of technologies, knowledge and skills needed to address the identified strategic challenges. The NGOs will be very useful as technology uptake pathways and delivery agencies.

Human and physical resources. Despite being scarce, there are resources available in the critical disciplines, human as well as physical, especially laboratories, computers, vehicles and infrastructure.

Proximity of markets in neighbouring countries. The neighbouring countries already offer a big market for the bananas produced in DR. Congo.

Partnership with international research organizations: Partners are a potential source of ideas and finances. For example INIBAP (renamed Bioversity International), ASERECA and BARNESA can help in seeking funds. Bioversity and IITA can be sources of germplasm.

The logical framework for the implementation of the strategic plan is presented in Annex 3 and details on the activities in Annex 4.

SUCCESS FACTORS

In order to effectively implement the different strategies for achieving the strategic objectives, the critical factors that will define success are:

- *Timely funding*: the proposed research interventions will require a timely flow and release of funds if the action plan is to be implemented accordingly.

- *Adherence to work plans*: this is necessary to achieve the outputs of the agenda and a means of accountability to the partners.

- *Community participation and ownership*: the communities must be involved and own the process.

- *Effective partnerships*: the production to consumption chain requires the participation of different players each contributing at critical points. The processors, marketing, transport to mention but a few will need to work together with a common vision.

- *Security*: this affects all the spheres of the economy and research can be very vulnerable to the extent that no funds will flow into the system and researchers won't be able to work.

- *Political will*: the government and other policy makers should be committed to the cause of improving the banana sub-sector.

CORE VALUES

The following core values are recommended in the implementation of the strategic plan:

- *Team spirit*: valuing team spirit, creativity and respect for one another and recognising diversity in the workplace (gender, cultural and professional), building on them as strengths.

- *Integrity*: respecting and responding to the needs of our partners and the people we serve with a high degree of integrity.

- *Transparency*: believing in and supporting transparency in our activities, resource allocation and decision-making.

- *Result oriented*: valuing time management and a result-oriented work ethics.

- *Non-bureaucratic*: maintaining an informal working environment, valuing effective vertical and horizontal communication more than hierarchy (non- bureaucratic).

IMPACT AND PERFORMANCE ASSESSMENT

Periodic assessment of performance and impact is a key element to measure the contribution of banana research to rural development, as well as to identify its strengths and weaknesses. In future, the DR Congo Banana Research Programme will ensure that performance indicators are identified. Such indicators will be simple and clearly defined to allow appropriate participatory methodologies to be used in performance and impact assessments.

The DR Congo Banana Research Programme will also assess the processes and methods. Accuracy and dependability of results not only depend on clearly defined monitorable indicators and the availability of reliable data and information, but also on the wider participation of stakeholders in the assessment process. A management information system is a useful tool for capturing, updating and creating data, and monitoring provides a feedback mechanism. Integrating the two greatly facilitates performance assessment. The programme will seek to develop and implement such a system and to monitor and evaluate processes and methods by:

- Establishing a set of key quantitative and qualitative monitorable indicators to asses the project outputs and results;

- Documenting results to evaluate their effectiveness and impact on increasing production, incomes as well as their environmental impacts;

- Creating a database to ensure the timely and reliable assessment results.

The assessment process will involve partners and clients in operational areas. In order to integrate monitoring and evaluation processes with the performance assessment process, the focus will be on developing milestones and outputs for performance evaluation. Comprehensive baseline surveys will be conducted to set benchmarks against which future improvements will be gauged.

ANNEX 1: THE WORKSHOP PROCESS MANAGEMENT COMMITTEE

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ANNEX 2: ORIGINAL CRITERIA AND SUB-CRITERIA

INCREASING HOUSEHOLD INCOME
Creates employment
Adds value to banana products
Increases banana products on the market
Introduces new technologies along the chain
Improves product quality
IMPROVING HOUSEHOLD FOOD SECURITY
Increases yields of banana and products
Reduces losses at all levels along the chain
Introduces demand-driven technologies
MAINTAINING THE SUSTAINABILITY OF THE NATURAL RESOURCE BASE
Reduces use of chemical additives
Reduces loss of soil fertility
Improves the quality of air and water
Conserves banana-based biodiversity
STRENGTHENING INSTITUTIONAL CAPACITY
Improves linkages and partnerships
Improves the skills of stakeholders
Strengthens Financial Resource Base
Improves infra-structure
IMPROVING THE POLICY ENVIRONMENT
Strengthens advocacy at the grass-roots
Generates policy data/information
Improves linkages between policy organisations
FACILITATING INFORMATION EXCHANGE AND UTILISATION
Increases information generation
Increases information dissemination
Increases information utilization

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ANNEX 3: LOGICAL FRAMEWORK OF THE STRATEGIC PLAN.

	Objectives	Indicators	Evidence (means of verification)	Assumptions
Goal	Bananas fully integrated into the market economy of DR Congo	- Percentage increase in contribution of banana to GDP - Number of organised marketing channels - Number of value added products on the market	- National budget speeches - National statistics -Market survey reports	
Purpose/ Outcome	Increased banana productivity in DR Congo	- Level of commercialization of fresh and value added products - Decrease in loss due to pests and diseases - Increased soil fertility and watershed management - Increased banana yields - Number of functional linkages among producers, processors and researchers	Rapid rural appraisal reports Annual reports Survey reports	
Outputs	1. Market opportunities for banana and banana products identified	- Number of trans-boundary banana products' markets and market chains - Number of identified potentially marketable banana product	Survey reports	
	2. Effective and sustainable partnerships among private sector, farmer organizations and policy makers linking banana sector to markets established	- Number of participating partners in production, processing and trading of bananas. - Number of functional partnerships - Number of products promoted through media, advertisement, and trade fair.	Variety release committee reports	

	Objectives	Indicators	Evidence (means of verification)	Assumptions
	3. Bargaining capacity of local communities strengthened	-Number of functional farmers groups - An operational mechanism of capturing and disseminating market information on banana products - Number of supportive policies passed by government	Producers satisfaction survey reports Extension delivery reports	
	4. Value added products identified, adapted and promoted at all levels of the stakeholders	- Number of value added products promoted	Survey reports Annual reports	Conducive environment for applying the skills exists
	5. Handling losses reduced	- Number of post-harvest handling options adopted - Reduction in handling losses	Survey reports	
	6 Development Agro-enterprises for banana processing facilitated	- Number of banana agro-enterprises	Survey reports	Farmers adopt the pests and disease management technologies
	7. Appropriate soil fertility management technologies/innovations for sustained smallholder banana production developed and promoted	- Number of soil fertility management technologies adopted	Adoption study reports	Favourable policy environment
	8. Environmentally-friendly pests and diseases management technologies for intensifying smallholder banana production developed and promoted	- Number of pest and disease management technologies promoted.	Survey reports	
	9. Strategy to stop BXW expansion implemented in North Kivu	- Number of functional partnerships - Number of activities jointly implemented	Partnership documents Annual and quarterly reports	Conducive environment for networking exists
	10. Livestock Integrated in the banana agro-system	- Number of farmers with livestock in the banana agro-system	Survey reports Annual reports	

	Objectives	Indicators	Evidence (means of verification)	Assumptions
	11. Planting material exchange policy reinforced.	- Number of policies that support the exchange of planting materials - Number of people happy with material exchange policies	Policy documents Customer satisfaction reports	
	12. Knowledge and skills of key stakeholders to manage clean planting materials enhanced	- Number of key partners in seed systems. - Number of community based nurseries and clean planting materials - Number of trained key stakeholders in handling clean planting materials	Survey reports	
	13. Clean planting materials accessed by farmers	- Number of producers accessing new varieties - Number of mechanisms for accessing varieties	Survey reports Annual reports	
	14. Market-led banana varieties developed	- Number of market-led banana varieties	Survey reports Annual reports	
	15. New varieties adopted	- Number of new varieties adopted	Adoption rate study report	
	16. Capacity for *Musa* sub-sector research built	- Number of researchers trained - Number of extension workers trained - Number of stakeholders trained - Adequacy of research infrastructure	Training reports	

ANNEX 4: RESEARCH OUTPUTS AND ACTIVITIES

Activities	Stakeholders	R&D work done by partners	Sites
1. Improving marketing and marketing information opportunities on banana			
Output 1.1. Market opportunities for banana and banana products identified			
1.1.1. Characterize domestic and trans-boundary banana and banana products markets and market chains	DIOBASS, UCG, UCB, INERA	DIOBASS, has started market studies in, UCB, UCG	South and North Kivu, Rwanda, Burundi and Uganda border
1.1.2. Identify potentially marketable banana product		South and North Kivu	
Output 1.2. Effective and sustainable partnerships among private sector, farmer organizations and policy makers linking banana sector to markets established			
1.2.1. Identify participating partners in production, trading including exporting and processing	INERA, IPAPEL, DIOBASS, AATN	-	South and North Kivu
1.2.2. Establish and strengthen linkages among partners along the product to marketing chain (MoUs, …)	INERA, SNV DIOBASS		"
1.2.3. Promote banana marketing through media, advertisement, fair	IPAPEL, RADIO Kahuzi, Radio Maendeleo,		"
1.2.4. Train stakeholders on banana quality standards	INERA, UCG, OCC.		"

Activities	Stakeholders	R&D work done by partners	Sites
Output 1.3. Bargaining Capacity of local communities strengthened			
1.3.1 Facilitate and strengthen farmers groups	INERA, IPAPEL		South and North Kivu
1.3.2 Generate and disseminate market information on banana products	INERA, SNV, IPAPEL, ISDR.		
1.3.3 Facilitate enabling policy to enhance banana and products	IPAPEL		"
2. Post-harvest technologies			
Output 2.1. Value added products identified, adapted and promoted			
2.1.1. Identify and document existing value added technologies	INERA, FAO/Goma.		South and North Kivu
2.1.2. Evaluate with farmers and other end-users the existing options and techniques for reducing losses due to handling and transportation	"		
2.1.3. Assess profitability of use of selected value adding technologies	UCG, UCB		
2.1.4. Develop and produce promotional materials (posters, brochures) and medias briefs, …	UCG, UCB, DIOBASS, FAO, ISDR.		
2.1.5. Train potential processors	IITA-FOODNET		

Activities	Stakeholders	R&D work done by partners	Sites
2.1.1. Collate and evaluate with farmers banana post-harvest handling options	INERA, SOPAT / Goma		South and North Kivu
2.1.2. Disseminate appropriate improved banana handling and post harvest technologies through demonstration, promotion materials (leaflets, brochures, posters)	DIOBASS, AEPAS, MEDIAS, ISDR.		"
2.1.3. Train stakeholders on banana quality standards	Bioversity, IITA, OCC		"
2.1.4. Train potential transporters			"
	DIOBASS, AEPAS.		
Output 2.3. Development Agro-enterprises for banana processing facilitated			
2.3.1. Evaluate existing banana processing technologies	INERA, Bioversity, IITA.		South and North Kivu
2.3.2. Assess the profitability of use of selected value adding technologies	UCG, UCB, INERA.		
2.3.3. Demonstrate relevant banana processing technologies			Bukavu, Goma
	DIOBASS, OLAME, UMAMABU, SOJUF, KIVU WINE		South Kivu
2.3.4. Train participating partners on production, processing and marketing technologies	Bioversity, IITA.		North and South Kivu
	DIOBASS, OLAME, UMAMABU, SOJUF, KIVU WINE		
	Bioversity, IITA.		

Activities	Stakeholders	R&D work done by partners	Sites
Soil fertility and IDPM technologies			
Output 3.1. Appropriate soil fertility management technologies/innovations for sustained smallholder banana production developed and promoted 3.1.1. Identify and evaluate soil erosion control strategies adapted to banana system 3.1.2. Evaluate and disseminate soil fertility management technologies 3.1.3. Advocacy for land tenure and conflict resolution	INERA, UCG, IITA, CIAT / TSBF. " UCB/CEGEC, UCG/CEJA		South Kivu (all) and Kichanga South Kivu (all) North and South Kivu
Output 3.2 Environmentally friendly pests (weevils and nematodes) and diseases (fusarium) management technologies for intensifying smallholder banana production developed and promoted 3.2.1. Evaluate with female and male farmers pests and disease management options including cultural practices (companion and intercropping) 3.2.2. Demonstrate appropriate IPM technologies through Farmer Field school 3.2.3. Monitoring pests and diseases	UCG, UCB, INERA, IITA, Bioversity, TSBF INERA, FRAMERS GROUPS, DIOBASS UCB, UCG, Bioversity, IITA		Kishanga, Kashenyi, Bugobe Centre, Kabumba, Cijingri, Rubumba North and South Kivu

Activities	Stakeholders	R&D work done by partners	Sites
Output 3.3. Strategy to stop BXW expansion implemented in North Kivu 3.3.1. Monitor BXW expansion in Eastern Congo 3.3.2. Disseminate alert system in unaffected zones 3.3.3. Reinforce BXW control measure	UCG, UCB, INERA, IITA, Bioversity, TSBF		Masisi, Rutshuru
Output 3.4 Integration of livestock in the banana agro-system 3.4.1. Train farmers of manure technologies 3.4.2. To choose multipurpose fodder crops in the banana agro-systems	INERA, IITA, Bioversity, TSBF INERA, IITA, Bioversity, TSBF		North and South Kivu "
4. Efficient seed system for clean planting materials			
Output 4.1. Planting material exchange policy reinforced 3.1.4. Develop policy briefs and promote for seed exchange 3.1.5. Develop micro- and macro-propagation facilities on station and in farmers communities 3.1.6. Facilitate farmers' organization for clean planting materials	IPAPEL, INERA INERA, DIOBASS, IPAPEL IITA, Bioversity "		North and South Kivu Mulungu, Bweremana Mulungu, Bweremana

Activities	Stakeholders	R&D work done by partners	Sites
Output 4.2. Knowledge and skills of key stakeholders to manage clean planting materials enhanced 4.2.1. Identify key partners in seed systems. 4.2.2. Organize community based nurseries and clean planting materials 4.2.3. Train key stakeholders	SENASEM, INERA SNV UCG, INERA		North and South Kivu Mulungu, Goma
Output 4.3. Clean planting materials accessed by farmers 4.3.1. Establish efficient CPM system 4.3.2. Establish community based CPM production 4.3.3. Monitor seed quality	UCG, UCB, INERA INERA, IPAPEL, ISDR UCB, UCG, SENASEM, INERA		North and South Kivu North and South Kivu North and South Kivu
5. Market-led banana varieties			
14.1 Banana varieties that meet market requirements/preferences identified 5.1.1. Introduce/ collect banana varieties that meet domestic and export market demands 5.1.2. Evaluate in participatory trials and select potentially marketable varieties in different agro ecological zones for adaptation 5.1.3. Conduct acceptability test	UCB, UCB, INERA, UCB, UCB, INERA, IPAPEL INERA, DIOBASS, UMAMABU		North and South Kivu " " "
5.2. New varieties adopted			

Activities	Stakeholders	R&D work done by partners	Sites
5.2.1. Multiply identified varieties 5.2.2. Disseminate selected varieties through demonstration trials in Farmer Field schools 5.2.3. Promote selected varieties through various promotional materials, medias, field days	UCG, INERA INERA, AEPAS, IPAPEL, DIOBASS INERA, IPAPEL, ISDR, RADIOS		Mulungu, Bweremana South and North Kivu
6. Capacity building			
Assess training need	INERA, UCB, UCG		North and South Kivu
Training	UCL, KUL, UCG, UCB, South Africa, Sokoine, Makerere		North and South Kivu

ANNEX 5: ACRONYMS

ASARECA	Association for Strengthening Agricultural Research in East and Central Africa
BARNESA	Banana Research Network for East and Southern Africa
BIOVERSITY	Bioversity International
BXW	Banana *Xanthomonas* Wilt (or Banana Bacterial Wilt)
CIALCA	Consortium for the Improvement of Agriculture-based Livelihoods in Central Africa
CIAT	Centro International de Agriculture Tropical
DGDC	Directorate General for Development Cooperation, Belgium
DIOBASS	Demarche pour une Interaction entre Organisation de Base et Autre Sources de Savoirs
DR Congo	Democratic Republic of Congo
ESA	Eastern and southern Africa Office
GDP	Gross Domestic Product
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
INERA	National des Etudes et de la Researches Agricole
IPM	Integrated Disease Management
ISNAR	International Service for National Agricultural Research
MEPU	Monitoring, Evaluation and Planning Unit, NARO
NARO	National Agricultural Research Organisation, Uganda
NARS	National Agricultural Research System
R&D	Research and Development

Consortium for the improvement of agriculture-based livelihoods in Central Africa

Following a call for proposals of the Directorate General for Development Cooperation (DGDC – Belgium) in April 2004, three proposals were approved:

• 'Sustainable and Profitable Banana-based Systems for the African Great Lakes Region', led by the International Institute of Tropical Agriculture (IITA), Kampala, Uganda.

• 'Enhancing the resilience of agro-ecosystems in Central Africa: a strategy to revitalize agriculture through the integration of natural resource management coupled to resilient germplasm and marketing approaches', led by the Tropical Soil Biology and Fertility Institute of the International Center for Tropical Agriculture (TSBF-CIAT), Nairobi, Kenya.

• 'Building Impact Pathways for Improving Livelihoods in *Musa*-based Systems in Central Africa', led by Bioversity International, Kampala, Uganda.

As the above projects proposed to operate largely in the same parts of Rwanda, Burundi, and the Democratic Republic of Congo (DR Congo), with similar national partner institutes, and due to the complimentary nature of the activities proposed, above institutes agreed to operate as a Consortium to ensure cooperation and complimentarity and avoid technical and financial duplication at the national level. The Consortium for Improving Agriculture-based Livelihoods in Central Africa (CIALCA) is a Consortium of the International Agricultural Research Centers (IARCs) and their national research and development partners that aims at close technical and administrative collaboration and planning in areas of common interest, thereby enhancing returns to the investments made by DGDC and accelerating impact at the farm level.

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