



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

CIALCA Progress Reports **02**

Summary Progress Report September 2005 – April 2007



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EXECUTIVE SUMMARY

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 in order to accelerate impact at the farm level. CIALCA mandate areas are located in DR Congo, Rwanda, and Burundi.

A Memorandum of Understanding (MoU) has been drafted that formalizes the collaboration between the three CGIAR-led projects funded by the Belgian DGDC. In addition, a CIALCA consultative committee (CCC) has been established to give all primary CIALCA partners the opportunity to help decide how CIALCA can best move forward. CIALCA tries to encourage communication between all research and development partners through common planning and feedback workshops, a CIALCA website (www.cialca.org), and electronic newsletters.

In the beginning of 2006, most CIALCA activities were related to exploring existing knowledge through literature reviews, exploiting geographic-related data through GIS analysis, and mobilizing existing expertise in the region. In the second half of 2006, much emphasis was put on thorough characterization of the agriculture-based livelihoods in the region. By late 2006 and the first half of 2007, these studies were further elaborated upon by zooming in on specific crops and themes; e.g. crop diagnostic surveys, market surveys covering the value chain from farmer to cross-border trade, and micronutrient sampling of food crops in the region. By late 2006 and early 2007, germplasm trials were started. Farmer evaluations and selections took place for the legumes. Further on-farm and on-station trials were installed and will continue to be installed in the near future to address specific constraints such as soil fertility, erosion, IPM, fodder production, post-harvest constraints, and food quality and quantity.

Besides reinforcing regional collaboration in the CEPGL countries, CIALCA is strengthening the Research for Development capacity in the region through supporting undergraduate and graduate students; i.e. a total of 29 students have been supported by CIALCA thus far. The Belgian university partners play a critical role in this as well. PhD and MSc students help to address strategic research issues that need to be resolved if long term impact is to be achieved.

The CIALCA partners all have invested many resources and time to create partnerships, to characterize the farming systems in the mandate areas, and to identify the bottle necks that have to be overcome to sustainably improve livelihoods. These investments express a shared medium-to-long term vision of partners that extends beyond the current phase of the projects.

1. BACKGROUND – THE CREATION OF CIALCA

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, 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 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.

Although maybe ambitious in nature, **CIALCA HAS PROVEN TO WORK**, both at the administrative and technical level, as shown below, because of the support received from the administrations of the respective NARSs and IARCs but especially because of the commitment towards the CIALCA ideas and approaches from all partners involved. To get this far, CIALCA has also meant a substantial investment in resources and time of all partners who thus share a medium-to-long term vision, extending beyond the current phase of the projects.

2. PROGRESS WITH CIALCA ACTIVITIES

After the initial conceptualization of CIALCA, various initiatives were taken between September 2005 and today (April 2007) to operationalize CIALCA, at the administrative, technical, and capacity building level, as summarized below. Additional details regarding progress with the proposed activities are summarized in the log-frame review of the three projects in Section 5 of this Report.

2.A. ADMINISTRATIVE PROGRESS

1. MEMORANDA OF UNDERSTANDING

- In order to formalize CIALCA, a **MEMORANDUM OF UNDERSTANDING** (MoU) between the three IARCs is near completion. This MoU details, among other aspects, reporting and accounting channels, use of common travel and student support rates, and the use and write-off of capital equipment. A **CIALCA LOGO** has also been drafted (see top left part of the cover page of this Report).

2. STEERING COMMITTEE

- Currently, the Terms of Reference of the **CIALCA CONSULTATIVE COMMITTEE** (CCC) are being finalized and it is expected that a CCC meeting will be held in association with the annual planning meetings of each project. The CCC will be responsible for overall supervision of the projects and monitoring implementation of the research agenda. The CCC will also guide the development of future phases of CIALCA.

3. OFFICES, COORDINATORS AND CAPITAL INVESTMENTS

- To facilitate CIALCA activities, **CIALCA OFFICES** have been set-up in **BUKUVA** (DR Congo) and **KIGALI** (Rwanda) while a CIALCA contact person has been identified in **GITEGA**, Burundi, and **KINSHASA**, DR Congo (**Photograph 1**). The offices are fully equipped with communication and transport equipment and are managed by a national coordinator who facilitates office operations, implementation of activities, and relationships with all national partners. Capital and operational funds needed for operating the offices are shared between IITA, TSBF-CIAT, and Bioversity following a **40:40:20 RATIO**, derived from the relative availability of operational and capital funds for the Great Lakes region in each of the projects.



Photograph 1: The CIALCA offices in Bukavu, DR Congo (left) and Kigali, Rwanda, (right).

- The **COORDINATES** of the CIALCA offices are:
 - **Burundi:** Mr. Sylvestre Hakizimana, IRAZ, PO Box 91, Gitega, Burundi; Tel: (+257) 403020/21; Mobile: (+257) 903315; Email: iraz@cbinf.com or hakizisyl@yahoo.fr.
 - **Rwanda:** Mrs. Kantengwa Speciose, c/o CIAT Rwanda, Kacyiru, Boulevard the l'Umuganda, Concorde building, 1st floor, Kigali, Rwanda; Tel:(+250) 55 104708 or 08518471; Email: skantengwa03@yahoo.fr.
 - **DR Congo – Sud-Kivu:** Mr Dieudonné Katunga Musale, Coordinator, 6 Av. Kasongo, Commune d'Ibanda, Bukavu, D.R.Congo; Tel:(+243) 98 669793; Email: katungamusale@yahoo.fr.
 - **DR Congo – Bas-Congo:** Mr Jean-Paul Lodi Lama, c/o INERA office, 13 Avenue des Cliniques, Kinshasa-Gombe, B.P.2037 Kinshasa 1 D.R.Congo; Tél: (+243) 815136746; Email: lodilama_jeanpaul@yahoo.fr.

4. COMMUNICATION AND REPORTING CHANNELS

- Communication and information sharing channels have been activated and consist of a CIALCA website (**WWW.CIALCA.ORG**), a quarterly electronic **NEWSLETTER**, and a series of **TECHNICAL REPORTS**, to be posted on the website.
- In terms of **TECHNICAL AND FINANCIAL REPORTING LINES**, funds to support project activities will flow from the individual IARC center to the partners at the sites that are leading those activities. Technical reports and accounting will flow through the CIALCA offices in the various regions to the individual IARCs. Funds to support specific activities, led by the CIALCA coordinators, will flow directly to the respective CIALCA offices.

2.B. TECHNICAL PROGRESS

1. PLANNING MEETINGS

- A major venue for technical planning of CIALCA activities have been **ANNUAL PLANNING MEETINGS** of the individual projects with all project partners, in which all other projects were represented. Such meetings took place in Bukavu, DR Congo (19-23 September 2005), for the TSBF-CIAT-led project, in Rubona, Rwanda (2-7 October 2005), for the IITA-led project, in Butare, Rwanda for the Bioversity -led project (28 November – 2nd December 2005) and in Bujumbura, Burundi (27 February - 3 March 2006) for both the IITA and Bioversity-led project.

2. SELECTION AND CHARACTERIZATION OF ‘MANDATE AREAS’

- A total of **10 ‘MANDATE AREAS’** have been identified in DR Congo, Rwanda, and Burundi, based on the goals of the individual projects, the presence of partners, and other technical or logistical reasons (**Figure 1**).
- Each mandate area was **CHARACTERIZED** in terms of a number of key variables, including the agro-climatology of the area, the population density of the area, and the access to markets.

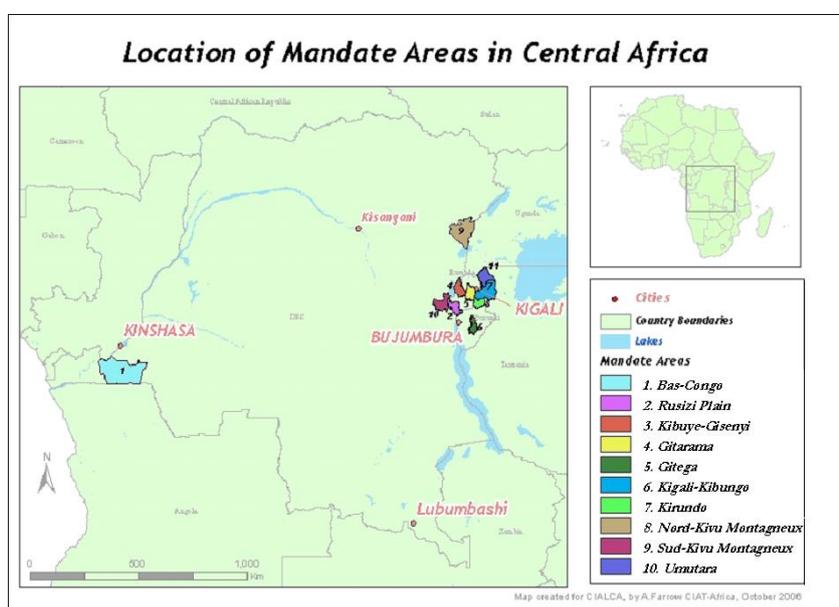


Figure 1: CIALCA mandate areas in DR Congo, Rwanda, and Burundi.

3. IMPLEMENTATION OF PARTICIPATORY RURAL APPRAISALS (PRAS)

- The main **OBJECTIVES OF PRA** were (i) to improve understanding of rural communities and farmers’ livelihood assets, strategies and opportunities; (ii) to identify researchable issues, constraints, opportunities, and entry points; (iii) to provide information that help in the selection of communities, associations and farmers that will participate in research and development activities; and (iv) to provide general and community-level information (**Photograph 2**) that help to focus and target baseline surveys and other in-depth characterisation studies.
- The PRAs were implemented in **45 VILLAGES** across all mandate areas and involved about **2600 PARTICIPANTS** (**Table 1**).



Photograph 2: Farmers drawing a village resource map in Murambi, Rwanda.

Table 1: Sites and participation in the PRA exercises.

Country	Mandate Areas	Nr of villages	Number of participating farmers			
			Total	Mean	Max	Min
Rwanda	Kibuye-Gisenyi, Kigali-Kibungo, Gitarama, Umutara	11	471	37	53	27
Burundi	Gitega, Kirundo, Ruzizi plains	9	230	25	52	16
DR Congo	Sud-Kivu montagneux	10	868	90	170	41
	Nord-Kivu montagneux	8	416	30	92	52
	Bas-Congo	8	404	50	103	23
Total		45	2599			

- Preliminary results from the PRAs show that (i) **BANANA AND BEANS WERE THE MAIN CROPS** in intercropping systems in Sud-Kivu, Rwanda and Burundi, but were less important in Bas-Congo, (ii) most farmers **DO NOT HAVE ACCESS TO IMPROVED CULTIVARS** of banana while 56% of farmers are using improved bean varieties, (iii) **SOIL FERTILITY** was recognized as a major factor affecting productivity across all sites, (iv) most sites generally have local associations and **FARMERS ORGANISATIONS**, with an average of 10 per village, most of them agricultural-based, with some involved in health and nutrition as well as education, (v) there are different **TYPES OF MARKETS** in the sites, ranging from local village markets operating on specific days to large regional markets, (vi) a considerable number (37.4%) of households in Sud-Kivu can only afford **ONE MEAL A DAY**, while the food security situation is better in Rwanda and Bas-Congo where most households (70.6% and 52.4 % respectively) have two meals a day, and (vii) most farmers have access to **HEALTH CENTERS** near their villages or at a reasonable distance.

4. IMPLEMENTATION OF THE BASELINE SURVEYS

- The baseline surveys are a **FOLLOW-UP AND IN-DEPTH STUDY** of the above described PRA exercise. The baseline surveys provide counterfactual data for ex-post **IMPACT ASSESSMENT** and information for priority setting and technology assessment. The data cover the following fields: household systems and socio-economic structures, farming system agronomics and economics, access to markets and marketing patterns for the focus crops, post harvest handling and processing of the focus crops, social structure of households and households' embedding in social structures within the sites, status and determinants of food security, and health and nutritional status.
- The baseline survey was implemented in **30 VILLAGES** across all mandate areas and involved about **2800 HOUSEHOLDS** (Table 2).

Table 2: Baseline sites and sample size.

Country	Action sites	Villages	Households/village	Total
DR Congo	Sud-Kivu montagneux	5	100	500
	Nord-Kivu montagneux	4	100	400
	Bas-Congo	4	100	400
Rwanda	Umutara	4	50	200
	Kigali-Kibungo	4	100	400
	Gitarama	1	100	100
	Kibuye-Gisenyi-Cyangugu	3	100	300
Burundi	Gitega	2	100	200
	Kirundo	2	100	200
	Ruzizi plains	1	100	100
TOTAL		30		2,800

- The baseline data has been entered and is given to all national partners. A report with the major findings is currently being written. One important finding is that in the CIALCA sites 40-70% of the families are **FOOD INSECURE** in Burundi, 30-45% in Rwanda, and 50-65% in DR Congo.

5. DETAILED CHARACTERISATION

- Farm-level banana diagnostic studies are currently being conducted to primarily quantify the **SOIL FERTILITY, PEST AND DISEASE, AND ECONOMIC** parameters driving the banana cropping system. Part of the plant samples will also be used to establish possible micronutrient deficiencies relevant to human nutrition. The diagnostic tool was developed and field-tested with partners in October 2006. The farm diagnostics teams in each of the countries consist of a mixture of **5-6 STUDENTS AND SCIENTIFIC STAFF**. Work in North Kivu has finished, but is still ongoing in South Kivu, Rwanda and Burundi. Staff and students executing the diagnostic surveys have all undergone a 1-week on-site training by IITA staff in collaboration with Bioversity.
- A characterization study is currently being conducted aiming to add on quantitatively measured information on specific aspects of **LEGUME CROPPING** to the information obtained through farmer interviews in the baseline study. Special focus is given to the evaluation of the **SOIL FERTILITY STATUS** as related to particular legumes attributes. In addition **MARKET ACCESS** is characterized and the role of legumes within the **NUTRITIONAL STATUS** of rural livelihoods is assessed.
- **BANANA MARKET AND CROSS-BORDER TRADE** surveys have been conducted in South Kivu and Rwanda, while it is still ongoing in Burundi (**Photograph 3**). The aim of the surveys is to understand and quantify constraints and actors in the banana value chain, with the aim to identify opportunities for improved marketing.
- A study is ongoing in Rwanda to characterize banana **POST-HARVEST PRODUCTS AND QUALITY**, production technologies, actors and profit margins, with the aim to improve post harvest quality and prices for producers, processors and consumers.



Photograph 3: Plantains exported from Eastern DRC to Uganda.

6. STRENGTHENING NATIONAL AND REGIONAL MECHANISMS

- The Bioversity project conducted a **REGIONAL STRATEGIC PLANNING WORKSHOP** to put in place relevant mechanisms that would respond to the constraints and challenges identified by the project. The overall aim of the strategic planning workshop was to ‘strengthen national and regional mechanisms to plan and orient investments, projects and activities for increasing the contribution of Musa to rural well-being. **MUSA SECTOR STRATEGIES FOR RWANDA, BURUNDI, DR-CONGO** and the Central African region were developed and are currently being finalized with input of the country partners.

7. BANANA GERMPLASM EVALUATION

- The objective is to introduce, evaluate and disseminate exotic Musa varieties which have the potential to **ENHANCE FOOD SECURITY AND FARM INCOME**. These varieties were

chosen according to yield, pest/disease resistance/tolerance and market demands. Protocols for trial establishment, management, and data collection have been developed in collaboration with partners. **TWENTY-ONE GERmplasm TRIALS** have been established in various agro-ecologies representing variations in soils and climate (i.e altitude) in the 3 countries (**Photograph 4**):

- Rwanda: Bugesera, Kibungo, Gitarama, Kibuye, Cyangugu, Kayounza
 - Burundi: Gitega (2), Kirundo (2) and Cibitoke
 - South Kivu: Mulungu, Luhihi, Kabamba, Burahle, Kamanyola, Lurahale
 - North Kivu: Butembo, Mavivi, Maboya, Mutwanga
- The germplasm sources include:
 - Tissue-culture derived **EXOTIC CULTIVARS ALREADY AVAILABLE IN THE REGION** in existing tissue culture labs (i.e. Agrobiotec, Burundi),
 - Tissue-culture derived **EXOTIC CULTIVARS FROM THE BANANA INTERNATIONAL TRANSIT CENTER** in Leuven,
 - Tissue-culture derived **IITA HIGHLAND BANANA HYBRIDS** developed under the DGDC-funded SMIP-I and SMIP-II projects
 - Sucker derived **LOCAL CHECKS** and best-bet varieties (incl. available exotics) from within the Great Lakes region.
 - A first set of **TISSUE-CULTURE DERIVED EXOTIC CULTIVARS** delivered by Agrobiotec, Burundi to the 3 countries and local Musa germplasm was field established during April-May 2007. The IITA hybrids and additional exotic varieties currently being multiplied by Agrobiotech will be field established during September 2007.
 - The planning is that near to most of the germplasm trials, **LOCAL MACRO-PROPAGATION** facilities will be developed for rapid, low-cost, and relatively clean multiplication of banana planting material. Staff from DR Congo, Rwanda and Burundi were already trained in macro-propagation at IITA-Uganda.



Photograph 4: One of the banana germplasm trial sites in North Kivu.

8. ON-FARM BANANA TRIALS

- The objective of the on-farm trials is to test best-bet practices **JOINTLY SELECTED BY FARMERS AND RESEARCHERS**, and to understand biophysical and socio-economic factors that influence adoption, profitability and sustainability of these technologies. These activities build very much on the outcome of the baseline, diagnostic, and market surveys. Results of these surveys and potential technologies will be proposed and discussed with farmers. Farmer groups will have to select a few promising technologies that they wish to test in their own fields with support from the project. We envisage that the selection of the technologies can take place in August, with on-farm trials starting in October 2007.

9. ON-STATION BANANA TRIALS

- A banana bunchy top virus (BBTV) screening trial with about 50 Musa varieties was established at the **ISABU** Cibitoke research station in Burundi.
- Musa planting density trials were established at the **ISAR RUBONA** and **ISAR KIBUNGO** research station. A third planting density trial will be established at Ruhengeri during September 2007.

- Musa germplasm collections were established at **INERA MULUNGU AND UCG BUTEMBO** for highland Musa genotypes. A third Musa collection will be established in September 2007 at Mavivi, north Kivu for lowland genotypes. A detailed characterization of the collected genotypes will be carried out over the coming year

10. LEGUME GERMPASM EVALUATION AND MULTIPLICATION

- NARS partners in the 4 mandate areas tested and screened **10 SOYBEAN, 10 PIGEON PEA, 25 BEAN, 20 COWPEA AND 60 GROUNDNUT VARIETIES** on-station during two consecutive seasons (started mid-2006). Attributes screened included biological nitrogen fixation (BNF) and tolerance to low-P conditions. Harvest data are currently being processed and analyses are pending.
- In September 2006, legume demonstration activities were started with 2 farmer associations in each of 4 action sites per mandate area (**Photograph 5**). In each of the **29 FARMER ASSOCIATIONS, 36 BEAN AND 27 SOYBEAN** varieties were grown in trials managed by these farmer groups, aiming to evaluate (i) farmers' criteria and preferences, (ii) BNF and low-P tolerance and (iii) nutritional quality (Fe, Zn contents). In addition, a number of activities were organized around these demonstration trials, including (i) **TRAINING OF FARMER GROUPS** on planting, fertilizer application, weeding and harvest techniques, (ii) activities on linking farmers to markets, (iii) activities on soybean transformation and (iv) integration of partners to initiate activation of satellite sites. Additional **GROUNDNUT** (all associations), **PIGEON PEA** (most associations) and **COWPEA** (only in Bas-Congo) were included.
- **FARMER ASSOCIATIONS WERE TRAINED** in **SEED MULTIPLICATION** and **STORAGE**, and are currently multiplying a number of varieties retained after the germplasm demonstration activity (**Photograph 6**). While in the on-going season, the principal aim is to increase seed stocks, activities are planned for the following season to strengthen these associations in becoming accredited seed dealers and linking them with seed suppliers.
- On-going **STRATEGIC RESEARCH ACTIVITIES** include assessment and understanding of **MICRONUTRIENT DEFICIENCY** and **SOIL ACIDITY** constraints. The germplasm evaluation trials also allow identifying promising germplasm in terms of **TOLERANCE TO LOW-P CONDITIONS** (for soybean) or general low soil fertility (for beans).



Photograph 5: Bean seed evaluation with farmers' associations in Bas-Congo, DR Congo.



Photograph 6: Soybean seed multiplication by a farmer association in Sud-Kivu, DR Congo.

11. EVALUATION OF IMPROVED SOIL FERTILITY MANAGEMENT OPTIONS

- In many areas in **RWANDA**, short-term drought periods within the season are a major limitation for crop production. A number of **RAINWATER-HARVESTING TECHNIQUES** commonly practiced in the Sahel are currently being evaluated on-station at 3 different sites in the country.
- In **SUD-KIVU**, land shortage and an increased usage of steep slopes for crop production has led to severe land degradation, and this is becoming an aggravating constraint for crop production in the area. An on-station trial has been established to investigate effectiveness of soil stabilization through **CALLIANDRA HEDGEROWS** as an alternative to labor-demanding terrace construction. In an additional trial, **VARIOUS FORAGE SPECIES** are being evaluated on sloping land for their biomass quality and effectiveness to reduce soil erosion (**Photograph 7**).
- In **BAS-CONGO**, low soil fertility is the most critical constraint for crop production. Legumes are commonly grown in association with cassava. A pair of field trials was established within farmer associations to evaluate **IMPROVED AGRONOMIC OPTIONS FOR LEGUME-CASSAVA INTERCROPPING** and soil fertility improvement through use of locally available green manure species and micro-dose mineral fertilizer application.



Photograph 7: Soil stabilization using Calliandra hedgerows and soybean production on sloping land at Mudaka, Sud-Kivu, DR Congo.

2.C. CONTRIBUTIONS FROM THE BELGIAN PARTNER INSTITUTES

1. SERVING GERmplasm NEEDS [LED BY K U LEUVEN]

- The **INIBAP TRANSIT CENTRE (ITC)** continues to maintain **1183 ACCESSIONS** and efforts are underway to introduce more germplasm into the collection from different countries, especially from DR Congo (38 plantain accessions were received at the ITC in December06 - January07), Tanzania, Kenya, Republic of Central Africa, Uganda, Rwanda and Burundi. This will ensure the conservation of Musa germplasm in face of the BXW epidemic.
- Most of the rejuvenated germplasm is grown in the field, and during the next 2 years we expect information on their trueness-to-type. Every day still 5-7 accessions are distributed from the ITC worldwide and for the moment **598 ACCESSIONS ARE ALREADY CRYO-PRESERVED**.

2. UNDERSTANDING STRESS RESISTANCE [LED BY K U LEUVEN]

- A **SUPERSAGE TECHNOLOGY** was employed in banana and it was indicated that in the Sigatoka response about 150 genes are potentially involved. Many of these genes were annotated.
- Banana transformation was further improved as well as banana **GENE TAGGING** frequency due to the development of a modified vector. Several of the identified genes show tissue specific expression.
- **PROTEIN EXTRACTION PROTOCOLS** were developed and differential proteins identified between drought tolerant and drought susceptible varieties. Similarly differential proteins

were identified between control and drought induced banana tissues. A website on the banana proteome was developed.

3. UNDERSTANDING AMF BIOCONTROL AND ITS IMPACT IN BANANA-BASED CROPPING SYSTEMS [LED BY K U LEUVEN]

- AMF-induced biocontrol of **BANANA NEMATODES** has been identified as a systemic biocontrol effect. Furthermore, data show that AMF controls nematode infection already at the level of attraction and penetration.
- Nine leguminous and eight non-leguminous **DUAL-PURPOSE INTERCROPS** were selected for their presence in banana-based mixed cropping systems. Their mycorrhizal response was tested under greenhouse conditions. In general, the leguminous crops (pigeon pea, cowpea, soybean, common bean) showed a high mycorrhizal dependency, while among the non-leguminous crops only Sudan grass and sesame showed a high dependency.

4. ANALYSIS OF PLANT MATERIALS [LED BY K U LEUVEN]

- Various plant materials (legume leafy biomass and grains) were submitted for **MICRO-NUTRIENT** (ICP method) and **ISOTOPE** (^{13}C and ^{15}N mass-spectrometry) analysis.

5. UNDERSTANDING BANANA AMF DEPENDANCY AND DIVERSITY AS A FUNCTION OF SOIL ENVIRONMENT AND BANANA VARIETAL DIFFERENCES [LED BY UCL]

- AMF samples have been taken in different agro-ecologies in Rwanda and taken for analysis at UCL. This study has revealed that East African highland bananas are strongly associated with AMF, and that **AMF DIVERSITY** is very high.
- ISAR staff has been trained on AMF methodologies at UCL. Banana germplasm collections in Burundi, DR Congo, Rwanda, Tanzania, Kenya and Uganda have been sampled to study whether **AMF DEPENDANCY** and diversity is related to banana varietal differences.

6. IDENTIFYING AND UNDERSTANDING SOIL CONSTRAINTS AND NUTRIENT FLOWS IN EAST-AFRICAN HIGHLAND BANANA SYSTEMS. [LED BY UCL]

- A first set of samples and soil pits revealed that **NUTRIENT IMBALANCES** and **SOIL PHYSICAL** constraints are strong production constraints in the region. This work is currently being followed up in the diagnostic surveys and PhD research.
- Nutrient pools in the mineral and organic fraction of the soil are strongly related to soil management and plant nutrient status. UCL is conducting upstream research on **RHIZOSPHERE PROCESSES** to better understand the soil environment to improve plant nutrition and **SUSTAINABLE** use of the natural resource base.

7. CHARACTERIZING THE SPREAD AND DIVERSITY OF BANANA BUNCHY TOP VIRUS (LED BY GEMBLoux AU)

- Supervise the training of a PhD student from ISABU (Burundi) in (i) optimising protocols for the molecular detection of **BBTV**, and (ii) detecting BBTv infection in banana materials collected in Central Africa.

8. SUPERVISION OF STUDENTS [LED BY ALL BELGIAN PARTNER INSTITUTES]

- All Belgian partner institutes are directly involved in the **SUPERVISION OF MSc AND PhD**-related activities (see tables below).

2.D. PROGRESS WITH CAPACITY BUILDING

Capacity building is a crucial component of CIALCA since all countries in which CIALCA operates are recovering from civil strife which has had very substantial impact on the capacity of various partners in the mandate areas.

1. MSc PROJECTS: In the context of CIALCA, **10 MSc-RELATED PROJECTS** are currently supported (**Table 3**). Most of these are implemented in DR Congo and Rwanda since the TSBF-CIAT-led project is not directly operating in Burundi. MSc projects are also supported for students from the Belgian university partners.

Table 3: MSc projects supported by CIALCA.

Name	Nationality	University	Topic
Julie Lunzehirwa	DR Congo	Facultés Catholiques de Kinshasa, DR Congo	The impact of beans and groundnut channels on the productivity and agricultural income of households in the cataractes area'
Rachel Zozo	DR Congo	Makerere University, Uganda	Assessing the socio-economic importance legumes-based on the livelihoods of farmers at Mugogo and Mudaka Markets in Ngweshe and Katana axes, Democratic Republic of Congo
Muke Manzekele	DR Congo	Université de Kinshasa, DR Congo	Techniques d'amélioration de la production agricole et de la stabilisation des sols en pente au Sud-Kivu Montagneux
Aime Herikazi	DR-Congo	Selection and admission still to be finalized.	Overcoming soil physical constraints in banana based cropping systems.
Agnes Mukandinda	Rwanda	National University of Rwanda, Rwanda	Nutrient flows in banana based cropping systems.
Placide Rukundo	Rwanda	Katholieke Universiteit Leuven, Belgium	Banana biotechnology
Edouard Rurangwa	Rwanda	Jomo Kenyatta University of Agriculture and Technology, Kenya	Initial survival of tissue culture bananas as affected by inoculation with arbuscular-mycorrhizal fungi.
Mathilde Uwizerwa	Rwanda	Kenyatta University, Kenya	Exploring Rhizobium diversity in soybean systems in Rwanda
Anaclet Nibasumba	Burundi	Université Catholique de Louvain-la-neuve, Belgium	Relationship between nutrients (cations) in the soil mineral and organic pools and nutrients at the banana root surface.
Geoffroy Germeau	Belgium	Université Catholique de Louvain-la-neuve, Belgium	Explaining banana yield differences in Rwanda through quantification of banana crop performance, soil fertility, pest and diseases and crop management practices.

2. PHD PROJECTS: CIALCA is currently supporting **8 PHD STUDENTS** (**Table 4**). In addition, CIALCA is actively helping its research staff to pursue further scholarship opportunities that can build on ongoing research. In that respect, the outlook is that two Belgian PhD students and one IITA-Uganda staff will do their PhD within CIALCA on farming systems, soil nutrient pools and recycling, and banana value chain and market analysis.

Table 4: PhD projects supported by CIALCA.

Name	Nationality	University	Topic
Dowiya Nzawele Benjamin	DR Congo	Sokoine University, Tanzania	Characterization of Musa germplasm in Eastern DR Congo
Tony Muliele	DR Congo	Université Catholique de Louvain-la-neuve, Belgium	Soil moisture and soil physical constraints in East African highland banana systems.
Svetlana	Rwanda	Université Catholique de	Research on banana-soil fertility-soil biology

Gaidashova		Louvain-la-neuve, Belgium	interactions, with special emphasis on the role of plant-parasitic nematodes and arbuscular mycorrhizal fungi (AMF)
Telesphore Ndabamenye	Rwanda	University of Pretoria, South Africa	Planting density, soil fertility, leaf nutrient status and nutrient absorption
Josaphat Ruisiro Mugabo	Rwanda	Katholieke Universiteit Leuven, Belgium	Agricultural intensification under population pressure in Rwanda: An analysis of fertilizers policy and legume-based systems economic incentives
Leon Nabahungu	Rwanda	Wageningen University, the Netherlands	Competing Claims on Wetland in Eastern Rwanda: Challenges and opportunities
Syldie Bizimana	Burundi	Université Catholique de Louvain-la-neuve, Belgium	Effect of soil management on nutrient availability and nutrient recycling in highland banana cropping systems.
Célestin Niyongere	Burundi	JKUAT, Nairobi, Kenya	Banana Bunchy Top Virus (BBTV) in the Great Lakes region.

3. UNDERGRADUATE PROJECTS: Besides graduate students, CIALCA is currently supporting **11 UNDERGRADUATE STUDENTS** (Table 5).

Table 5: Undergraduate projects supported by CIALCA.

Name	Nationality	University	Topic
Matara Murhonyi (Memoire-Ingénieur)	DR-Congo	Université Catholique de Bukavu	Identifying fungal diseases affecting banana production in South Kivu
Bahati Lukangira (Memoire-Ingénieur)	DR-Congo	Université Catholique de Bukavu	Quantifying the spread and importance of banana bunchy top virus (BBTV) in South Kivu
Kambale Mboho (Memoire-Ingénieur)	DR-Congo	Université Catholique de Graben	Pest and disease problems in banana systems in Nord Kivu.
Sereka Saghasa (Memoire-Ingénieur)	DR-Congo	Université Catholique de Graben	Understanding soil management in banana-based farming systems in Nord Kivu
Kakule Lukalango (Memoire-Ingénieur)	DR-Congo	Université Catholique de Graben	Characterizing and understanding banana germplasm diversity in Nord Kivu
Sondirya Tsongo Michel (Memoire - Ingénieur)	DR-Congo	Université Catholique de Graben	Identifying socio-economic constraints in banana-based farming systems in Nord Kivu
Ntakirutimana Oswald (Memoire - Ingénieur)	Burundi	Université de Bujumbura	Contribution à l'étude de l'état phytosanitaire du bananier dans les Provinces de Gitega, Kirundo et Cibitoke
Chantal Karondo (Stage - Ingénieur)	Burundi	Université de Bujumbura	Etude de la diversité génétique du germoplasme de bananier au Burundi
Fidès Barigenera (Stage - Ingénieur)	Burundi	Université de Bujumbura	Evaluation de l'état phytosanitaire des bananiers dans les communes les plus productrices de banane de Gitega: Giheta, Itaba et Makebuko
Léonidas Ndikuriyo (Stage - Ingénieur)	Burundi	Université de Bujumbura	Détermination des équivalents taxonomiques en nomenclature Américaine (Soil Tax.) et FAO-INEAC comme une façon de définition des zones potentielles de culture du bananier.
Félix Gatoto (Stage - Ingénieur)	Burundi	Université de Bujumbura	Enquête de prospection de BBTV sur base de symptômes caractéristiques et les pertes causées par le BBTV dans la province de Cibitoke.

4. POST-DOCTORAL POSITIONS: CIALCA is supporting post-doctoral positions:

- **DR JOYCE MNYAZI JEFWA**, a Kenyan national, was recruited as a post doc to work on AMF in banana systems in the framework of the Bioversity project. She will assess AMF

species associated with banana cultivars and evaluate banana cultivars inoculated with indigenous AMF for their performance in the nursery and in farmer's fields.

- **DR PIETER PYPERS**, a Belgian national, was recruited to work as a soil scientist within the TSBF-led legume project. He's backstopping the project activities in DRC and Rwanda, and is particularly focusing on soil fertility aspects and the beneficial role of legumes within the overall productivity of cropping systems.
- **DR. CHARLES MUREKEZI**, a Ugandan national, has been recruited as a project scientist with IITA. Dr. Murekezi is a specialist in the field of banana agronomy and virology and is based in Rwanda. He will spend 60% of this time to train and backstop the banana research team at ISAR. Another 40% of his time will be spent in Burundi and DR Congo to backstop other project activities.

5. TRAINING OF NATIONAL INSTITUTE SCIENTISTS:

- **FORMAL TRAINING EVENTS** have been organized with national institute scientists and NGO partners in the context of the PRA's, baseline surveys, legume germplasm evaluation, seed systems, banana nematology training, banana macro-propagation training, monitoring and evaluation, and final characterization studies. Such training events are aiming at cross-regional exchange of expertise.
- **ON-THE-JOB TRAINING** of national institute scientists and NGO partner has taken place in the context of agronomy, data collection, and sample processing.
- Various **MSC AND PHD PROJECTS**, mentioned above, are implemented by colleagues from the national research institutes.

6. TRAINING OF FARMER ASSOCIATIONS:

- In the context of legume activities, various farmer associations in each of the mandate areas have been trained in **PARTICIPATORY GERMPLASM EVALUATION** (including training on planting, fertilizer application, weeding and harvesting techniques) and **SEED MULTIPLICATION** and storage.
- Plans are underway to initiate training events on **SOYBEAN PROCESSING, MARKET LINKAGES**, and participatory **MONITORING AND EVALUATION**.

2.E. LESSONS LEARNT

1. ADMIN BENEFITS OF CIALCA

- Although no funds were originally budgeted for setting up **OFFICES IN VARIOUS LOCATIONS**, due to the combined effort of the three projects, sufficient funds were identified to have such offices installed. This has proven to be an essential component in implementing project activities.
- Managing CIALCA has been very efficient because of a clear **DISTRIBUTION OF TASKS** between the three projects. For instance, the CIALCA website is hosted by Bioversity, the management of the Kigali office is supervised by TSBF-CIAT, and the Bukavu office by IITA.
- PRA's and baseline surveys were **IMPLEMENTED JOINTLY** by the three projects. This has not only resulted in a very cost-effective way to obtain the data but in tools that are richer

in terms of covering a wider range of topics important for rural livelihoods in the mandate areas.

2. PARTNERSHIPS

- CIALCA partners have been actively using **FACILITIES OF THE CIALCA OFFICES** (e.g., meeting venue, internet access).
- **VISIBILITY OF CIALCA** in the region has been relatively high since the various partners openly identify themselves with the Consortium. CIALCA is further increasing its visibility through field trials at strategic locations, farmer workshops, scientific meetings, the CIALCA website and better branding of the CIALCA logo.

3. TECHNICAL COMPLIMENTARITY

- The different projects have been **LEADING ACTIVITIES** that are relevant for all three projects, depending on their in-house capacity. For instance, nutritional aspects have been backstopped by TSBF-CIAT while market-related studies have been backstopped by IITA. The same also applies to specific technologies. For instance, IITA is assisting with getting access to disease-resistant cassava varieties for the mandate areas in which cassava plays a major role. Bioversity pulls in technical outputs and expertise from work in West Africa, Latin America and Asia. For example, BBTv research outputs from Asia contribute to work on BBTv in the Great Lakes Region.
- Due to the wide thematic coverage of the three projects as a whole, CIALCA activities cover **ALL MOST IMPORTANT REALMS** of rural livelihoods in the mandate areas. The same is true for the major components of the **FARMING SYSTEMS** in these areas.
- Various MSc or PhD-related activities are **CO-SUPERVISED** by colleagues who have research links to several of the CIALCA projects.
- Within the banana research group, there are strong **COMPLEMENTARITIES** in skills, which is optimally exploited by designing collaborative research activities. For example, the Bioversity and IITA project have co-organized the germplasm trials which will be used by UCL and KUL students and staff to study GxE interactions from different but complementary angles. Many more such examples can be found.

4. EXTRA ACTIVITIES THROUGH CIALCA

- Some **EXTRA PROPOSALS** have been written and submitted to strengthen CIALCA activities, typically in the area of scaling up. An example is the proposal submitted to the CSO-CGIAR Competitive Grants Program on ‘Mobilizing Innovation Platforms for Bringing More Quality Benefits to More People in Post-Conflict Central African Great Lakes Region’.

3. STRATEGY MAY 2007 – DECEMBER 2008

1. CAPACITY BUILDING

- The various **MSC PROJECTS** will be finalized (see Table above).
- Various **FORMAL TRAINING** events will be organized with national institute partners and farmer associations. Examples of the latter will focus on tackling soil fertility constraints, pest and disease constraints, and strengthening producer-market linkages.

2. ACTIVATION OF SATELLITE SITES

- The number of **SATELLITE SITES** will be increased and the level of activity per satellite site enhanced.
- To achieve the above, more **NGO PARTNERS** and other organizations interested in technology dissemination will be engaged in the various mandate areas.

3. TSBF-CIAT-LED PROJECT

- Project activities will be fully integrated with functional **HEALTH CENTERS** in the various action sites. This will happen through co-organization of legume processing activities and information dissemination.
- Two cycles of **FARMER-PARTICIPATORY TRIALS** evaluating various legume-based soil fertility management interventions will be finalized.
- **STRATEGIC RESEARCH** will be continued to better understand the potential role of legumes in improving nutrition of people and plants in a sustainable way.
- **TRADE-OFF ANALYSIS** will be initiated using the AfricaNUANCES modeling framework to assess best-bet options to enhance the contribution of legumes to rural livelihoods in the action sites.

4. IITA-LED PROJECT

- **FARMER PARTICIPATION** in constraint analysis, identification and testing of best-bet technologies will increase through feedback workshops, field trials run by community based organizations, on-farm trials, and participatory monitoring and evaluation.
- Linkages with the **PRIVATE SECTOR** will be reinforced to (i) improve the delivery of more healthy and desired planting material through macro- and micro-propagation, and (ii) improve the marketing and product quality of banana processors.
- **STRATEGIC RESEARCH** on factors related to natural resource management and pest and diseases will guide the way forward to introduce novel management practices such as zero-tillage intercropping, and development and testing of novel technologies such as endophyte- and AMF-inoculated tissue culture plants in the region.
- **VALUE-CHAIN ANALYSIS** will help to identify opportunities for farmers to better target their production to the output markets.

5. BIOVERSITY-LED PROJECT

- Establish **FARMER PARTICIPATORY TRIALS** according to the constraints and farmer's demands voiced during the baseline and diagnostic surveys. These activities aimed at improving **BANANA AND BANANA-BEAN** production systems will be conducted through farmer research groups.

- **CHARACTERIZATION AND CONSERVATION OF BANANA GERmplasm** is important to preserve the potential of bananas in terms of food security and income generation. Large parts of eastern DRC are particularly unexplored.
- **NEW PEST AND DISEASE OUTBREAKS** require a combination of strategic research on spread and control, while informing farmers on how to best reduce or mitigate these problems. Bioversity will continue to seek linkages with partners in the field of IPM.
- Strengthening the **REGIONAL RESEARCH CAPACITY** through strategic planning at national level, regional networking, and capacity building will remain a key aspect of Bioversity's contribution. This is especially relevant for the CEPGL countries that need to re-build their capacity after years of conflict.

4. STRATEGY FOR THE PERIOD 2009 - 2012

1. INTEGRATION OF THE VARIOUS COMPONENTS AT THE SYSTEMS LEVEL

- During the first phase, at the technical level, the projects have been focusing on the specific crops and interventions, as proposed in the various proposals. During the second phase of CIALCA, these components will be **INTEGRATED AT THE FARM HOUSEHOLD LEVEL** to sustainably improve food security, food quality, and household revenues.
- Because of this, the TSBF-CIAT-led project is also going to get **ENGAGED IN BURUNDI** (while during the first phase, this project only worked in DR Congo and Rwanda).
- Likewise, the banana projects led by IITA and Bioversity may exploit opportunities to explore the DR Congo further westward where plantains dominate at **LOWER ALTITUDE**.
- Within the banana CIALCA group, there is a desire to **FURTHER INVOLVE COMPLEMENTARY** skills in research, which was not the explicit objective of the earlier CIALCA project proposals that were written as stand-alone projects.
- **STRATEGIC RESEARCH** will continue to be implemented to answer specific problems identified during the various technology demonstration and evaluation activities.
- In all mandate areas, **CASSAVA IS A PREFERRED STAPLE CROP** and often also an important cash crop. Farmers however lack improved cassava planting material. For the 2009-2011 strategy, more activities will be focused on access to improved germplasm, improved agronomy and effective use of nutrient inputs in cassava systems, and marketability of cassava-based products.
- The low soil fertility and limited use of **EXTERNAL INPUTS** need to be addressed urgently to improve crop production in the region. More focus will be given to options stimulate use of nutrient inputs and strengthening in effective input use, through e.g. crop-livestock integration, introduction of small fertilizer packages, agro-dealer training.
- The screening and introduction of **NEW LEGUME AND BANANA VARIETIES** will continue.

2. SCALING UP AND OUT

- In the first CIALCA phase, partnerships were created with the NGO and CBO sector. To improve up and outscaling, existing partnerships will have to be further exploited and **NEW PARTNERS FOR OUTSCALING** will have to be found.
- To make the outscaling more effective, proper **COMMUNICATION STRATEGIES AND TOOLS** will need to be developed.

- During the second phase, efforts will be made to disseminate the various CIALCA products to a substantial number of **FARMING HOUSEHOLDS WITHIN THE MANDATE AREAS**. It is not yet envisaged to start activities in new regions or mandate areas.

3. STRENGTHENING AND BROADENING PARTNERSHIPS

- To address some of the above issues, the current CIALCA **PARTNERSHIPS NEED TO BE BROADENED** through inclusion of other institutes and organizations that are specialized in specific issues identified during the first phase.
- **NEW INITIATIVES** around the CIALCA network will be proposed to further strengthen the impact of CIALCA within the mandate areas. Links to existing and new **BTC PROJECTS** will be explored to facilitate the delivery of research products into dissemination structures.

4. CAPACITY BUILDING

- The **VARIOUS PHD PROJECTS** that were initiated during the first phase (see Table above) will be finalized during the second phase of CIALCA while some extra PhD projects that will address issues at the farming systems level across the three projects will be identified during year 1 of the second phase.
- **NEW PHD PROJECTS** will be initiated, first exploring the possibility of engaging students that have finished their MSc projects within CIALCA. **NEW MSC PROJECTS** will be started.
- Efforts will be made to strengthen the **RESEARCH INFRASTRUCTURE** at the national system level, with an initial focus on updating the sample processing and storage facilities, both in terms of infrastructure and technical capacity.
- CIALCA is expected to strengthen the **SCIENTIFIC DIMENSION OF THE CEPGL**, possibly through revitalization of IRAZ as a regional information resource centre.

5. LOG-FRAME EVALUATIONS

5.A. LOG-FRAME OF THE TSBF-CIAT-LED PROJECT

Objectively verifiable indicators/milestones	Approx. level of success
Work Package 1: <i>Baseline information and site selection</i>	
1.1. By quarter 2 of year 1, all partners are involved in the planning and implementation of the project activities in all action sites. → <i>Achieved (see various planning meetings and review missions).</i>	100 %
1.2. By quarter 2 of year 1, all necessary information is available to select action and satellite sites for all mandate areas. → <i>Achieved (see PRA and baseline reports).</i>	100 %
1.3. By quarter 4 of year 1, sufficient information is available to direct marketing-related activities for all mandate areas. → <i>Partially achieved (the baseline surveys included market-related information; this needs to be complemented with various market-related studies to be implemented from May 2007 through 2 MSc (in Bas-Congo and Sud-Kivu) and 1 PhD (in Rwanda) projects.</i>	50%
1.4. By quarter 3 of year 1, at least 5 action and 30 satellite sites have been identified across all mandate areas. → <i>Partially achieved (a total of 16 Action sites is active - 4 in Bas-Congo, 4 in Sud-Kivu, 8 in Rwanda - and a total of 12 Satellite sites is active- (12 in Bas-Congo)).</i>	75%
1.5. By quarter 1 of year 2, baseline information on livelihood status has been collected in the action sites. → <i>Achieved (see baseline reports).</i>	100 %
1.6. By quarter 1 of year 2, farmer groups have been identified in all action sites. → <i>Achieved (at least 2 farmer associations are actively involved in project activities in each of the 16 Action sites).</i>	100 %
1.7. By quarter 1 of year 2, farm typologies have been constructed that will form the basis for evaluation of the appropriateness of specific technologies to specific groups → <i>Partially achieved (all information to construct typologies is available through the PRA and baseline activities; currently efforts are taking place to construct typologies as an important factor to consider in farmer adaptive trials).</i>	75%
Work package 2: <i>Participatory evaluation of best-bet options</i>	
2.1. By quarter 2 of year 1, a list of promising NRM options is available for initial testing, taking into consideration the overall action site characteristics. → <i>Following the PRAs, the baseline activities, and discussions with farmer groups and partners, major entry points for addressing declining soil fertility have been identified. A major issue in this is the availability of sufficient improved varieties.</i>	100%
2.2. Between quarter 3 of year 1 and the end of year 3, the number of on-going on-farm trials increases from 50 to 1000, across all mandate areas. → <i>Currently, a total number of at least 64 field activities is on-going with different farmer associations. During the second season of 2007, adaptive on-farm trials are going to be set up, thereby largely increasing this figure.</i>	100%
2.3. By the end of year 3, the impact of NRM options on various aspects of rural livelihoods is evaluated in all action sites. → <i>Baseline data have been collected. The activity itself is to be implemented in year 3.</i>	NA – yr 3 activity
2.4. By the end of year 3, the role of access to markets and centres de santé in improving livelihoods is evaluated for all action sites. → <i>Baseline data have been collected. The activity itself is to be implemented in year 3.</i>	NA – yr 3 activity
2.5. By quarter 1 of year 2, seed multiplication is on-going in all action sites to satisfy the demand in the action and the satellite sites.	100%

→ Currently, at least 30 farmer associations across all action sites are multiplying improved legume varieties and cassava.	
Work package 3: Understanding mechanisms and contributions	
3.1. By the end of year 3, sufficient knowledge on mechanisms driving tolerance to drought and low soil P is available to guide breeding efforts. → Currently, a range of soils and legume varieties is being evaluated for drought and low P resistance across all action sites as a basis for the strategic research. The activity itself is to be completed in year 3.	NA – yr 3 activity
3.2. By the end of year 3, relationships between soil fertility status and the nutritional quality of bio-fortified crops is used by development partners to target production of these crops. → Currently, a range of soils and legume varieties is being evaluated for micro-nutrient content across all action sites as a basis for the strategic research. The activity itself is to be completed in year 3.	NA – yr 3 activity
3.3. By the end of year 3, the potential for occurrence of positive interactions between organic and mineral inputs is evaluated for the most common cropping systems in each mandate area. → Currently, a range of soil fertility management trials for legume and cassava-based systems is in place across all action sites as a basis for the strategic research. The activity itself is to be completed in year 3.	NA – yr 3 activity
3.4. By the end of year 3, the contribution of resilient germplasm in driving overall system resilience is understood for the conditions occurring in all mandate areas. → Currently, a research protocol is being developed to address this issue and the trial is expected to be implemented during the second season of 2007. The activity itself is to be completed in year 3.	NA – yr 3 activity
3.5. Throughout the project life, new questions generated in the evaluation efforts of Work Package 2 are addressed and fed back to these evaluation activities. → The activity planning process is set up in a way that each strategic research issue is the result of observations made in the field with farmer associations. Examples of such protocols being implemented are (i) the appropriate management of organic resources and small doses of fertilizer in cassava-based systems (Bas-Congo), (ii) the integration of grain legumes in cassava-based systems (Bas-Congo, Sud-Kivu), (iii) appropriate input management for enhancing the productivity of improved bean varieties (Sud-Kivu), and (iv) water × nutrient interactions for maize-based systems (Umutara).	100%
Work package 4: Trade-off analysis and impact assessment	
4.1. Once each year an annual planning meetings and once each season, an action site meeting is organised. → Achieved (see various meeting reports).	100%
4.2. By quarter 3 of year 1, a monitoring and evaluation framework is established and operationalised. → On-going (training in M&E was held and is going to be implemented from May 2007 onwards).	50%
4.3. By the end of year 1, local and scientific indicators have been identified to measure progress with project interventions against baseline information. → On-going (baseline information was collected; training in M&E was held and is going to be implemented from May 2007 onwards).	75%
4.4. By the end of year 2, products of the trade-off analysis are guiding the introduction and evaluation of alternative NRM options, better suited to the farmer production objectives and the environment of the actions sites. → Started (links with the AfricaNUANCES project which is providing technical tools for trade-off analysis, have been established in the context of this project).	NA – yr 2 activity
4.5. By the end of year 3, the impact of the project activities in the action sites, satellite sites, and mandate areas is quantified, against the baseline information collected. → To be implemented in year 3.	NA – yr 3 activity
Work package 5: Scaling up and out	
5.1. By quarter 3 of year 1, partners in the action and satellite sites are aware of the project and ready to collaborate. → On-going (see various meeting and mission reports; meetings are held to continuously explore new potential partners operating in the various thematic areas covered by the project).	50%
5.2. By quarter 3 of year 1, partners have identified the optimum way of communicating	100%

project-related information. → <i>Achieved (see various meeting reports).</i>	
5.3. From quarter 3 of year 1 onwards, various initiatives are taken to facilitate farmer-to-farmer dissemination, including seasonal field days and farmer exchange visits between action and satellite sites. → <i>On-going (various activities related to the evaluation of improved germplasm and soil fertility improvement technologies have been initiated with associations; exchange visits are taking place but field days and exchange visits with satellite sites are to be implemented during year 2).</i>	50%
5.4. By the end of year 3, sufficient information is available to advice on optimum ways to disseminate and scale up project products, taking into account the overall conditions of the mandate areas. → <i>To be implemented in year 3.</i>	NA – yr 3 activity
5.5. By the end of year 3, at least 10% of the farmers and 50% of local policy makers are aware of the project products. → <i>To be completed in year 3 (the choice of action sites and satellite sites will guide the process to reach farmers and policy-makers that are engaged in activities within the mandate areas).</i>	NA – yr 3 activity
Work package 6: Capacity building	
6.1. By quarter 3 of year 1, specific training needs for all stakeholders are identified. → <i>Achieved (see various planning meetings).</i>	100%
6.2. By quarter 3 of year 1, research for development teams have been identified in each action sites, comprising partners from the NARS and NGOs. → <i>Achieved (see various planning meetings).</i>	100%
6.3. Between quarter 3 or year 1 and the end year 3, at least 50 farmer groups and 1000 farmers across the various mandate areas have acquired the necessary skills to test, evaluate, and adapt alternative NRM options. → <i>On-going (currently, at least 32 farmer associations with at least 800 members are involved in the project activities).</i>	70%
6.4. By the end of year 3, at least 2 input dealers in each action and satellite site have acquired sufficient knowledge to guide farmers in the most appropriate management of inputs for their respective environments. → <i>To be implemented in year 3.</i>	NA – yr 3 activity
6.5. By the end of year 3, at least 6 MSc projects have been submitted for defences and at least 3 PhD projects are nearly completed. → <i>On-going (currently, 5 MSc projects and 3 PhD projects are on-going).</i>	85%
6.6. By the end of year 3, proceedings of a final symposium are submitted for publication. → <i>To be implemented in year 3.</i>	NA – yr 3 activity

5.B. LOG-FRAME OF THE BIOVERSITY-LED PROJECT

Objectively verifiable indicators/milestones	Approx. level of success
Work Package 1: Establishing <i>Musa</i> sector linkages within each country (INERA, ISAR, ISABU, IRAZ)	
1.1. <i>Musa</i> sector development framework established. → <i>Musa sector strategic plans (for Burundi, DR-Congo and Rwanda) developed by a wide range of Musa stakeholders during a Bioversity-led planning meeting in Butare, Rwanda.</i>	100%
1.2. GIS-based compilation of information on agro-climate, production zones, socio-economics of farm communities and organisations. → <i>Participatory rural appraisal [PRA], baseline and diagnostic surveys carried out across the 3 counties.</i> → <i>GIS activities carried out in the CIALCA framework by a TSBF GIS expert.</i>	75%
1.3. <i>Musa</i> production zones characterized and pilot sites selected.	75%

→ Participatory rural appraisal [PRA], baseline and diagnostic surveys carried out across the 3 counties. Benchmark sites selected for demo-plot establishment, PhD, MSc and BSc studies, and farmer participatory research.	
1.4. Strategy and resource mobilization approach formulated and implemented. → →Musa sector strategic plans (for Burundi, DR-Congo and Rwanda) developed by a wide range of Musa stakeholders during a Bioversity-led planning meeting in Butare, Rwanda.	25%
1.5. Final plan developed to guide future sector development and resource mobilization. → To be implemented in Y3	NA – yr 3 activity
1.6. Methods guide for national sector development compiled. → To be implemented in Y3	NA – yr 3 activity
Work package 2: Building Musa partnerships regionally (Bioversity-BARNESA, Bioversity-MUSACO)	
2.1. Country perspective shared with region / GIS based compilation of information / pilot sites prioritized according to the regional perspective. → Musa sector strategic plan for the CEPGL region developed by a wide range of Musa stakeholders from Burundi, DR-Congo and Rwanda during a Bioversity-led planning meeting in Butare, Rwanda → GIS activities carried out in the CIALCA framework by a TSBF GIS expert. → →Benchmark sites selected for demo-plot establishment, PhD, MSc and BSc studies, and farmer participatory research according to the regional needs.	60%
2.2. Regional agenda initiated. → →Musa sector strategic plan for the CEPGL region developed. → Research topics chosen according to the regional priorities.	60%
2.3. Final results shared with regional networks and plan for future developed. → To be implemented in Y3	NA – yr 3 activity
Work package 3: Serving international germplasm needs (Bioversity-KUL ITC: INIBAP Transit Centre)	
3.1. Germplasm collected and maintained → The INIBAP Transit Centre (ITC) continues to maintain 1183 accessions and efforts are underway to introduce more germplasm into the collection from different countries, especially from the Democratic Republic of Congo (38 plantain accessions were received at the ITC in December06-January07), Tanzania, Kenya, Republic of Central Africa, Uganda, Rwanda and Burundi. This will ensure the conservation of Musa germplasm in face of the BXW epidemic.	To start in June 2007
3.2. Collection rejuvenated and cryo-preserved → Most of the rejuvenated germplasm is grown in the field, and during the next 2 years information on their trueness-to-type is expected. Every day still 5-7 accessions are distributed from the ITC worldwide and for the moment 598 accessions are already cryo-preserved.	To start in June 2007
3.3. PATHOGENS treated and germplasm disseminated → Activities start on June 1 st 2007	To start in June 2007
Work package 4: Integrating local and improved germplasm (INERA, ISAR, ISABU, IRAZ)	
4.1. Plan for collection, characterisation and conservation developed with regional perspective. → Musa germplasm collections are being established in north and south Kivu, DR-Congo by an INERA PhD student. Info on the accessions will be entered into the Bioversity MGIS software which will make it possible to link the DR-Congo germplasm to already established Musa collections in Rwanda, Burundi, Tanzania and Uganda.	75%
4.2. Local germplasm inventoried/characterised. → A PhD student from INERA DR-Congo is collecting and characterising Musa germplasm from eastern DR-Congo, and comparing this germplasm with Musa collections in Rwanda [ISAR], Burundi [IRAZ] and Uganda [NARO/IITA] → IRAZ is strongly involved in the Musa germplasm activities.	60%
4.3. In situ conservation piloted → pending the identification of local germplasm	pending
4.4. Cultivar performance data compiled. → To be implemented in year 3.	NA – yr 3 activity
4.5. Cultivars in trials.	40%

→ 21 <i>Musa</i> germplasm demo-plots (each containing over 20 genotypes) have been established in contrasting agro-ecological zones across the 3 countries	
4.6. Feasibility of alternate seed multiplication and dissemination systems diagnosed. → A macro-propagation training course was given to regional stakeholders (including CIALCA partners) in the framework of a USAID funded project (C3P).	20%
4.7. Regional plan on cultivar introduction, evaluation and seed multiplication established. → To be implemented in Y3	NA – yr 3 activity
Work package 5: Understanding stress resistance (supportive and strategic research – KULeuven)	
5.1. Abiotic stress resistance measured → Activities start on June 1, 2007	To start in June 2007
5.2. Gene tagging and transgenic lines → Activities start on June 1, 2007	To start in June 2007
5.3. Fungal resistance genes characterized → Activities start on June 1, 2007	To start in June 2007
Work package 6: Developing improved production systems (INERA, ISAR, ISABU, IRAZ with TSBF)	
6.1. Technical options for soil fertility, plant nutrition and pest and disease management compiled from the region and beyond. → Info available in Bioversity's Musalit database and several Bioversity project final workshop proceedings. → Bioversity, France is also developing a <i>Musa</i> resource knowledge centre.	30%
6.2. Plans established for on farm work with farmer research groups. → Identified constraints and farmer's needs emerging from the PRA/baseline surveys and diagnostic surveys will determine the best-bet technologies to be tested on farm. → On farm trials with best-bet technologies to be established by both IITA and Bioversity during September 2007.	25%
6.3. Market oriented improved production systems developed. → On farm trials with best-bet technologies to be established by both IITA and Bioversity during September 2007.	To start in 2007
6.4. Soil fertility and plant nutrition constraints identified. → PRA, baseline surveys and diagnostic surveys carried out across the 3 countries.	50%
6.5. Biological and agronomic feasibility of soil improvement and plant health options determined in research trials. → On farm trials with best-bet technologies to be established by both IITA and Bioversity during September 2007. → A PhD study (ISABU) on Banana Bunchy Top Virus is ongoing. → A PhD study (ISAR) on planting density, soil nutrient uptake and leaf nutrient status is ongoing. → 2007.	25%
6.6. Farmer participatory research groups involved in on farm studies on soil enhancement technologies. → On farm trials with best-bet technologies to be established by both IITA and Bioversity during September 2007.	To start in 2007
6.7. Methods and examples compiled in a manual for use by other extensionists and farmers. → To be implemented in Y3	NA – yr 3 activity

5.C. LOG-FRAME OF THE IITA-LED PROJECT

Objectively verifiable indicators/milestones	Approx. level of success
Work Package 1: <i>Baseline assessment (BASELINE)</i>	
1.1. Gather and synthesize available information on banana pest and disease and soil constraints, banana markets, existing production and post-harvest technologies, and cultivar distribution at national and regional levels; identify NGO, farmer group, and development partners; select benchmark sites. → <i>Achieved (see various planning meeting outputs and consultancy report).</i>	100 %
1.2. Assess demand patterns, price and income elasticities, consumer preferences, regional and international trade for fresh and processed banana products → <i>Partially achieved – (Market surveys 80%, Farm gate prices, 70%, processed products, 75%).</i>	75%
1.3. Identify nutritional constraints to banana production in major production zones → <i>Results from Rwanda, not all on-farm diagnostic data collected and analysed yet (currently ongoing)</i>	50%
1.4. Assess economic characteristics of existing technologies at national and regional levels. → <i>Partially achieved – farm economics data through baseline survey finished, but specific on-farm banana economics data is still being collected with ongoing diagnostic studies</i>	50%
1.5. Characterize in detail for 6 benchmark sites banana-based farming systems (soil, pest and disease constraints, cultivars, farm and household characteristics, and production patterns). → <i>Finished in North Kivu and Rwanda, but ongoing in South Kivu and Burundi.</i>	50%
1.6. Economically assess banana production constraints at sites → <i>Output can only be achieved after successfully completing the diagnostic surveys. Data collection should be ready by late July latest and preliminary economic analyses to guide on-farm trials should be ready by August-September 2007.</i>	40%
Work package 2: <i>Integrated banana systems development, evaluation, and demonstration (SYSTEMS)</i>	
2.1. Develop and select with farmers three best-bet technologies per site for further evaluation → <i>Not yet achieved. Feedback workshops for best-bet technology testing are organized in Aug-Sept 07 based on outcome diagnostic survey and economic assessment of best-bets (see 1.6)</i>	25%
2.2. Multiply banana germplasm in low-cost multiplication centers in 3 countries; production of starter material in tissue culture lab in Uganda → <i>Macro-propagation training was provided in 2006. Centres have been established in DR Congo and Rwanda, but Burundi is still trailing. TC material is continuously multiplied at IITA and IRAZ</i>	75%
2.3. Demonstrate to farmers and development partners improved germplasm, IPM and soil-improving technologies (and their integration) on-station and on-farm; obtain farmer feedback → <i>Germplasm trials established, on-farm trials start in October 2007</i>	50%
2.4. Evaluate the economic and yield benefits of best-bet banana integrated practices (IPM, nutrient, and agronomic) imposed upon existing fields; discuss and obtain feedback from farmers, adapt trials based on farmer feedback	NA – yr 3 activity
2.5. Evaluate the economic and yield benefits of best-bet banana integrated practices (germplasm, IPM, nutrient, and agronomic) imposed upon newly established fields on-farm and on-station; discuss and obtain feedback from farmers, adapt trials based on farmer feedback	NA – yr 3 activity
2.6. Quantify on-farm nutrient flow dynamics with the objective of optimizing nutrient cycling → <i>Diagnostic and PhD studies ongoing.</i>	30%
2.7. Disseminate production packages (germplasm, IPM and soil management) to farmers within benchmark sites through trainings.	NA – yr 3 activity

Work package 3: <i>Post-harvest (POST-HARVEST)</i>	
3.1. Evaluate potential post-harvest options (processing and value adding) from inside and outside the study areas. → <i>Data collection almost done in Rwanda. Product quality tests remaining in addition to small exploratory studies in DRC and Burundi</i>	40%
3.2. Demonstrate to and train farmers in novel post harvest technologies to farmers; adapt technologies with farmer feedback	NA – yr 3 activity
3.3. Farmers trained in business plans for the post-harvest options identified in year 2	NA – yr 3 activity
Work package 4: <i>Capacity-building (CAPACITY)</i>	
4.1. 2 PhD dissertation studies on topics relating to banana, soil types, rhizosphere processes, nutrient uptake and pest/disease tolerance. → <i>PhD students identified. Managed to be more cost efficient so recruited 3 PhD students for UCL.</i>	30%
4.2. Public awareness of project goals and outputs increased throughout project. → <i>Good interaction with partners and farmers but this will remain an continuous effort in the project</i>	50%
Work package 5: <i>Monitoring and evaluation (M&E)</i>	
5.1. Project monitored annually; progress on milestones assessed; logframe and budgets adjusted as necessary; next year's activities planned; project staff evaluated → <i>progressive activity; i.e. logframes and budgets are continuously adjusted when drawing new agreements with partners. Planning through meetings with partners. Project staff evaluated annually</i>	50%

6. LIST OF AVAILABLE CIALCA REPORTS

All below reports are available in PDF format from the CIALCA website (www.cialca.org).

6.A. PROGRESS REPORTS

Progress Report 1: CIALCA (2006) Technical Progress Report September 2005 – October 2006.

Progress Report 2: CIALCA (2007) Summary Progress Report September 2005 – April 2007.

6.B. TECHNICAL REPORTS

Technical Report 1: Farrow et al (2006). Characterization of Mandate Areas for the Consortium for Improved Agricultural Livelihoods in Central Africa (CIALCA).

Technical Report 2: Musa sector strategic plan for Burundi

Technical Report 3: Musa sector strategic plan for DR Congo

Technical Report 4: Musa sector strategic plan for Rwanda

Technical Report 5: Musa sector strategic plan for Central Africa

Technical Report 6: Rishirumuhirwa (2006), The role and management of bananas in Burundian farming systems

Technical Report 7: Sanginga et al (2007). Participatory Rural Appraisals of the livelihood status of smallholder farmers in the CIALCA mandate zones of DR Congo, Rwanda, and Burundi.

Technical Report 8: Pypers et al (2007). Participatory evaluation and characterization of improved legume germplasm at the CIALCA action sites in DR Congo and Rwanda.

Technical Report 9: Abele et al (2007). Baseline study of the livelihood status of smallholder farmers in the CIALCA mandate zones of DR Congo, Rwanda, and Burundi.

6.C. THESIS REPORTS

Thesis Report 1: Geoffrey Germeau (2006). Identification des contraintes en culture bananière traditionnelle dans trois régions du Rwanda par enquête diagnostic. Université Catholique de Louvain (UCL)



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 the International Network for the Improvement of Banana and Plantain of the International Plant Genetic Resources Institute (IPGRI-INIBAP), 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 complementarity 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.



Institut de Recherche Agronomique et Zootechnique (IRAZ), Burundi



Institut des Sciences Agronomiques du Burundi (ISABU), Burundi



Université du Burundi (UNB), Burundi



Institut des Sciences Agronomiques du Rwanda (ISAR), Rwanda



Université National de Rwanda (NUR), Rwanda



Institut National des Etudes et de la Recherche Agricole (INERA), DR-Congo



Plateforme DIOBASS, DR-Congo



Université de Kinshasa (UNIKIN), DR Congo



Université Catholique de Bukavu (UCB), DR Congo



Université Catholique du Graben (UCG), DR Congo



Faculté Universitaire des Sciences Agronomiques de Gembloux, Belgium



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**Supported by the Directorate General
for Development Cooperation,
Belgium**