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**Executive Summaries of the final
reports for the concluded projects**

Background

This document contains the Executive Summaries of the final reports for the following concluded projects submitted by the Project Executing Agencies (see Section IV of document PJ-52/13). Copies of the full reports are available on request from the Secretariat.

- Annex I:** Robusta quality and marketing improvement by optimal use of coffee terroirs – CFC/ICO/05 (PEA: ACRN)
- Annex II:** Access to finance for the development of diversification crops in coffee producing areas – CFC/ICO/30 (FGCCC (Côte d’Ivoire), OCIBU (Burundi))
- Annex III:** Increasing the resilience of coffee production to Leaf Rust and other diseases in India and four African countries – CFC/ICO/40 (PEA: CABI)

Action

The Projects Committee is requested to take note of this report.

EXECUTIVE SUMMARY OF THE FINAL REPORT**ROBUSTA QUALITY AND MARKETING IMPROVEMENT
BY OPTIMAL USE OF COFFEE TERROIRS
CFC/ICO/05****1. INTRODUCTION****Context**

Following an important and resourceful study undertaken and published as Common Fund for Commodities (CFC) – Technical Paper No.4 in February 2001 under the title ‘Characteristics of the demand for Robusta coffee in Europe’, financed by the Common Fund and supervised by the International Coffee Organization (ICO); it was highlighted that the origins and destinations of Robusta coffees were classified according to cup characteristics ranging from a taste said to be ‘strong’ to a ‘neutral’ one.

- Italian and French markets were mainly the destinations for strong coffees from Côte d’Ivoire, Guinea, Cameroon, Democratic Republic of Congo and Madagascar.
- Swiss consumers preferred the origin Robusta coffee with mild cup stemming from Robustas from India, Indonesia and Togo.
- The neutral Robusta mainly used as catalyst in blends from Vietnam and Uganda was prized on the German market that mainly consumes Arabicas.

Based on this study, the ICO secured agreement from the CFC to finance a pilot project in Côte d’Ivoire in order to implement this categorization of production per terroirs and to promote a commercial policy that could lead to the achievement of added value.

Project rationale and objectives

The project seeks to establish whether the way in which Robusta coffee is marketed can be changed. Currently Robusta is sold as a bulk commodity and Robusta coffee from different origins is mixed into one lot. This project is testing whether a premium can be obtained if the Robusta coffee is differentiated by region where it is grown. It is believed that like Arabica coffee, Robusta coffees originating from different climatic terroirs have different taste and cup characteristics and therefore could be marketed as distinct products.

The project seeks to understand the sources of this unique taste and to catalogue the basis of each taste. The broad objective is to improve the welfare of coffee producers and economies dependent on coffee providing them an opportunity to get a premium from their coffee. The farmers will also gain a better knowledge of Robusta quality (types and diversity) and quality tasting skills for development of a more comprehensive marketing policy.

Description of project components

The project activities can be grouped under three main components:

- Identification and characterization of terroirs.
- Coffee quality characterization in relation to the terroirs.
- And marketing of the Robusta coffee based on the identified terroirs.

The specific activities under the project included:

- (a) Identification and characterization of Robusta coffee terroirs according to climate and pedology.
- (b) Identification of the suitable farms to carry out the project.
- (c) Genetic characterization of cultivars on each terroir.
- (d) Chemical and organoleptic characterization of coffee quality in relation to terroirs and identification of the key parameters of the encountered diversities.
- (e) Synthesis and dissemination of the results as a coffee catalogue.

Results

- A Robusta catalogue containing coffee quality characteristics as well as terroirs characteristics serving as reference for marketing.
- A new Robusta marketing system based on producers and coffee traders' product knowledge.
- A new Robusta coffee production that considers the terroirs in accordance with market requirements.

The project was funded by the Common Fund for Commodities through a grant to the level of US\$448,000, by the InterAfrican Coffee Organisation (IACO/ACRN) to the level of US\$146,000 and by the National Agriculture Research Centre (CNRA) to the level of US\$348,000 representing the Ivorian counterpart. The project was implemented by IACO/ACRN under the supervision of the International Coffee Organization (ICO), from October 2005 to March 2008.

2. ACHIEVEMENTS

Component 1: Terroirs characterization

Terroir identification

Five terroirs have been identified according to climate, type of soil and coffee tonnage produced: Abengourou, Aboisso, Divo, Man and Soubré. But four terroirs were retained for the project in the following areas:

- The region of Abengourou with shale soils yielding 13% of the domestic coffee production.
- The region of Abidjan with tertiary soils giving 14% of the coffee production.

- The region of Divo/Gagnoa on granitic soils with 14% of the coffee production.
- And the region of Man, a mountainous area on granitic soils with 25% of the domestic coffee production.

The four regions represent 66% of the domestic coffee production. They are located in an equatorial climatic zone.

Coffee cultivars

Concerning cultivars, information was drawn from a bibliography and from the selected on-farm visits under the project. One could have two types of coffee trees on those terroirs. The first one included clones developed in the early 70s by research-based centres involved in propagation by cutting and field extension service. The second type comprises coffee trees grown from seeds or seedlings taken from coffee plantations. The first kind of coffee accounted for about 15% of the Ivorian Orchard according to the local extension service. Of this same type, one could also pick out Guinean and Congolese Robusta coffee. Most of the plantations falling under the second type of coffee were over 40 years old; one could make out miscellaneous plant materials comprising such local names as “Aboisso Coffee” and “Abengourou Coffee.”

Farms identification

Selection and characterization of farms

The objective was to select 4 terroirs, 3 levels of cultural techniques and 3 farms, giving a total of 36 farms for the whole project. This boils down to selecting 9 farms per terroir.

In so doing, three sites or villages were selected by terroir on the basis of technical levels (level 1, 2 and 3).

The technical levels were identified as follows:

- Level 1: Plant material selected with good agricultural practices.
- Level 2: Plant material selected with average agricultural practices.
- Level 3: Plant material not maintained.

Morpho-pedological surveys, i.e. the study of soils along a toposequence as well as the description of cultural techniques were carried out in each farm. With regards to the sociopolitical situation, the environmental characteristics of the regions of Abengourou (1), Aboisso (2) and Divo (3) were achieved. A morpho-pedological survey consists in:

- Parcelling lands with a GPS system so as to find out the geographic coordinates, the height and surface area of existing coffee plantations.
- Installing toposequences on every plot of land; to date only one toposequence was installed under our study.
- Conducting cluster sampling along every toposequence, i.e. slope highest points, mid-slopes and catchment areas. Soil sampling was carried out with cylindrical tubes, digging by portions of 20 cm down to a depth of 120 cm.
- Describing soil samples according to their depth, texture, coarse components, colour and draining patterns.

Gathering cultivars and genetic characterization

Collection of cultivars

One hundred genotypes were put in nurseries at the Divo-based research station to safeguard the collected material from September 2006 onward. Cuttings reproducing their parents' characters were discriminated against the collected coffee cherries nursery.

Cultivars genotype determination

Activities related to genotype determination have not been achieved under the project.

Component 2: Coffee quality characterization

Training of national researchers

Four training sessions were completed:

- Biometric and statistical analyses for a Coffee Geneticist of CNRA.
- Chemical analysis for the Chief of Programme.
- On cup-tasting for two technicians, in Montpellier.
- Cup tasting training sessions in Abidjan (IACO centre) for a panel of eight tasters.

Samples Quality Characterization

Four terroirs were selected according to climate, types of soils and coffee production: coffee cherries were sampled in 36 smallholder farms from the terroirs of Abengourou, Aboisso Divo and Man (9 per terroir) from 2005 to 2007. The post-harvest operations of drying and

wet processing as recommended during the project initiation were carried out by the National Agriculture Research Centre (CNRA) on the Divo station. The cup tasting of coffee samples was done at CIRAD in Montpellier and IACO in Abidjan.

3. RESULTS

3.1. Cup tasting

Sensorial analysis of samples reveals that each terroir has organoleptic characteristics. Thus:

- The Aboisso terroir presents an acidulous coffee with a good aromatic quality.
- The Divo terroir presents an earthy, bitter body coffee.
- The Abengourou terroir presents an astringent, herbal and bitter body coffee.
- The Man terroir presents a good aromatic intensity and quality, body coffee.
- The wet process of the four terroirs presents an acidulous coffee with a good aromatic quality.

It stems from these results that the wet process improves the Robusta coffee quality. This technology is to be considered to obtain a Robusta coffee of a superior quality.

3.2. Quality parameters

The determination of coffee quality parameters such as caffeine, trigonellin, chlorogenic acids, fats and sucrose contents through physical and biochemical analyses showed a difference between the terroirs of Abengourou, Aboisso and Divo.

3.3. Effects of soils

Organoleptic data of the coffee and soil originating from the terroirs of Abengourou, Aboisso and Divo were analysed. The three terroirs are distinguishable from one another. The terroir of Aboisso is absolutely different from that of Divo. Though different from the two others, Abengourou presents some intersections with both, a bit more with Divo than Aboisso, however.

4. SOCIAL IMPACT OF THE PROJECT

The identification of the different types of coffee according to the terroir is an important fact for Robusta producers. The categorization of the production helps establish descriptive slips for coffee promotion, target niche markets and refrain from bulk sales of coffee lots.

Producers and cooperatives that were met had shown keen interest and they wished the extension of the survey in the country, the training of producers in good harvest and post harvest techniques, in physical and organoleptic coffee analysis and in wet method.

6. Lessons learned

The implementation of the Project required of specialised teams composed of agronomists, agro-pedologists, geneticists, chemists, biometricians and tasters. A two-year pilot phase resulted short. Three years would have been better to adequately tap all the results. Additionally, the implementation of the Project results would imply the establishment of regional cup tasting centres for product quality control before export.

Conclusion

This Project highlighted the terroir impact on chemical and organoleptic characteristics of Robusta coffee. All the results of the various analyses confirm the effects of the terroir on cup tasting and coffee quality parameters.

On the basis of the sensorial differences, each terroir can have specific markets at marketing level. The terroir concept and cup tasting are therefore efficient tools for good marketing.

The use of these methods requires a new approach of Robusta coffee production and marketing. The terroirs approach is a good way for Robusta producers' countries to improve the quality of their products.

List of the documents available on request:

- Terroirs characterization report.
- Sensorial analysis reports.
- Training reports.
- Results dissemination report.
- Results restitution report.
- Catalogue.

EXECUTIVE SUMMARY OF THE FINAL REPORT

ACCESS TO FINANCE FOR THE DEVELOPMENT OF DIVERSIFICATION CROPS IN COFFEE PRODUCING AREAS

CFC/ICO/30

Project objectives and scope

The main aim of the project was to promote income security and reduce poverty in coffee producing areas through the promotion of a sustainable credit programme to finance the activities of small producers. The project also aims to provide solutions for food security problems in coffee producing communities. The project focused on the following components:

- a) Assessment of targeted farmers and their credit needs for the crop diversification programme.
- b) Development of a suitable and sustainable diversification loan structure for a crop diversification programme for farmers.
- c) Provision of credit facilities to develop alternative crops and activities.
- d) Market development for diversified products.
- e) Development of value added products.
- f) Training to strengthen farmers' capacities for mobilization of savings and effective credit management.
- g) Project coordination, supervision and monitoring.

Project results

I. Selection of project beneficiaries and areas

Socio-economic study in the two countries

In order to gain a better understand of the characteristics of the Project area, a socio-economic study was carried out in project areas in Burundi and Côte d'Ivoire. The study showed that:

In **Côte d'Ivoire**, economic activities in the selected areas in the West and South-West are dominated by agriculture, with coffee and cocoa as the main crops. These two regions account for 40% of the country's coffee farming population and, before 2002, accounted for almost 53% of national coffee production. The study also showed that the agricultural production system in these three areas is controlled by agricultural workers, consisting mainly of young people and women, who find themselves, in many cases, among the worst victims of poverty:

- The female population accounts for 48% of the active farming population.
- The under-21 population accounts for 54.16%.
- The segment of population between 20 to 49 years old, which constitutes the most active rural working population and accounts for 35% of the total farming population.

In **Burundi**, the economy is heavily dependent on the agricultural sector, which employs over 90% of the population, accounts for 50% of the gross domestic product (GDP) and for over 95% of export earnings. Food crops, cultivated mainly for subsistence, account for 87% of total agricultural production, with cash crops accounting for the remainder. Coffee is the most important cash crop, accounting for over 80% of export earnings and providing a monetary source for around 600,000 households. This indicates that Burundi produces a limited number of commodities, exposing the country to economic crises which have harmful effects both on economic growth and on poverty reduction.

- 589,950 households out of a total 1,404,642 of Burundi's households (i.e. 42%) are coffee farmers.
- Burundi's coffee holdings comprise around 122,728,183 coffee trees in village farms, representing an average of 200 trees per household.
- 60% of coffee trees are aged between 9 and 30 years.

Selection of project beneficiaries and areas

In **Burundi**, 12 project areas were chosen in four natural coffee producing areas, namely **Bweru, Buyenzi, Kirimiro and Mumirwa**. These areas account for three-quarters of the country's total coffee production. Initially, 2,161 small coffee farmers were selected as project beneficiaries.

In **Côte d'Ivoire**, 1,000 coffee farmers were selected in five zones in the Centre-West and West for the pilot project phase.

II. Development of a suitable and sustainable diversification loan system for farmers

1) *Three studies were carried out in each of the two countries*

- Agricultural credit experience.
- Preparation of a loan system for small coffee farmers.
- A manual of procedures supported by credit management software.

2) *Financial intermediaries were identified*

- In **Burundi**, the National Economic Development Bank, i.e. *Banque nationale de développement économique* (BNDE).
- In **Côte d'Ivoire**, the *Banque Atlantique* (BACI), a commercial bank.

III. Financing and support for the development of diversification crops

In both **Burundi** and **Côte d'Ivoire**, communal equipment was provided to project beneficiary cooperatives or unions in the form of loans (warehouses were provided as donations to support activities).

IV. *Financing and support for the development of domestic and foreign markets for diversification products*

In both countries processing equipment became operational despite delayed installation. Domestic consumption of diversification products increased in both countries. Food security in project areas improved considerably.

V. Training of producers

Producer training was carried out with the aim of strengthening the capacities of project beneficiaries in management of diversification activities, loan management and repayment, mobilisation of savings, and management of communal equipment. Training covered the following areas:

- Management of loans and communal equipment.
- Mobilisation and management of savings.
- Profitable cultivation techniques.
- Goat farming.
- Harvest management.
- Loan repayment.

VI. Repayment of revolving fund loans

In **Burundi**, repayment of loans to project beneficiaries had reached a level of 83% at the time of preparation of this report. In **Côte d'Ivoire** results were more qualified, mainly on account of the political disturbances which affected harvesting and the marketing of diversification products. The rate of recovery was around 7% at the time of preparation of this report. Activities have continued, however, and beneficiaries are still continuing to repay their loans.

VII. Impact of the project

In **Burundi**, the project helped to increase production of food crops, reducing the problem of food insecurity in project areas. This means that the model used worked extremely well. Given this result, Burundi received additional financing from the Common Fund to develop the use of organic fertilizers in agriculture.

In **Côte d'Ivoire**, the project was carried out against a background of the country's socio-political crisis while difficulties in the management structures of the coffee-cocoa chain hampered its execution. Nevertheless, the model developed in the framework of the project could be transposed to other agricultural products. It provides a tool for the fight against poverty in rural areas as well as a means of strengthening cooperatives, making it possible to reduce management costs.

VIII. Conclusion and recommendations

In order to ensure the continuation of agricultural credit for diversification by coffee farmers and given the importance of diversification activities, a permanent revolving loan management structure in the two countries will be needed. Moreover, reimbursements continue to be made in Côte d'Ivoire despite the official end of the project, since the cooperatives have taken over management of the project to continue activities.

Consequently, it is requested that the equipment acquired in the form of donations under the project (vehicles and various forms of equipment) be definitively conceded to the structures which will carry out monitoring of producer activities. The bodies concerned are the Burundi Regulatory Authority of the Coffee Sector (ARFIC) and the *Conseil Café-Cacao* (Coffee-Cocoa Council) in Côte d'Ivoire. In the case of Côte d'Ivoire, the *Conseil Café-Cacao* has now established a structure for the coordination and monitoring of the coffee farming redevelopment programme, which could incorporate project acquisitions.

EXECUTIVE SUMMARY OF THE FINAL REPORT**INCREASING THE RESILIENCE OF COFFEE PRODUCTION TO
LEAF RUST AND OTHER DISEASES IN INDIA AND FOUR AFRICAN COUNTRIES**

CFC/ICO/40

I. Project background

1. Coffee leaf rust (CLR), caused by a fungus called *Hemileia vastatrix*, is one of the seven most important diseases and pests affecting tropical plants. It is known to cause crop losses of the order of 30% to 60% according to coffee growing regions. It's progression on the plant leads to defoliation virtually rendering the plant leafless and can even cause death of infected trees. The leaves are a very important organ of the plant that produce not only food through photosynthesis but also many other plant constituents that are involved in survival, fitness and defence of the plants. When leaves are lost due to the leaf rust, the plant stands compromised in all these aspects and enemies take advantage of the situation. **Africa** and **India** are the most affected by CLR, while **Africa** is affected by both CLR and berry diseases. These two diseases are the main constraints to sustainable coffee production, in particular the loss of production leading to the loss of income, employment and export values, affecting negatively the livelihood of coffee growers and workers. The prevention and management of these diseases increase the cost of production.

2. Efforts to develop and test new resistant materials are hampered by the long-term costs of developing new varieties. Environmental changes and ageing tree populations require new varieties with resistance to diseases and pests that constitute potential threats.

3. The project had its roots in the last coffee price crisis, between 2000 and 2005, when the unprecedented low prices led to large scale neglect of plantations and consequent upsurge in leaf rust devastation and emergence of white stem borer as a very prominent pest. In **India**, breeders developed coffee selections through hybridization and pedigree selection protocols that were found to be standing up to the disease pressure in the crisis period. The leaf rust resistant selections were also less damaged by the stem borer and it was felt important to consolidate the resistance present in the indigenous selections that may possess resistance to anthracnose.

4. It is therefore in this context of high incidence of CLR in the aftermath of previous years of inability of small growers to maintain their farms that the present project was designed and submitted by **India** and four **African** countries for funding. It is expected to

improve some of the recommended practices by integrating botanicals and bio-agents in the existing practices, to reduce the cost of disease management and promote environmentally friendly control measures.

5. Approved in October 2007, the project implementation started in all participating countries with its inauguration in April 2008 in Chikmagalur, **India**.

II. Project results

II.1. Identification of needs and resources – Rural community responses to coffee diseases

a) Socio-Economic study of the impact of CLR

6. The socio-economic analysis reveals important implications of CLR on sustainable income generation and long-term livelihood security of small coffee farmers. In **India**, the survey has indicated the following results:

- CLR is not new for coffee growers in **India**. In fact, growers identified the CLR with the beginning of their coffee farming or may not even remember when it did first occur in their estates.
- Over the years, the trend in the occurrence of CLR is non-increasing (or decreasing and constant). This may be a positive outcome of preventive and management practices of CLR by coffee farmers in **India**.
- In general, the most important and broad problems for CLR are associated with environmental changes (e.g. lack and/or untimely rainfall), because coffee farming is largely rain fed and a combination of human activity (e.g. weeding and pruning).

7. In **Africa**, the baseline surveys indicated various results of the CLR incidence. In **Zimbabwe** coffee tree infection varies from 0% to 40%. The leaf rust incidence is severe in some regions in **Uganda** as the survey indicated that 79% to 100% incidence has been recorded. In **Kenya** the epidemiology of the leaf rust was carried out considering under shade and non-shade farms. The most affected farms were those under full sun. In **Rwanda** the biological surveys indicated that the infestation ranges from 0% to 30% but the incidence is less severe for coffee farms at high altitude.

b) Control methods of CLR

8. In **Africa**, the treatment of the leaf rust is carried out by less than 20% of farmers who use copper based fungicides while the rest of the farmers do not apply any control

measures. In **India**, the survey showed that methods adopted by coffee growers included planting resistant and/or tolerant varieties, application of Bordeaux mixtures and application of systemic fungicides.

- Planting **CLR resistant and/or tolerant** varieties is considered effective by a large number of farmers in Karnataka (91% of farmers), in Kerala (97%) and in Tamil Nadu (100%).
- Application of **Bordeaux mixtures** by three times (pre-monsoon alone, post-monsoon along and pre and post monsoon).
- Application of **systemic fungicides** (e.g. Bayleton/Contof) by three times (pre-monsoon alone, post-monsoon along and pre and post monsoon). The percentage growers who applied *Bordeaux mixture* and *systemic fungicides* in both pre-monsoon and post-monsoon is higher than those who applied either in pre-monsoon or post-monsoon. The main sources of advice for the application are fellow farmers, visiting researchers, extension workers and TV.

c) **Strategies to cope with CLR and farmers' needs**

9. In order to cope with CLR growers in **India** have adopted five different types of income generating activities: (a) planting new varieties of coffee; (b) replacing coffee by other crops; (c) selling timber; (d) selling away land/buildings; and (e) selling away other assets. In general, however, diversification into these income generation activities is not appreciable among the CLR affected coffee farmers in **India**. Two major support services needed by farmers are: (a) timely advice on use or application of technical inputs and (b) promotional measure to increase domestic market demand for coffee.

10. In addition, the survey in **India** revealed that farmers need four important measures to improve their income in the presence of CLR:

- Easy access and low interest on borrowings from institutional (e.g. banks, cooperatives) sources.
- Minimum support price for coffee.
- Debt relief measures by exempting interest payments on loans borrowed from institutional sources.
- Input subsidies for applications of disease control methods/technology.

II.2. Sourcing and production of coffee genetic material: Introducing new coffee materials

a) New genetic materials

11. With regard to the sourcing of genetic material, **India** has released a new variety called **Chandragiri** that is more resistant to leaf rust with improved yield. New seed blocks of this variety have been established over 15 hectares. The Coffee Research Foundation in **Kenya** has released a new variety called **Batian** with high yield and more resistant to leaf rust and coffee berry diseases.

b) Seed production

12. Demand for new planting materials has been increasing in **India** and **Kenya**. In **Zimbabwe** the expected demand by the coffee industry for improved varieties at the time of the baseline surveys was over 410 thousand seedlings. This has since increased to more than one million seedlings.

13. In **Zimbabwe** six local varieties were collected for use in trials in addition to the two Indian selections. Three nurseries have also been established in **Zimbabwe** (Piringani, Honde Valley and Chipinge). In **Uganda** eight locally available varieties including SL14, SL28, SL34, Catimor NG9257, KP423, Bugisu local and Ruiru 11 as well as two selections from **India** (Sln.5 and Sln.6) were included in variety trials. In addition, all collected varieties and those from **India** were planted in field gene banks.

II.3. Conservation and identification of coffee varieties and diseases races

14. The main activities included the conservation of coffee germplasm, the isolation and characterization of rust races and the development of genetic markers for application in coffee breeding.

a) Isolation and characterization of rust races/Application of Marker-Assisted Selection (MAS) in coffee breeding

15. In **India**, two new rust races with gene combinations have been isolated. New races of coffee materials have been multiplied and maintained for the purpose of screening of new breeding lines. The marker assisted selection using Sequence Characterized Amplified Region (SCAR) markers has been successfully employed for the first time in coffee breeding in **India**. A new marker laboratory for targeting rust resistance genes has been developed and fully equipped under the project.

16. In **Africa**, the samples of affected coffee leaves were collected from different coffee production zones and sent to the Coffee Leaf Rust Research Institute (CIFC) in Portugal for CLR race determination. A range of previously unknown races were identified, some of which are breaking down resistance in some varieties such as Catimor in **Zimbabwe**. In addition, the discovery of the new races is of a major concern because some countries have races which are not in their neighbouring countries.

b) Conservation of coffee germplasm

17. In **India**, the project has supported the revitalization of two blocs of gene bank of Arabica in the Central Coffee Research Institute (CCRI) station in Chikmagalur and its sub-station in Chettalli. In Africa, the project resources have contributed to the rehabilitation of a number of field gene banks for coffee collections, particularly in **Kenya, Uganda and Rwanda**. In **Zimbabwe**, gene bank activities were initiated at Piringani, Chipinge, Vumba and Mutasa. In **Uganda** project resources helped in the maintenance of 135 lines at Kituza, Kawanda and Bugusege. A notable activity was also the relocation of germplasm from Kawanda (liable to destruction due to proximity to the City of Kampala) to Kituza and Bugusege.

II.4. Capacity building

18. For the capacity building of African research institutions, the project resources were used to send some scientists for training in Portugal. Moreover, scientists were also sent to the University of Nairobi (**Kenya**), Makerere University in **Uganda**, and University of **Zimbabwe** for graduate and postgraduate training. Concerning scientific cooperation, **India** has setup a platform for capacity-building of the African scientists in marker-assisted selection.

II.5. Field trials on farm and station, capacity building and establishment of protocols for sharing planting materials

19. The main activities include the development of nurseries of improved varieties, on-station and on-field trials and the biocontrol trials. In **India**, a number of nurseries of station bred selections (S.795; SIn.5A and SIn.6) and progenies derived from crosses involving diverse sources of resistant materials were set up as target for evaluation in the project. The seedling growth and vigour of the target selections were assessed under a range of ambient conditions covering five locations. Trial plots were also established in 14 locations, including six on-station trials and eight in coffee farmers' fields. It appears that the new variety called **Chandragiri** has manifested high stability for various characters in different environments. The tests for the efficiency of the anti-fungal botanicals and bio-agents were also carried out in on-station and on-farm trials.

20. In all African participating countries a number of varieties were documented and collected for use in trial farms as well as materials imported from **India** to monitor their adaptation in the African context. Seed plots were established as well as on-station and on-farm trials. In **Kenya**, the Indian selections Sln.6 and Sln.5A mature early but seem to be inferior to Kenyan varieties in terms of yields. However, yield recording, quality evaluation and crossing activities continue. Disease tolerance of the selections is still under observation. Another major achievement for **Kenya** is the release of a new variety called **Batian** that has already been gazetted. In **Rwanda**, five varieties including two from India (Sln.5A and Sln.6), and three from other African zones are being evaluated for their resistance to leaf rust and coffee berry disease (CBD) under field condition. In **Zimbabwe** on-farm and on-station trials were established to evaluate coffee hybrids in 11 sites in Mutasa, one in Chimanimani, two in Chipinge and one in Makonde districts. In **Uganda**, two Indian selections were planted in on-station trials and in 12 on-farm trials. In all countries in Africa, the Indian varieties were generally successful in terms of resistance to CLR, although segregation was observed in Sln.5A. In addition, results from laboratory screening in **Kenya** showed that Sln.6 has some resistance to coffee berry disease. Field results also revealed that the same selection has tolerance to bacterial blight of coffee (BBC).

II.6. Scientific management, information systems and communications

21. Communication strategies were used to raise the awareness of stakeholders on the development of CLR and Good Agricultural Practices for better diseases management. The main communication strategy was based on the concept of Farmer Field School (FFS) where different stakeholders meet to learn from extension service providers and discuss their concerns about CLR and other diseases, and other improved production practices for increased coffee productivity. All participating countries have established a number of FFSs consisting of a group of 20 to 30 farmers meeting regularly in the farm of one of their members selected as a study plot.

22. In **India**, there were 10 FFSs including five in the **Tamil Nadu State** and five in **Karnataka State**. The Coffee Board Research Department used both print media and electronic media (radio and TV) in local languages as a mass communication strategy. In **Africa**, the communication strategy was based essentially on focus group discussions through FFSs which were established in many project sites and have been instrumental in helping farmers to learn by doing through participatory approaches, and adopting Good Agricultural Practices in coffee farming communities.

23. Substantial improvements in coffee productivity have been observed with farmers clearly talking about their improved productivity and incomes resulting from their participation in FFSs. Some farmers such as those from **Kenya** have gone to the extent of sharing their experiences with other farmers, and helping fellow farmers in neighbouring villages to start FFSs.

III. Social, economic and environmental effects of the project implementation

24. The project has facilitated the production of resistant varieties to CLR and other diseases, contributing to the improvement of the productivity and promoting environmentally friendly agricultural practice. The use of chemical fungicides has reduced substantially. A number of farmers confirmed that their input costs have gone down due to a better management of CLR, in particular the adoption of resistant varieties and the Good Agricultural Practices through FFSs. Farmers have confirmed the improvement of their yield and the coffee proceeds have been improving their living standards. Farmers are committed to continue improving their knowledge on coffee farming.

IV. Conclusion and recommendations

25. The project has achieved a number of positive results including the improvement of smallholder farmer's knowledge of CLR and other diseases and increasing coffee productivity in participating countries. **India** is planning to develop a mobile technology enabling farmers to receive directly advice from coffee research and extension services. Activities relating to the coffee germplasm conservation have been developed with the rehabilitation of a number of gene banks in all participating countries. Moreover, technology transfer was effective between India and the African countries participating in the project.