ANNEX 4

SUSTAINABLE TREE CROPS PROGRAMME

STCP

REGIONAL PROPOSAL FOR DEMAND DRIVEN TECHNOLOGY DELIVERY, RESEARCH, AND IMPACT, IN THE SUSTAINABLE TREE CROPS PROGRAMME (STCP)

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PROJECT SU MMARY

PROJECT TITLE: REGIONAL PROPOSAL FOR DEMAND DRIVEN TECHNOLOGY DELIVERY, RESEARCH, AND IMPACT, IN THE SUSTAINABLE TREE CROPS PROGRAMME (STCP)

DURATION: 36 months

LOCATION: Cameroon, Cote d' Ivoire, Ghana, Guinea Conakry and Nigeria

BRIEF DESCRIPTION

A strategy for technology dissemination and research is proposed to increase and sustain cocoa productivity and quality in a wider range of socio-economic settings of the STCP participating countries in West Africa. The design principle surrounds the concept that such strategy can attain the full potential of cocoa to reduce poverty by improving the economic and social well-being of smallholders and the environmental sustainability of their tree crop systems.

The primary aim of the project is to develop and disseminate environmentally sound and productivity-enhancing technologies for use by smallholder tree crop farmers and other users. Within the project vision, plans are to build on of the most successful research results produced by STCP and globally. Policy options will be developed to influence government policies. Scientists, extension services, targeted farmer groups and development agents will be pooled together in a multidisciplinary and participatory fashion to address key issues within a community focus. STCP will communicate innovative solutions to all interested parties globally.

For programmatic purposes, the project will be comprised of six themes:

1- Integrated pest and disease management
2- Germplasm improvement and production of quality planting materials
3- Rehabilitation of existing smallholder tree crop farms
4- Valuing the environmental services of three crops
5- Enhancing post-harvest product quality
6- Ensuring and measuring impact of innovations

Some of these activities will be implemented as part of cashew research within STCP.

Through the link with the pilot projects, this proposal will help build the capacity to operate a research and technology dissemination process

effectively, in full partnership with cocoa, and cashew (Guinea Conakry) smallholders in West Africa.

The investment requested for this project is expected to develop more efficient institutional arrangements for technology dissemination and research. After three years, best technology innovations, developed and disseminated in the region, will be in use by farmers.

REGIONAL PROPOSAL FOR DEMAND DRIVEN TECHNOLOGY DISSEMINATION, RESEARCH, AND IMPACT, IN THE SUSTAINABLE TREE CROPS PROGRAMME (STCP) – FINAL PROJECT PROPOSAL

Jose Luis Rueda, Martin Gilmour, Jim Gockowski , and Stephan Weise

INTRODUCTION

1.0 Current global cocoa production is highly concentrated in West Africa where two major producers: Cote d' Ivoire and Ghana make up for almost 60% of the total world output totalling nearly 1,800,000 t in the 2000/2001 crop year. Cocoa is mainly produced at smallholder farms, who often pursue many livelihood strategies, and it is the major source of income for these households, as well as for numerous landless agricultural workers. Despite the large share of cocoa in national incomes, producing countries are characterised by slow agricultural growth, poverty, falling wages, and stagnant economies (Hazell and Reardon, 1998; Hernandez-Cata, 2000). In addition, there are major forces that drive change: the threat from cocoa pests and diseases coupled with old age of some farms and depletion of soil fertility, are increasingly causing significant reductions in yield/ha of cocoa and quality deterioration. Furthermore, concern has been expressed regarding the capacity of available resources and technologies to increase and sustain long-term cocoa productivity. Research on the foundations of sustainable cocoa production systems with minimal environmental degradation will require an approach that takes into consideration the natural resource base. Hence, the full potential of cocoa to contribute to agricultural growth can be attained by implementing targeted agricultural research and technology dissemination aimed at increasing productivity in a sustainable fashion.

Agricultural research that yields improved technologies, is recognised as an effective approach to enhance the agricultural productive capacity, and lead to both economic growth, and poverty reduction (Lustig and Stern, 2000). A key issue in West Africa cocoa production is how to target agricultural research in a way that its productivity gains in domestic levels can be implemented successfully in a wider range of socio-economic settings at the regional level. Well-targeted agricultural research on a regional basis can potentially:

- reduce the production cost per unit of output,
- increase the output of marketable produce, especially in nutrient deficient soils,
- increase supply of better quality cocoa for export, and local processing
- increase rural households demands for farm and non-farm products,
- Increase on-farm employment opportunities,
- increase foreign exchange income at the country level, and
- generate savings for smallholders.

Productivity-enhancing technologies developed through research will yield such potential benefits in key cocoa producing countries only if these technologies are appropriate and profitable enough to be adopted by farmers. All of these supported by an appropriate policy context that will lead to technology adoption, increase participation of empowered smallholders in markets, and this will improve the efficiency of the tree crop sector in reducing poverty.

Within the STCP vision to link producers and consumers throughout the whole chain, this proposal will provide the necessary backstopping for the effective dissemination of innovations within a community focus, for enhanced impact of research on their livelihoods, and on the natural resources managed by these groups. A key issue will be gender equity to ensure participation of rural women in the overall research and technology dissemination process and their access to key resources and benefits.

2.0 Economic growth depends on the ability of agents to innovate. For our purposes, innovation is defined as anything new introduced into an economic or social process in the cocoa supply chain. OECD defines innovation as the ability to use knowledge creatively in response to market opportunities or other social needs (OECD, 1999).

3.0 Sustainable productivity improvements of cocoa smallholdings must be attained to increase farmer incomes, and achieve more efficient use of the land. One way forward is the dissemination and adoption of better production and post-harvest technological innovations, with emphasis on the rehabilitation of old cocoa farms, suitable soil fertility replenishment approaches, and the reclamation of deforested lands. Research must ensure a transformation of knowledge into innovations. The agents involved in the innovation process in the cocoa chain must interact in a positive manner to ensure that there is a clear understanding of both: scientific bases of the underlying phenomena and the singular characteristics of the dissemination process of the innovation itself. There is a clear need for more efficient institutional arrangements for research and the steady flow of technology innovations into farmer fields.

In order to be successful, and deliver the best possible return to technology dissemination and research investments, future interactions of agents involved in the technology delivery and research should be regionally coordinated by a fully dedicated professional manager. This Co-ordination provides continuity, will help build trust, avoid duplication of efforts, will clarify the role of each agent in the innovation process, and strengthen synergies, all of which are particularly significant in the transition to sustainable forms of cocoa production.

Developing a sound regional research programme addressing key issues with high potential to enhance productivity is a challenge that the Sustainable Tree Crops Programme (STCP) has to face to achieve its goal of “improving the

economic and social well-being of smallholders, and the environmental sustainability of their tree crop systems".

4.0 At the Steering Committee meeting in Herdon, Va., Key issues for Research and technology dissemination where identified.

It was agreed that:

At least 4 best available technologies are packed and disseminated to address profitability/income generation
At least 20 "farmer trainers" per country are trained in year one (through a sustainable system)
Priority technologies (long-term) are developed/progressed and packaged in:
- Control strategies for black pod and mirids
- Biocontrol in Black pod and mirids
- IPM packages
- Clonal multiplication
- Rehabilitation of small cocoa holdings

A regional research coalition be made operational
Standards of sustainability be developed (include addressing hazardous practices)
Impact of innovations should be measured

3.0 **Project goal and Objectives**

Purpose: Environmentally sound, socially acceptable, productivity-enhancing technologies will be made available for use by smallholder tree crop farmers and other users.

Objectives:

1. To disseminate technology innovations for tree crop productivity improvements on farmer fields;
2. To ensure and assess impact of innovations;
3. To develop technologies and policy options to increase productivity, generate greater income and preserve the natural resource base ;
4. To enhance sustainability of research and technology dissemination through institutional development.

4.0 **Strategic Approach**

A series of research breakthroughs in cocoa have been produced over a number of years as result of investments in research programmes at the national, regional and global level. STCP plans to build on of the most successful results, and take them to a further stage, adding value

in doing so. Within this context, during the working period of 2000-2001, the STCP implemented several research activities in all participating countries addressing issues related to increasing productivity and sustainability of the tree crop smallholders. In addition, research was conducted to address policy issues that would support component technology introductions in cocoa farming systems. The links between research and the extent to which generated technologies can be translated into income for farmers, were assessed during an "Implementation Workshop" that took place at Ibadan, Nigeria in September 2001. A draft publication edited by Drs. Martin Gilmour and Jose Luis Rueda is available at request.

Activities for technology dissemination will test a wide range of technological innovations and develop an effective technology dissemination and integration process leveraging local expertise and highly experienced cocoa agronomists from other world regions.

Participatory technology dissemination methods, such as "Farmer Field School", will be a key element of the implementation of this component. Such method will result in trained farmers and develop a cadre of grassroots extension agents. Mathematical programming, as developed by Kazianga and Sanders, 2002; will be used to evaluate the introduction of technology innovations in cocoa farms. This method of analysis of technology dissemination takes into account current land use systems, prices, liquidity, and labour constraints. It will allow differentiate the individual effects of technology innovations in capital generation for small farmers.

4.1 Focal Centres providing leadership for specific research activities: When charting the initial research strategy, STCP has focused on ways to implement its activities in a few places or centres of research that could serve as places for focal development of key technologies (Table 1.0). The assumption is that in each identified centre high levels of expertise are in place for research implementation. Key problem-solving research activities that will translate directly into technology innovations can then be implemented by STCP by overcoming the existing market failures that arise from the lack of interaction among agents. The strategy for this will be to develop synergies and built on existing capabilities. The results will be extrapolated to other sites within West Africa. Smallholders should be the ultimate benefactors of STCP research products, either directly or via extension services.

4.2 Approach to Research: In order to address the problems of research on cocoa, the approach to research taken will have three key principles:

- Conduct applied, strategic and adaptive research within a multidisciplinary approach, in a non-linear vision of science;

- Improvement of cocoa productivity by drawing in appropriate global research results to date, and innovations developed based on these, with an emphasis on sustainability;

- Strengthening of cooperation with a wider range of global partners, ensuring proper interaction among agents through the STCP framework.

4.3 Links to Pilot Projects: The pilot projects are a regionally co-ordinated action plan aimed to test, under real-life situations, alternative approaches and interventions, promising technology innovations and methodologies to improve environmental sustainability, and the economic and social circumstances of communities involved in cocoa production. Seven pilot projects will be implemented in total in Cote d' Ivoire (3), Cameroon, Ghana, Nigeria and Guinea Conakry. This Regional Proposal for Technology Dissemination, Impact and Research is an important element of the STCP pilot projects since it will strengthen the research capabilities of STCP partners, and provide schemes for technology dissemination.

It is expected that this proposal will help build the capacity to test technology dissemination approaches effectively, for specific thrusts.

This proposal is based on the assumption that it will be fundamentally interdependent with the other STCP regional services, namely: Trade and information systems, and Child Labour. A substantial collaboration at the regional level, a strong cross-functional relationships among participating countries, and effective interactions of agents involved in the innovation process, will be promoted to enhance the synergies gained, and address issues that can most effectively be dealt with from a regional platform.

A key issue of this regional research and technology dissemination effort is the improvement of existing cocoa agricultural systems within a community focus, where all activities will be sustainable, ensuring their production capacity in the long term. Connecting cocoa research with economic growth will require a holistic, multidisciplinary, and participatory methodology within a farming systems approach to research and technology dissemination. This will take into account community land use and production constraints, and the scaling up of productivity and resource use at the smallholder level, to higher hierarchical levels within a country and at the regional level. Therefore, an analysis of the impact of rural poverty reduction improvements on the society at large could be pursued by STCP as part of the impact assessment.

Technology adoption for farmer groups represents a gradual process of change, where opportunities for technology options within this process have to fit within economic and socio-cultural values (Dent, 1993). In

this project, research and technology dissemination will be carried out more or less concurrently. Scientists, extension services, targeted farmer groups and other development agents will be pooled together whilst the participatory research is still in progress. In this way, their view points and knowledge for development of sustainable cocoa systems will be included in the development of new technology. Farmers will be active participants in the technology development, dissemination and adoption process as the innovation is applied in their local context (Rogers, 1995). Extension services will be viewed as co-developers of a new technology rather than taking a single role of disseminating finished products (Ruthenberg, 1985).

Innovative solutions to farmer production constraints will be primarily proposed to groups of smallholders in STCP pilot project areas, previously defined as part of the pilot planning phase. However, technology dissemination at pilot projects is not the exclusive role of STCP research. STCP will actively look for opportunities to communicate relevant results to all interested parties within the cocoa sector within each country, but also at the regional and global level through the members of the steering Committee and the STCP chairperson for research.

4.4 Technology Dissemination: farmer field school approach to technology dissemination:

Cost effective mechanisms must be developed within farmer associations for training farmers in integrated crop and post harvest management practices targeting the problems of pest and diseases, aging tree stocks, and low quality. Success of these technology dissemination activities will result in raise of farmer incomes by 1) increasing productivity 2) reducing dependency on costly agro-chemicals 3) improving the quality of cocoa. Further benefits will be obtained by reducing the incidence and risk of pesticide contamination among cocoa producers and their family members through integrated management and proper safeguards. Environmental gains include the reduction of the amounts of pesticides entering the environment.

Develop training modules for FFS and TOT.

The first step in the process is to develop the modules for the training of trainers and the farmer field school. Some work along these lines has already been done by CABI Bioscience and ACDI/VOCA (SUCCESS program in Indonesia). A consultant with experience in cocoa-based FFS will be engaged for a 10 day TDY to provide expertise in setting up the training modules. Building upon this expertise, the proposed training modules will then be adapted to local needs and conditions through consultations with technical experts in Nigeria, Ghana, and RCI by the regionally based TT expert. Problems that have already been noted include:

1) pest and disease management for capsids, stemborers, swollen shoot, and blackpod disease
2) rehabilitation of the cocoa tree stock
3) poor post harvest quality.

We should expect these problems to vary by site with not all problems to be the simultaneous focus of a FFS. An STCP regional workshop on IPM recognised black pod disease as number one priority cocoa production constraint in the region, followed by mirids and stem borer. Initially, it is proposed that cocoa IPM training modules be developed.

The responsibility for deliver on this activity will lie with the TT expert. The expert will ensure that the standards of the training and field school meet the requisite level. After 10 days with the FFS cocoa consultant, the specific detailed content of the training modules will be developed over the course of 6 weeks of in-country visits (two weeks per country for technical consultations). In each country, two consultants with expertise in the chosen subject matter of the FFS will be enlisted to participate in this activity.

Recruitment of farmer-facilitators from farmer associations participating in the STCP.

This activity will entail recruitment of 25 FFS trainers/facilitators and the sensitisation of farmer associations in each country. Visits to the membership of those associations expected to participate in the FFS will serve as a recruitment mechanism for the facilitator and inform the association's cocoa growers about the field school activity. The recruited trainer will himself/herself be a cocoa farmer (or sharecropper) who has demonstrated among his/her peers the necessary competencies (good communication skills, literacy, analytical skills) required for successfully carrying out FFS in his/her locality.

Conduct training of trainers workshops

After the training modules are completed and the facilitators have been selected, the TOT will be conducted, lasting a total of three weeks in each site. The training will be conducted on a cocoa field chosen by the participating farmer association. The objective of this training is to develop a cadre of workers with the capacity to conduct farmer field schools targeting the priority cocoa problems identified. Each TOT will train 25 village-based facilitators drawn from the ranks of the farmer association. The training will be based on the training modules described above.

Institutionalisation of the farmer field schools with the participating farmer associations

This activity will involve the elaboration of a management and implementation structure within the apex farmer association for overseeing 50 FFS and the 25 facilitators. The activity will be conducted by a qualified local consultant with project implementation experience. Included in this activity will be the development of a monitoring and reporting mechanism, which will be developed in consultation with the RTT regional expert to evaluate results. The cocoa FFS expert to be hired for developing the training modules will also provide expertise for the development of organisational and monitoring mechanisms in support of FFS within farmer associations.

Implementation of farmer field schools with the participating farmer associations

Each of the farmer-trainers from activity C above will be expected to facilitate and implement two cocoa-IPM FFS simultaneously (biweekly meetings with each group) consisting of 25 farmers during the growing season. The activity will include setting up a system of self-monitoring so that individuals can themselves evaluate the impact of this training. At the end of the FFS productivity gains of 2.5% are expected

Expected outcomes:

Short term three months
At the end of the three-month startup period, capacity for implementing the FFS approach targeting cocoa IPM will exist in Nigeria, Cote d' Ivoire and Ghana. In each country it is expected that:

- A locally adapted set of training modules will exist.
- 25 farmer-trainers will have been recruited in each country
- 50 field schools and 1250 farmers will have been identified for launching in 2003 cocoa campaign.
- Organizational setup for implementing, monitoring and measuring impact of FFS extension approach will be in place among apex farmer organizations.

Long term—year 1, year 2, year 3
In year 1 it is expected that a total of 3,750 farmers will have been trained in a four-month farmer field school for cocoa IPM and an additional 3,750 in year 2. In year 2 the environmental and socio-economic impacts of the FFS will be evaluated for the 3,750 first year participants and in year 3, the impacts will be evaluated for 7,500 participants. Among the assessment measures will be benefit-cost accounting, and economic surplus approaches.

Expected cost and benefit of the technology dissemination:

Detailed budgets for activities A and C are found in the start up period proposal for the RTT project. Activities B and D are found in the country proposals. The indicative budget amounts to a cost of roughly $1,200 per trainer. If the average cost of the FFS was maintained at $40 per farmer, and each trainer were to successfully complete 10 FFS (250 farmers trained) then the average cost per trained farmer would be somewhere in the neighbourhood of $45.

If we assume that:

- participating in the FFS results in a 2.5% overall gain in productivity per farmer because of better management which is maintained for five years,
- the average STCP farmer produced 1,000 kg of cocoa prior to the training
- the farm gate price of cocoa received is $0.50/kg (scenario one) or $0.75/kg (scenario two).

Then, under conservative scenario one, the internal rate of return (IRR) to the set of farmer field school activities would be 12% and under scenario two the IRR is equal to 31%.

5.0 PROJECT THRUSTS

For programmatic purposes, the project will be comprised of six thrusts. Some of these activities will be implemented as part of cashew research within STCP. All cashew research will be conducted in Guinea.

The six thrusts will be:

1.0 Integrated pest and disease management
2.0 Germplasm improvement and production of quality planting materials
3.0 Rehabilitation of existing smallholder tree crop farms
4.0 Valuing the environmental services of three crops
5.0 Enhancing post-harvest product quality
6.0 Ensuring and measuring impact of innovations

1.0 Integrated Pest and disease management

Objective: To develop an integrated strategy for plant health management on farmer fields, with emphasis on the use of biological and economical sustainable control practices.

Activities:

1.1 Technology Dissemination

1.1.1 Cocoa IPM farmer field school extension approach with farmer associations: Farmer field schools help farmers learn about integrated crop management by providing tools and knowledge for making crop management decisions. The schools are run by trainers who, themselves, undertake training in the field, learning first-hand about the problems that farmers face throughout a cropping season. Trainers and farmers devise testable crop management practices to suit their differing requirements drawing upon technical expertise. In the farmer field schools, farmers evaluate preventative measures against diseases and, where appropriate, take remedial action against insect pests based on observations in their own fields. Conservation of natural enemies and other beneficial organisms is vital. Pesticides are applied only in case of emergency or when no other management methods are available. Discovery-based exercises are an important part of the field school programme and assist farmers in understanding key concepts such as disease cycles, pathogens, biological control, pest life cycles, and crop nutrition.

Target countries: Nigeria, Ghana, Cote d' Ivoire, Cameroon (initial focus on 2 countries)
Potential Partners: CRIG, CNRA, CRIN, IRAD, IITA, ACDI/VOCA, CABI Bioscience
Potential Consultants: B.K. Matlick, Janny Vos (CABI).

1.2 Research

1.2.1 Biological control of Black Pod

Status: One biological control agent has proven to be most effective for the control of *P. megakarya* under laboratory conditions in Cameroon. Scientist from Cote d'Ivoire (I. Kebe) trained in the USA on isolation and biocontrol organisms.

Outputs:
-a collection of biocontrol strains, field tested for the control of black pod caused by *P. megakarya* (Cameroon).
-biocontrol systems established for *P. palmivora* (Cote d'Ivoire)

The activity aims to further develop a key component to be included in the integrated control of P. megakarya and *P. palmivora* in West Africa, with emphasis on sustainability.

Leading institution: IRAD
Target countries: Cameroon and Cote d' Ivoire
Institutions: IRAD, CNRA

1.2.2 Development of control strategies for black pod disease

Status: a series of agronomic best practices, chemical control and biological control agents have been identified for the control of black pod disease and outlined in the Cotonou Workshop in November 2001.

Output: A strategy for integrated control of black pod in West Africa

The activity will build on achievements obtained in Cameroon for biocontrol agents, and it will be aimed to construct an approach to integrated control of black pod disease that suits national capabilities. This may include soil amendments, soil covers, root endophytes, and other best practices.

Leading Institution: CABI
Target country: Cameroon, Cote d' Ivoire, Ghana, and Nigeria
Institutions: IRAD, CNRA, CRIG, CRIN

1.2.3 Development phase for a bio pesticide for cocoa mirids

Status:
-a promising isolate of *Beauveria bassiana* has been isolated and a technique for the mass production of its spores has been established. Ghana has reported good results in using pheromones for mirid control.

-Botanical pesticides derived from the Neem tree (*Azadirachta indica* A. Juss) have a potential for the control of insect pests in cocoa.

Output:

-a bio pesticide for the control of cocoa mirids

The activity will continue the work on identifying entomopathogenic isolates against mirids and evaluate their potential for the development of mycoinsecticides. It will also conduct on-farm research to test new control methods for mirids.

If successful, then the technology can be rolled out to the pilot project in Ghana and regionally.

Leading Institution: CABI
Target country: Ghana, Cote d' Ivoire
Other: Cameroon, Nigeria
Institutions: CRIG, IRAD, CRIN, CNRA

1.2.4 IPM Strategy in cocoa systems

Status: cultural practices, chemical control and biological control agents have been identified for the control of pests in cocoa, as outlined in the Cotonou workshop during November 2001.

Output: IPM strategies identified

The activity will encompass the validation of best bet IPM options with farmers, develop rational methods for use of pesticides and strengthening quarantine through capacity building.

Leading Institution: IITA/CABI
Target country: Ghana, Cote d' Ivoire
Other: Nigeria, Cameroon,
Institutions: IITA, CABI, CRIN, IRAD, CRIG

2.0 Germplasm improvement and production of quality planting materials

Purpose: Introduce, evaluate and multiply germplasm on farmer fields under appropriate plant health conditions. Obtain a better understanding of on-farm management and use of cocoa and other tree crop genetic resources.

2.1 **Technology dissemination**

2.1.1 Production and distribution of planting materials in cocoa

Goods seeds which produces fairly uniform progeny is available in most cocoa-growing countries. The genetic variation observed in the Amazon hybrids or Amelonado, is regarded as acceptable. Seedlings are low cost and easy to produce. Some seeds of Amazon hybrids are produced in seed gardens, where seeds produced will be of known parentage (female self-incompatible), and proven performance. Vegetative propagation has an important role where it is necessary to reproduce trees true to type. This is done by rooted cuttings or buddings onto a seedling rootstock.

As part of the technology dissemination efforts, STCP plans to strengthen currently available nurseries in farmer organizations and research centres. Technology innovations will be introduce to speed the process of production of plant materials, specially for rehabilitation of smallholder tree crop farms.

2.1.2 Production and distribution of planting materials in cashew and cashew development

The production of planting materials, a key constraint for cashew farmers in Conakry, will be part of the services of the proposed Quality Management Centres (QMCs) for Farmer Organizations. The strategy proposed is to initially strengthen existing production centres in communities ('pepiniere villagois') and in research sites. AS part of the technology dissemination activities, two structures would be developed : (a) Grafting nurseries at the QMCs, one ha in total ; (b) 6 hectares of nurseries scattered at the community level.

During Year one, a propagation workshop will take place, and the development of pest and disease manuals associated with propagation and production of cashew will be pursued.

2.1.3 Domestication of high-value fruit trees and medicinal plants

Status: Indigenous high-value tree species have been selected and propagated in Cameroon, Nigeria, Equatorial Guinea and Gabon by ICRAF

Output: High-value fruit trees introduced and produced via vegetative propagation techniques.

The activity will consist of the introduction of high-value fruit trees, and the development of vegetative propagation activities such as rooting; grafting and marcotting, which will help to select, multiply and mass-produce indigenous high-value tree species of the region. Moreover the techniques will be taught to farmers in pilot villages. As similar activities are already been undertaken in the region, they will be extended to Ghana and Cote d' Ivoire.

Leading Institution: ICRAF
Target country: Ghana, Cote d' Ivoire
Institutions: CRIG, CNRA, ICRAF

2.2 **Research**

2.2.1 Clonal multiplication of cocoa through tissue culture

Status: In vitro methods (micro propagation and somatic embryogenesis) have been developed. Training on integrated propagation system has taken place in Ghana, Nigeria, and Cameroon. Tissue culture labs set up in all countries, but further training is needed. Cocoa swollen shoot virus (CSSV) is important in Ghana, and it is desirable to guaranteed CSSV free plantlets. In vitro multiplication

research linked to quarantine facility at Reading University to speed up availability of genetic materials for STCP participating countries.

Output: High quality planting materials available for farmers. Tissue cultured-derived elite clones screened for CSSV in Ghana.
The activity will continue tissue culture training for the improvement of propagation systems in Cote d'Ivoire, produce virus free clones in Ghana, and conduct in vitro multiplication research at the Quarantine facility at Reading.

Target country: Ghana, Cote d'Ivoire
Leading institution: PSU
Institutions: CNRA, CRIG, PSU, University of Reading

2.2.2 Clonal multiplication of cashew

Status: Nurseries already implemented in communities and farmer organizations in Guinea Conakry. Need for tissue culture propagation identified.

Output: High quality planting materials available for farmers

The activity will develop propagation methods for the improvement of propagation systems to produce high-quality planting materials of cashew in Guinea for grafting and from seedlings. Tissue culture propagation will be further evaluated contacting cashew research centres outside West Africa.

Target country: Guinea
Leading Institution: University of Conakry
Institutions: IRAG, PSU, SPCIA, USAID-Conakry

2.2.3 Cocoa genetics

Status: several research efforts in cocoa genetics have been carried out in the region by national institutions and CIRAD. Cocoa geneticist already hired by IITA.

Output: Regional cocoa germplasm characterised

Leading Institution: IITA
Target countries: Cameroon, Cote d' Ivoire, Nigeria, and Ghana.
Institutions: CNRA, IRAD, CRIG, IRAG, CRIN, USDA, CIRAD, IITA

2.2.4 On-farm testing of cocoa varieties

Status: cocoa clones with suitable yield and disease/pest resistance have been included into a database at the University of Reading (International Cocoa Germplasm Database, ICGD), and other national

breeding programmes in the region. The Intermediate Quarantine new facility at Reading University, is the only recognised source of cocoa genetic materials for West Africa.

Output: cocoa varieties tested for farmer use.

This activity aims to evaluate on-farm varieties under different conditions. It will further link STCP to other major cocoa germplasm efforts such as CFC project II aimed at develop farmer participatory methods for technology transfer of new cocoa varieties, and the BCCCA funded activities on enhanced breeding.

Leading Institution: IITA
Target country: Cote d' Ivoire
Other: Ghana, Cameroon, Nigeria
Institutions: CRIG, IRAD, University of Reading, CFC, BCCCA, CIRAD, IITA, IPGRI.

2.2.5 On-farm testing of cashew varieties

Status: Five promising clones have been selected by IRAG following multilocation trials

Output: cashew varieties tested and evaluated for farmer use

The activity will evaluate on-farm cashew varieties for high yield and other attributes under different farmer conditions. This activity will be closely linked with the activity for "regional cashew survey".

Leading Institution: IRAG
Target country: Guinea Conakry
Institutions: IRAG, SPCIA

3.0 Rehabilitation of existing smallholder tree crop farms

Purpose: Develop appropriate techniques and approaches to rehabilitate existing smallholder cocoa farms to increase productivity, income and sustainability of the tree crop systems.

3.1 **Technology Disemination**

3.1.1 Rehabilitation of small cocoa holdings

Status: Cost-effective cultural practices have been identified. Use of propagation methods such as grafting, and other management practices such as thinning, pruning, appropriate nutrient use, use of

leguminous trees for shade management, cultural practices for crop maintenance, are available and their benefits understood.

Output: targeted small cocoa holdings rehabilitated

The activity will develop Farmer Field Schools modules to disseminate technology innovations for the rehabilitation of cocoa farms using vegetative propagation techniques such as grafting.
Target country: Nigeria
Other: Cameroon, Ghana, Cote d'Ivoire
Institutions: IRAD, CRIN, IITA, XLGROW, ACDI/VOCA,
Consultant: B.K. Matlick.

3.2 **Research**

3.2.1 Soil fertility management

Status: different soil fertility enhancement practices have been identified for tree crop based systems. Research findings indicate that higher cocoa yields are obtained under reduced shade and increased nutrient supply.

Output: a soil fertility replenishment approach developed and adopted by small cocoa farmers

The activity will research an integration of technologies for nutrient management to enhance soil fertility in smallholdings.

Leading Institution: CNRA
Target country: Cote d' Ivoire
Institution: CNRA, XLGROW-USA, ICRAF

3.2.2 Acquiring local agronomic and ecological knowledge

Status: Training of researchers on agro forestry and knowledge acquisition has taken place.

Output: Local agronomic and ecological knowledge acquired

The activity will acquire, compare, and evaluate farmers' knowledge about ecology and management of cocoa multistrata systems in Cameroon.

Leading Institution: University of Wales
Target Country: Cameroon
Institutions: IITA-Cameroon

4.0 **Valuing the environmental services of tree crops**

Purpose: Reduce deforestation through the introduction of environmentally friendly and economically feasible practices for the establishment of tree crops on deforested lands.

4.1 **Research**

4.1.1 Establishment of cocoa agroforests in deforested lands

Status: Knowledge of biological and nutrient cycling aspects in establishing cocoa agro forests in *Chromolaena odorata and Imperata cylindrica* has been obtained.

Output: Multiespecies cocoa established

The activity will aim to continue the research to determine the biological and economic effects of establishing multistrata cocoa agro forests in the *Chromolaena odorata* and *Imperata cylindrica* fallow lands of West and Central Africa. Knowledge acquired will be disseminated to all STCP partners in the region as to enhance environmental services, increase biodiversity protection and reduce poverty.

Leading Institution: IITA
Target country: Cameroon, Nigeria, Cote d' Ivoire, and regional efforts.
Institution: IITA, IRAD

4.1.2 Impact of management practices on the sustainability of cocoa agroforests

Status: Initial results indicate that cocoa smallholder farming systems potentially maintains ecosystem integrity. Also, that survival of cocoa seedlings through to maturity was the same in the presence or absence of shade, and that soil water and soil temperature appear more important than shade.

Output: Ecology of cocoa agro forests investigated as a model system for West Africa

The activity will further characterise the ecological and economic knowledge of existing cocoa systems within a mosaic of different land uses; assess the carbon stock; and to examine the effects of management (shade/fungicide) on the ecosystem function and carbon and nutrient cycling. It will also look at the ecological consequences of transforming old cocoa farms and will help generate biophysical indicators of the sustainability of resource use in cocoa agro forests.

Leading institution: IITA-Cameroon
Target country: Cameroon, Cote d' Ivoire
Institutions: IRAD, IITA, CNRA

4.1.3 Development of a regional pilot project for carbon benefits

5.0 Enhancing post-harvest product quality

Traditionally, African cocoa has not been sold to any great extent on a differentiated product market (although information on the extent to which manufacturers can locate and purchase lots of cocoa from specific regions within African country offering characteristics they desire is contradictory). Pilot projects could potentially sell *regionally differentiated cocoa products* if processors and or manufacturers desired and would purchase cocoa on that basis.

The threat from cocoa pests and diseases coupled with old age of some farms and depletion of soil fertility, are increasingly causing significant reductions in yield/ha of cocoa and quality deterioration.

5.1 **Technology Dissemination**

5.1.1 Cocoa quality improvement

Status: Appropriate methods for post-harvest management such as bean fermentation, drying and storage of cocoa are available.

Output: Increased cocoa quality and reduced post-harvest losses

The activity will support technology dissemination on appropriate post harvest handling of cocoa beans. It will build on existing results obtained in the MARS/GTZ and SOCODEVI projects currently implemented in Cote d'Ivoire. Implementation of the latest industry recommendations for improved quality cocoa will be carried out, empowering farmers to manage bean quality at the earliest stage of the supply pipeline.

Target country: Nigeria, Cameroon, Ghana, Cote d'Ivoire
Institutions: IRAD, CRIN, CRIG, CNRA, ACDI/VOCA,
Consultant: B.K. Matlick.

6.0 Ensuring and measuring impact of innovations

Standards of Sustainability

Because of the complexity of cocoa systems, a combination of several indicators is required to measure sustainability. In quantitative terms, sustainability can be defined as the change in the value of bio-economic indicators over time. For positive indicators, a zero or positive slope indicate that the agricultural system concerned is sustainable. The opposite would indicate that the system is not sustainable and that some technological intervention is required (Rueda et al. 1994).

The goal of this activity will be to deliver what a consumer wants more efficiently, while ensuring a sound basis for a robust supply, both in the bulk of the production, as well as in niche opportunities as these arise.

Key elements to be considered will be: production system resilience, environmental externalities, credit, profitability and equity, labour practices, farmer organisations, information transfer pathways, market chain efficiency and product quality.

Proposed approach:
1-Technical roundtable
2-Consultation on feasibility
3-Multi-level implications identification

This project will help identify measurable and verifiable indicators of the consequences of resource use and social practices at the farm level in cocoa production. These will be the result of multidisciplinary teamwork during the research process. Clear examples of how these are being defined as part of the STCP activity implementation process is the current and future work on agronomic and ecological knowledge, ecological research on cocoa agroforests, biocontrol of *P. megakarya* , IPM strategies, shade management, soil fertility replenishment, quality management, market information systems, and labour practices.

The indicators identified will reflect the adequacy of land use and social practices. Limitations of the current practices and recommendations to correct these will be determined, together with appropriate procedures for the transfer of this knowledge to farmers in the technology dissemination process and as part of the implementation of activities within the pilot projects.

At the later stage, the project will review together with a wide range of stakeholders the significance of proposed standards at the different hierarchical levels, and integrate the necessary elements for their utilisation on regional basis.

Target countries: Cote d' Ivoire, Cameroon, Ghana, Guinea Conakry, Nigeria
Institutions: IITA, BNETD

Impact of cocoa trade innovations in West Africa

On-going

Status: links in West Africa cocoa trade and marketing and market failures have been identified in selected countries

Output: Impact of policy changes and cocoa trade in West Africa assessed

The activity is currently implemented by Purdue University in USA. It aims to evaluate how cocoa markets have evolved following structural adjustment reforms. Models will be developed to establish the financial viability of innovative marketing institutions.

Leading Institution: Purdue University
Target country: Ghana
Other: Cote d' Ivoire, Cameroon

6.0 REGIONAL TECHNICAL EXPERTISE AND PROJECT CO-ORDINATION

There is an important need for the systematic and comparable assessment of all the various interventions proposed by both the regional projects (RTT, Child Labour, TISP) and the seven country pilot projects. The timely assessment and monitoring of institutional innovations, socio-economic outcomes, and environmental impacts is necessary at repeated stages for fine tuning the interventions and ultimately for providing guidance to farmer organizations that will allow for their economic growth and capacity for service provision.

There is also an important need for expertise and backstopping on the extension of knowledge and technology through participatory farmer-led processes, in particular the farmer field school approach.

To meet the above needs, two internationally recruited technical positions are required at the regional level:

- a specialist on research and impact assessment (who also will assist the STCP program manager in co-ordinating the research portfolio of STCP)
- a technology transfer expert with experience in farmer field school extension approaches.

6.1 Global Cocoa Research Advisory Group

It is proposed that the the technology dissemination, research and impact regional effort is guided by a Global Cocoa Research Advisory Group, composed of leading cocoa research experts and development workers from

industry and private consultants with a deep interest in the region. This includes the Research Leader of the STCP Steering Committee who will chair the proposed Committee. Appendix 2. provides a list of potential members of the Advisory Group and its expected functions.

7.0 **SCHEDULE OF ACTIVITIES**

A general list and schedule of activities will be:

Year 0: During the working period of 2000-2001, the STCP implemented several research and technology dissemination activities in all participating countries. In addition, research was also conducted to address policy issues that would support component technology introductions in cocoa farming systems. Key results obtained to date have guided the priorities outlined in this project proposal for the forthcoming years.

Year 1: -Further implementation of technology dissemination and research activities,
-Development of TORs for sub-contracted research,
-Preliminary synthesis of key issues and identification of themes and issues needing further research,
-Appointment of Global Cocoa Technology Dissemination and Research Advisory Group,
-Impact assessment mechanisms in place
-Annual review meeting with Steering Committee to monitor progress, assess research innovations and their potential to be proposed to smallholders, and approve work plans for next year.

Year 2: **-**Managerial processes in place to ensure rapid delivery systems for the dissemination and adoption of innovations by small farmers,
-Publish project papers, develop e-conferences to share knowledge on key constraints to cocoa production,
-Models for assessment of impact of innovations in place,
-Workshop with all partners to monitor progress, assess impact, consider longer-term future of technology dissemination, research and impact assessment, realign priorities based on results to date, and plan key human resource development activities.

Year 3: -Critical mass of human resources and institutions in cocoa research and technology dissemination in place,
-Further realignment of priorities,
-Phase out of some research activities,
-Regional cocoa research network strengthened,
-Monitoring methodologies standardised across the region,
-North-South collaboration established,
-Key policy options identified,

-Key technology innovations for pest and diseases adopted in farmer fields,
-Annual review meeting with the Research Advisory Group for impact assessment, priority alignment and planning of training needs.

8.0 **EXPECTED BENEFITS**

By initiating the regional programme, as detailed in this document, the following benefits will be added to the overall STCP expected output:

-Developing an effective technology delivery system for small tree crop farmers in West Africa;

-Addressing priority cocoa production constraints in key centres for technology development, hence, results obtained will have a large potential for extrapolation and further adoption on a regional basis;

-Avoiding duplication of efforts by providing a framework for cocoa technology dissemination and research to which similar initiatives can link and save time and financial resources for technology generation and transfer;

-Creating a critical mass of human resources and institutions in several disciplines of cocoa research and technology dissemination, by bringing together currently disjointed efforts;

-Increasing the efficiency of cocoa improvement through effective collaboration between South/South, and North/South public-private institutions, including IARCs;

-Developing and standardising common methodologies for impact assessment.

-Generating measurable and verifiable indicators of sustainability for cocoa production (biophysical, social and economic indicators)

Table 1.0 Examples of proposed focal research centres for STCP

Activities	Focal centre of research
* Biological Control of Black Pod	IRAD
* Biopesticide for Cocoa Mirids	CABI
* Soil fertility management	CNRA
* Germplasm/Multiplication	CNRA
* In vitro multiplication	PSU
* Rehabilitation of cocoa holdings	CRIN
* Establishment on degraded land	IITA
* Regional Cashew development	SPCIA
* Impact of Cocoa trade	Purdue University

Appendix 1. Contributors

This proposal is based on several comments in writing or verbal communications from colleagues, partners and Steering Committee members of STCP. The final draft was prepared by Jose Luis Rueda, Martin Gilmour, Jim Gockwski, and Stephan Weise as result of initial consultations held at MARS, United Kingdom.

Key contributors in alphabetical order included:

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Many thanks to all these colleagues for their valuable contributions.

Appendix 2. Global Cocoa Technology Dissemination and Research Advisory Group

The proposed Global Cocoa Research Advisory Group will convene an expert group in cocoa research and development from global industry and private consultants. The group will be linked to the Steering Committee of STCP. The combined group will:

-Monitor scientific excellence in all research activities;
-Provide intellectual leadership and assist in realignment of research priorities;
-Approve joint work plans based on priorities;
-Approve progress reports;
-Evaluate the performance of the Co-ordinator for Regional Research and Technology Dissemination.

Proposed Members (not country related)

-Martin Gilmour (Chairperson, Research Leader STCP Steering Committee)
-Tony Lass (STCP Steering Committee)
-Michael Appiah (STCP Steering Committee)
-Salomon Nyasse (IRAD-Cameroon)
-Koffi N'Goran (CNRA-Cote d'Ivoire)
-Rob Lockwood (Consultant, Tropical Agriculturist)
-Ross Jaax (ACDI/VOCA)
-Others to be invited

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