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AFRICAN AGRICULTURAL TECHNOLOGY FOUNDATION
AND
NETWORK FOR THE GENETIC IMPROVEMENT OF COWPEA IN AFRICA

Report of Cowpea Stakeholders Workshop

on

A Cowpea Technology Plan to serve African Farmers and Consumers.

February 10 – 12, 2004

M Plaza Hotel,

Accra, Ghana

**Participants at the Cowpea Stakeholders Workshop,
M Plaza Hotel , Accra Ghana. February 10 – 12, 2004**

Contents

LIST OF ABBREVIATIONS

AATF	African Agricultural Technology Foundation
ABSP	Agricultural Biotechnology Support Programme
ADP	Agricultural Development Project
ARI	Agricultural Research Institutes
ASARECA	Association for Strengthening of Agricultural Research in Eastern and Central Africa
BAC	Bacterial Artificial Chromosome
BBC	British Broadcasting Cooperation
Bt	*Bacillus thuringiensis*
CGIAR	Consultative Group on International Agricultural Research
CIAT	Centro Internacional de Agricultura Tropical
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo
CIP	Centro Internacional de la Papa
CORAF/WECARD	West and Central African Council for Agricultural Research and Development
CRSP	Bean/Cowpea Collaborative Research Support Programme
CSIRO	Commonwealth Scientific and Industrial Research Organization
DANIDA	Danish International Development Agency
DfID	Department for International Development
ECA	Economic Commission for Africa
FARA	Forum for Agricultural Research in Africa
FAO	Food and Agriculture Organization of the United Nations
FBO	Farmer Based Organizations
FTO	Freedom to Operate
GDA	Global Development Alliance
GEF	Global Environmental Facility
GM	Genetically Modified
GMO	Genetically Modified Organism
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRAF	International Center for Research in Agroforestry
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IPR	Intellectual Property Rights
IPM	Integrated Pest Management
IPM/FFS	Integrated Pest Management Farmer Field Schools
IRM	Insect Resistance Management
IRRI	International Rice Research Institute
ISRA	Institut Senegalais de Recherche Agricole
IWMI	International Water Management Institute
MAS	Marker Assisted Selection
NAPRI	National Animal Production Research Institute
NARES	National Agricultural Research and Extension Systems
NARS	National Agricultural Research Systems

NEPAD	New Partnership for Africa's Development
NGICA	Network for the Genetic Improvement of Cowpea for Africa
NGO	Non-governmental Organization
NSS	National Seed Service
OECD	Organization for Economic Development
PRC	Polymerase Chain Reaction
RIL	Recombinant Inbred Lines
SRO	Sub-regional Organizations
SLP	Systemwide Livestock Programme
TSC	Technical Steering Committee
USAID	United States Agency for International Development
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
VOA	Voice of America
WASNET	West African Seed Network

Executive Summary

1. Following the decision of the Technical Steering Committee(TSC) of the AATF/NGICA partnership, formed during the Small Group meeting in Kenya on constraints to Cowpea Production and Utilization, a Cowpea Stakeholders Workshop was organized at the M Plaza Hotel in Accra Ghana from February 10 – 12, 2004.

2. The overall objective of the workshop was to develop a process and to formulate a plan for a cowpea improvement project in sub-Saharan Africa. Project activities will use modern plant improvement technologies in the form of superior-performing cowpea cultivars with novel traits as well as ancillary cowpea production, utilization and marketing technologies to bring the benefits of these modern technologies to African farmers and consumers.

3. Thirty eight workshop participants at the workshop included specialists from National Agricultural Research Systems, the CGIAR, Purdue University, USA, University of California, University of Virginia, Michigan State University, Bean/Cowpea CRSP project, University of Ghana, USAID, The Kirkhouse Trust, The private sector such as Biotechnology Companies, AATF and NGICA. The Forum for Agricultural Research in Africa, FARA, provided local logistic support for the workshop.

4. Plenary presentations made by AATF staff, Larry Murdock and members of the Technical Steering Committee and other specialists provided the background, updates of Task Force activities since the Nairobi meeting, as well as the technical framework to guide deliberations of the 6 Task Forces to contribute to preparation of the Cowpea Project Concept Note.

5. The workshop successfully

- Laid the foundation for a cowpea technology transfer project that would be jointly implemented by AATF-NGICA and other development partners.
- Prepared a cowpea project that would be implemented to improve cowpea production, utilization and marketing in sub-Saharan Africa through linkages of modern technologies that are developed and disseminated in a manner which would to bring long term benefits to African producers and consumers.
- Formulated a funding plan for the project, identified potential sources of funding for project activities and
- Established a management structure for implementation of the cowpea project.

6. The workshop developed a conceptual framework as the basis for formulation of the Cowpea Project Concept Note as follows:

6.1 Conceptual framework for the project formulation

The procedure for formulating the Cowpea project concept note will adopt the AATF approved project formulation and approved process which consists of the following steps.

i. AATF leads the development of the project concept
ii. The project concept note is developed in close consultation with key stakeholders; Project concept notes cover technical, commercial, financial and associated legal/regulatory issues.
iii. The draft concept note is subjected to a peer review process and finalized
iv. The revised Concept note is submitted to the AATF Board for approval
v. Following approval, the Business Plan for the project is developed.

After extensive discussion, the workshop adopted the following framework for the development of the Cowpea Project Concept Note.

Title :

A total of 34 texts were recommended for the project title. Participants votes on the top 3 titles, resulted in the following

- Top choice**:** (19 votes) *Enhancing livelihoods through improved cowpea productivity and utilization in Africa.*
  Suggested changes to this title were given as
  (i)*Enhancing livelihoods with integrated use of emerging cowpea technologies in Africa*
  (ii) Enhancing livelihoods in Africa with emerging cowpea technologies.
- Second choice:(8 votes) *Improvement of livelihoods through the creation of high value cowpea.*
- Third choice(7 votes) *Enhancing access to advanced technologies for cowpea improvement in Africa.*
  Suggested change : *Advanced technologies for improvement of cowpea in Africa.*

AATF management was mandated to polish the selected title to appropriately reflect the key ideas discussed. Special effort should be made to ensure that the title captures the key words/concepts that reflect current rural development issues such as food security, improved nutrition , rural livelihoods, poverty alleviation, income generation and improved standards of life.

Project focus : The primary focus for the project product would be cowpea varieties that are

- Socially acceptable
- Meet the needs of the variety of end users
- Highly productive
- Resistant to biotic and abiotic stresses
- Address food security issues
- Improve nutrition
- Generate income for resource poor farmers in sub-Saharan Africa.

Project activities:

Activities selected should include cowpea processing technologies, involve strong collaboration with institutions, groups, organizations and agencies already engaged in research and development of cowpea production, storage, utilization and marketing. Activities should be linked to Deliverables. The broad areas of project activities required were identified as follows:

i. Strengthening cowpea seed production and marketing systems in sub-Saharan Africa.
ii. Setting up a project management system
iii. Developing and applying a genetic transformation system for cowpea
iv. Developing and applying a marker assisted selection approach for the improvement of cowpea.
v. Developing dual-purpose cowpea varieties to extend the utilization of cowpea.
vi. Better understanding of consumer preferences concerning GM cowpea
vii. Extending non-chemical cowpea storage technologies that respond to consumer demands
viii. Establishing FTO(Free To Operate) for cowpea biotechnologies.
ix. Setting up a risk management plan for transgenic cowpea in sub-Saharan Africa.

The activities will be implemented to yield the following deliverables.

i. Bt gene in market acceptable cowpea varieties widely available to small holder farmers in Africa.
ii. Efficient local systems for delivery of high quality cowpea seeds
iii. Increased capacities in cowpea systems including research, seed distribution and cowpea processing
iv. Genetic markers for specific biotic and biotic stresses including *Striga*
v. More rapid development of elite cowpea varieties for resistance to *Striga* and other biotic and abiotic stresses using marker selection systems.

Project management structure:

The project structure will be in a Modular form, each sub-project making up the component Modules. Each of the modules will be coordinated by individual module leaders or task force leaders or task coordinators. The AATF and NGICA partnership will be the assigned overall coordination entity for the project and this entity will hire a project manager to undertake the task of coordinating the work of the module leaders; this structure is simply illustrated as follows

PROJECT ⇨ Overall Coordination
-AATF/NGICA - *Project Manager*

SUB-PROJECT ⇨ Oversight
-Technical Committee- *Module Leader*

For effective overall project implementation, technical sub-committees will provide oversight for each component sub-project Module.
Strong partnerships will be established between relevant national, regional and international institutions and agencies for effective project implementation.
Periodic monitoring and evaluation will form an essential and integral part of the project implementation process.

Funding strategy

The entire project could be funded by a single donor, but different donors may fund components Module sub-projects that are of particular interest to them.
The approved AATF funding formula will be adopted as follows:
Project formulation – AATF funds 75% while 25% will be sought as matching funds
Project implementation- AATF to fund 25% while 75% will be sought from donors.

The Global Development Alliance Secretariat of the United States Agency for Development USAID, has expressed interest in the AATF/NGICA Partnership Cowpea project therefore efforts will be made to complete the preparation of the Project Concept Note to conform with the GDA guidelines for submission to GDA/USAID.

6.2 Outline of the cowpea project concept note

Fundamental principles underlying project formulation

i. The project objectives should stress critical issues of Enhancing Rural Livelihoods, Food security, Improved Nutrition for farming families, Increased Household Incomes, use of Emerging Technologies such as biotechnology, information technologies and chemical technologies, Sustainability, Presidential initiatives, Effects of HIV/AIDS, Geographical focus and Impacts on livelihoods of small holder farmers in sub-Saharan Africa.
ii. Focus will be on generic technologies, giving examples of technologies/ tools that will be used to achieve the project objectives.
iii. Interventions will be made so that their impact on cowpea production and utilization can be realized within a set of time horizons, namely immediate(short term), medium term and long term.
iv. Activities will involve integrating approaches from different collaborating institutions/time frame/technologies and geographic focus. The work of institutions will be integrated in such a manner that relevant technologies are captured in various areas.
v. The project should build the foundation for the use of modern and sophisticated technologies to achieve early impact.
vi. Intellectual Property Rights issues will be integrated within the framework of the Improved Varieties sub-project; the institution and mechanism for managing IPR issues during project implementation has been identified.
vii. It is recognised that different project Deliverables will go to Farmers, Consumers, Traders, Researchers, and technology developers.

viii. The project concept note will be prepared to conform with the guidelines for the Global Development Alliance – USAID; the document should be limited to 10-12 pages according to the GDA guidelines.

ix. To facilitate the preparation of the project concept note, information will be sought from Chairs of Task Forces if necessary. The sources of information identified are indicated in brackets in relevant parts of the project concept outline.

x. Names of specialists may be suggested for the Peer Review Panel as required by the AATF procedure for project development and approval.

6.3 Outline of the Cowpea Project Concept Note developed.

Accepted Title

Enhancing Livelihoods in Sub-Saharan Africa through Integrated Use of Emerging Cowpea Technologies

Introduction

Economic importance of cowpea ; outline mode of
-Production
-Utilisation and income generation
Current productivity constraints and gaps
Partnerships (past, on-going), AATF/NGICA/IITA Bean CRSP etc, that continue working to address constraints
Expected benefits from project implementation
Impact of the project activities on a time frame

Objectives/Goals

-To enhance livelihood in Sub-Saharan Africa through emerging cowpea technologies.
. define meaning of enhanced livelihoods, improved nutrition, income generation,
. emerging cowpea technologies, including Biotechnology, Information technology, Chemical technology
. capture range/breath of technologies
. time, technologies, integrating institutions, systems, mobilizing and linking
. time horizons, linking over the life time of the project

Deliverables : these will constitute the focus of the project

- Improved varieties (seed, grain and fodder)
- High quality seed- for seed storage
. Seed quality control - seed laws and bio-safety issues
- High quality grain for processing, utilization/storage and consumption.
- Improved Cropping/Production systems and practices-adopting the Farmer Field School participatory model to address all constraints; soil/water management, pests/diseases, storage, processing and utilization, market information etc
- Improved cowpea processing
- Market plans for cowpea in various grain sheds in SSA
  - information for business plan & opportunities
  - model for cowpea business plan

- investment options

Capacity Building for compliance with seed laws

Enhanced livelihoods **:** the following deliverables will contribute to enhancing livelihoods

-efficient seed delivery system
- seed companies
- ease to attract markets, manage risks and reach new markets
- efficient storage to address pest infestation
- production of quality grain and fodder

Activities – to be elaborated by Task Forces according to uniform format

The format will consist of the following

- Overview of the problem/constraint
- Objective of the sub-project
- Activities to be undertaken
- Geographic Focus – starting with the Nigerian GrainShed.
- Partners to be involved
- Methodology
- Deliverables
- Milestones based on AATF time horizons, immediate, medium term and long-term
- Budget

HS (High quality Seed) *(**Source information from Seed Task Force)*

- Non-chemical cowpea storage technologies
- Certified cowpea seed distribution
- Production of high quality seed
- Seed quality control; best available cowpea seed storage technologies; certified cowpea seed distribution system, production of high quality seeds, production of nuclear seeds.

Capacity building (produce and store quality seed) for compliance with seed laws; farmers capacity to produce and store high quality seeds, capacity to enforce seed quality control measures - seed handlers, extension agents.

Improved Varieties (IV) *(** Source information from Field Constraints Task Force)*

- Introgression of genes for resistance (MAS)
- Develop genome-wide DNA marker set
- Introgression of genes using MAS
- Genetic transformation of Bt into cowpea
- Capacity building for application of MAS-(*target Kirkhouse Trust program for funds)*
    - Use MAS in breeding (regional/national levels by breeders)
    - Use transformation techniques.

Intellectual Property: all related issues to be handled here*(** Source information from IPR Task Force)*

HQG (High Quality Grain)

- Extension of storage and packaging technologies to be closely linked with activities on resistance against storage weevils.
- Characterization of cowpea grain
- Capacity building
  . Farmers to deliver high quality grain
  . Traders to deliver high quality grain to processors
  . Entrepreneurs to recognize business opportunities arising from income generation e.g. deliver solar heaters, deliver inputs etc.

Improved cowpea production systems (IPSC)

- Cowpea crops/livestock production system
- Integrated production and pest management, IPPM.
  - Cultural crop management
  - Cultural pest management

- Cowpea crop management systems
  - Inter-cropping
  - Monoculture
  - Use of Fertilizers

Capacity Building of farmers to adapt and adopt improved production systems

- Farmers to adopt IPPM technologies for cowpea production
- Change agents to introduce, validate and adapt production technologies

Marketing and Trade Plan *(**Source information from Marketing and Trade Task Force)*

i. Seed sub-sector Analysis
ii. Consumer preferences studies relating to grain seeds and processed products.
iii. Farming system changes and Impact analysis
  - Changes in farming/ production systems
  - Impact analysis: ex-ante and ex-post analysis to be conducted at each of the following levels)
    - farm level
    - community
    - country and
    - sub-regional

iv. Trade analysis
  - Supply and Demand for grain and processed cowpea and trade analysis (food safety issues)

v. Dissemination of the information from these studies to stakeholders of the project and to impact on priority setting for the other project components.

Capacity Building for

- farmers, traders and processors on cost/benefit analysis;
- development agents/change agents and NGOs, social scientists, biological scientists to do impact assessment and market studies

Improved cowpea processing*(**Source information from Storage/Utilization Task Force)*

i. Needs and Opportunity assessment of needs using participatory approaches
   - Technology needs
   - Barriers to technology acceptance by end-users
   - Barriers to consumer acceptance of products

ii. Extension/adoption of value-added cowpea products

iii. Food Safety studies in Bt Cowpea and processing

Capacity building on

- Training in the creation and management of small to medium scale cowpea processing enterprises
- Public awareness in food safety issues

7. Specific IP issues will be handled under improved varieties. Only capacity building and public awareness to be handled as a stand alone activity.

8. Format to be used for preparing text for each sub-project.

Objectives of the sub-project
Activities to be undertaken
Geographical focus
Partners to be involved
Methodologies to be applied
What will the activities deliver
Milestones
Horizon 1 1 – 3 years
Horizon 2 3 – 6 years
Horizon 3 beyond 7 years
Budget
Nigerian Grain shed. More focus
Deadline 15 March, 2004

9. **Action plan** : A uniform set of notes from presentations made by Task force leaders and Rapporteurs.

20th	February	Tony to Phelix
25th	February	Phelix to PFTF

NOTES OF THE WORKSHOP

Background

At the small group meeting on Constraints to Cowpea Production and Utilization in sub-Saharan Africa, held at the headquarters of the African Agricultural Technology Foundation (AATF) in Nairobi, Kenya from July 10 to 11, 2003, an AATF and NGICA, the Network for the Genetic Improvement of Cowpea, partnership was formed. The Technical Steering Committee of this partnership decided to organize a Stakeholders Workshop in Accra Ghana to develop a technology plan that would bring the benefits of modern technologies to African cowpea farmers and consumers.
This report presents the details of the organization and outcome of this stakeholders workshop.

Workshop objectives

The overall objective of this workshop was to develop a process and to formulate a plan for a cowpea improvement project in sub-Saharan Africa. Project activities will use modern plant improvement technologies in the form of superior-performing cowpea cultivars with novel traits as well as ancillary cowpea production, utilization and marketing technologies to bring the benefits of these technologies to small holder farmers in Africa and to the improve the diets of rural and urban Africans.

Specifically the workshop will:

- Lay the foundation for a cowpea technology transfer project that would be jointly implemented by AATF-NGICA and other development partners.
- Prepare a project concept note that would improve cowpea production, utilization and marketing in sub-Saharan Africa through linkages of modern technologies that are developed and disseminated in a manner to bring long term benefits to African producers and consumers.
- Formulate a funding plan for the project, identify potential sources of funding for project activities and devise a mechanism to facilitate sub-projects obtaining the required resources.
- Establish a management structure for implementation of the cowpea project.

Pattern of the Workshop

A few key plenary presentations were made at the start of each day. Summaries of the presentations are given in the next section of this report. Participants were assigned to the six task forces,(see Annex III) which worked in break-out sessions to discuss particular cowpea production and utilization constraints and to identify technical inputs and activities required for the project. Chairs of the task forces later reported to plenary

sessions when their recommendations were fully discussed, modified and approved. At a final plenary session the outline of the Cowpea project Concept Note was formulated.

Summaries of plenary presentations

PRESENTATION I

Topic: **Technological Advances, IPR, Food Security and Poverty in Africa**

Presenter: **Eugene Terry**
Implementing Director, AATF
Nairobi, Kenya.

Background

Food insecurity and poverty are major problems which constrain human and socio-economic development in sub-Saharan Africa where crop yields fell by about 8 per cent between 1980 and 1995. Farm productivity remain low because of a variety of factors , despite the fact that there are technologies that offer hope for producing crops that can withstand ecological factors such as drought, impoverished soils, pests and diseases. But these technologies must be easily accessed and delivered to sub-Saharan Africa in order to enhance agricultural productivity.

Creation of AATF

The rationale for creating the African Agricultural Technology Foundation AATF was therefore as follows:

- The need for effective mechanisms to negotiate the access and transfer of propriety and other technologies held by the public and private sectors anywhere in the world.
- The need to create appropriate long-term networks to manage the deployment of these technologies at all stages in the value chain.

AATF is a unique initiative that has no design models to copy; it is an African institution owned and led by Africans and focusing exclusively on African priorities; an innovative private/public partnership designed to harness the best practices, resources and expertise of public/private sectors.

Mission & Core Business

AATF links the needs of resource-poor farmers in sub-Saharan Africa with potential technological solutions through:

Identification and facilitation of royalty-free transfers of proprietary technologies through negotiation, entering into contractual agreements with existing institutions that will manage deployment of the technologies and ensuring that subsequent constraints after access are addressed.

AATF Partners & Investors include Agricultural producers/Consumers, Regional and national Institutions and agencies such as NEPAD, ECA, FARA, SROs and NARS. Others are the International Agricultural Research Centers of the CGIAR/ARIs and local and international NGOs, Agricultural Technology Industry IP holders, African Trade and Agribusiness Organizations, International Investors-The Rockefeller Foundation, USAID, UK/DFID and African Governments.

Update
AATF has been incorporated as a private Limited Liability Company in the United Kingdom and in Kenya which is also the host country. A board of Directors has been formed and held 2 meetings, a 10 year Business Plan has been developed and three initial senior management staff appointed. Formulation of the AATF project portfolio and the Work Program for 2004 are in progress. Pilot projects already identified include

- *Striga* Control in Cereals
- Insect Resistant Maize for Africa
- Pro-Vitamin A in Maize and Rice
- Cowpeas Production and Utilization and
- Production of Bananas and Plantains

A project flow scheme which outlines the specific project activities including technology licensing and regulatory control, freedom to operate (FTO) assessments, licensing for regional distribution, liability protection, commercialization and stewardship, has been designed and approved.

PRESENTATION II

Topic: **AATF Communications & Fund Development Strategy-2004**

Presenter: **Nancy Muchiri**
AATF
Nairobi, Kenya.

AATF has developed a Communications and Fund Development strategy that revolves around partnership relationships. The overall objective of this relationship is to achieve a high level of commitment which will ensure that there is ownership, mutual responsibility and that respect is generated in partnerships at the highest levels. AATF originated from collaboration and partnerships and the fulfillment of its mission depends on successfully linking partners to address the crucial problems of food security and poverty in Africa, especially amongst small holder farmers in sub-Saharan Africa.

The level of efficiency of our management of the associations between AATF and its collaborators/partners will determine the nature of our image, our role and our levels of success. Therefore AATF strength will be in maintaining the interest of our stakeholders, including donors, and encouraging others to contribute to AATF's programmes and efforts.
The Communications/Donor/Public Relations department will continue to expand the Foundation's support base through:

- Seeking more investors and partners to provide support in cash and kind
- Raising funds and developing relationships in a partnership and friendly environment

- Appealing to people in order to win confidence for AATF and being involved at all stages of the project development process.

AATF promises to establish a system of proactive management of information flow to ensure that all those associated with the Foundation are well informed of what is going on at all times.

PRESENTATION III

Topic: **Introduction: General Aims and Procedures of this Workshop.**

Presenter: **Larry Murdock**
Purdue University
West Lafayette, Indiana, USA

Thanks to AATF for major support for this meeting! Without AATF, this cowpea workshop would not have occurred. But it is important to note as well that numerous people came thanks to support from the Bean/Cowpea CRSP and IITA. I extend my thanks also to the Rockefeller Foundation, which made my own participation possible. I am especially pleased to acknowledge the presence of Sir Edwin Southern, representing the Kirkhouse Trust. We all appreciate your donating your time and energy, Sir Ed, and we are grateful for your interest in cowpea.

Background

Early in its inception, AATF identified 8 problem areas as possible areas for intervention. One of those problem areas was cowpea, an indigenous crop of Africa. Five areas in all were selected as pilot projects.
With support from AATF, nine scientists interested in cowpea met in Nairobi, for two days last July. Those present were:

Ousmane Coulibaly- an agricultural economist from IITA, Benin
Idah Sithole-Niang from Zimbabwe, NGICA Co-Chair
Laurie Kitch - representing FAO
Ndiaga Cisse - cowpea breeder, Senegal,
Morag Ferguson – ICRISAT/IITA
Eugenia Barros – CSIR/Bio/Chemtek S.A.
Mohammad Ishiyaku – cowpea breeder, IAR, Nigeria
Rose Ndegwa – IP specialist at ILRI
Larry Murdock, Purdue University, NGICA Co-Chair
Eugene Terry – AATF, Nairobi

We agreed very quickly that we should focus on:

1) Increasing productivity of cowpea farmers in Sub-Saharan Africa
2) Fostering greater cowpea utilization – recognizing the nutritional importance of cowpea in feeding the growing population of African cities.

We were collectively in agreement that just growing more cowpea is not enough. Farmers growing that cowpea have to sell it – otherwise they won't grow it. So we had to keep marketing and trade in mind, as well as cowpea utilization.

- AATF and NGICA agreed to work in partnership to develop a Project Concept Note - - as the basis for future AATF project dealing with increasing cowpea productivity and utilization.

The process we agreed upon was this:

- The first step was a planning meeting – namely the small group meeting then occurring in Nairobi.
- Creation of task forces to carry forward the process of goal selection.
- Presentation of the preliminary ideas and suggestions to a much larger group of cowpea stakeholders for discussion and deliberation, modification and eventual consensus - - the current meeting here in Accra.
- The development of a draft project concept note by a professional writer, building on the input of the broad cowpea community.
- Submission of the project concept note to a distinguished panel of expert reviewers.
- Revision of the document into a final project concept note to be presented to the AATF Board for approval.

Several additional decisions were reached by the group, namely:

1. Idah Sithole-Niang, working with AATF staff, would serve as liaison between AATF and NGICA scientists. She would prepare the SGM report.
2. Larry Murdock would organize the larger cowpea Stakeholders Meeting - - this meeting - - in collaboration with AATF and with AATF support.
3. NGICA would help mobilize additional support for this meeting.
4. A Technical Standing Committee would consist of participants at the Nairobi meeting plus others added to make the committee more representative: Ester Sakyi-Dawson (University of Ghana-Legon, Accra) was added, a food scientist; Muffy Koch from Golden Genomics – an expert in Biosafety from South Africa; George Bruening – who is actively involved in efforts to create a genetic transformation system for cowpea.
5. That we would schedule the general stakeholders meeting for Accra, Ghana, in the cowpea growing area of West Africa – originally late in fall 2003, but subsequently moved to this date – this meeting.

Strategic Concepts and Values

1. The project will work in three time horizons, in term of when impact is expected to be felt.
   Short: 1-3 years

   Medium: 4-7 years

   Long: 7-10 years

2. We envisioned that short-term impacts might involve:

    a. Increased availability of improved cowpea seeds
    b. Improved availability of existing storage technologies
    c. Fostering better input supply or market availability

3. Mid-term impact could involve improved seed produced through the use of markers (MAS)

4. Long-term impacts could include Bt cowpea Maruca or □-AI cowpea (cowpea weevils)

None of the impacts I have just listed are necessarily the ones this workshop will reach consensus on. You may have better ideas.

Indeed, that is why you are here: to create, as the members of the cowpea community, a plan for increasing cowpea productivity and utilization. The ideas I have presented are merely the basis for discussion. I'll be surprised and disappointed if you don't add additional ideas, and modify others.

This is a workshop, your workshop.

Please, as you deliberate and discuss, keep the African farmer foremost in your mind; it may be a woman with several children and a half hectare plot of cowpeas that she tills and weeds, hour upon hour, by her own hands, depending on her cowpeas to improve her family's health, or on the small money she can earn selling her cowpea in the local market for a little cash income.

Or it may be an ambitious young man who has stayed on the farm and hopes to generate needed cash income for his family, so he can send his children to school or maybe buy himself some tools or a bicycle or a sewing machine for his wife.

These are the people who need our help, and probably will never hear about us at all. Please always keep these people in mind as you work.

If and only if our deliberations and our plans and our work actually reaches those farmers and the consumers who they help feed - - only then can we say we are truly successful. Grants funded, reports filed, scientific papers published, extension messages extended count as little compared to impacting peoples lives. People have to use the products of our work.

Thanks for coming, and please do your best for the African farmer and consumer.

PRESENTATION IV

Topic: **Update on NGICA, Network for the Genetic Improvement of Cowpea in Africa**

Presenter: **Ida Sithole-Niang**
University of Zimbabwe
Harare, Zimbabwe

The presentation gives an update of activities of the Network for the Genetic Improvement of Cowpea for Africa (NGICA) which were agreed at the workshop of cowpea stakeholders held in Dakar, Senegal in January 2001. Participants at this workshop were scientists, representatives from non-governmental organizations (NGOs), donors and administrators. It was agreed that NGICA would use molecular biological tools to address some of the productivity, utilization and availability constraints that had been identified as limiting cowpea production. The network is to be administered by two coordinators, one from Africa and the other, a scientist from an industrialized country.

To-date NGICA has lobbied donors for funds and continued efforts to promote and support work on the genetic transformation of cowpea. NGICA funded the translation of Maarten Chrispeels pamphlet on genetically modified foods into French. A conference on the Genetic Transformation of Cowpea was organized in Capri, Italy in November 2002.

During 2003 NGICA was involved in preparing background documents for laying the foundation of an effective African Agricultural Technology Foundation (AATF)/NGICA partnership and collaboration which has culminated in this Accra Cowpea Stakeholders meeting. Initially a consultative meeting was held in Nairobi to define the best approach to formulating a cowpea project. This was followed by a Small Group Meeting (SGM) made up of African Scientists who defined the key areas to address productivity and utilization constraints in cowpea. Four productivity constraint areas were identified and a fifth one included to address the area of intellectual property rights, IPR. Six taskforce teams and leaders were identified, and formed the basis for assembling a much more encompassing-group of experts for the consultative process planned for the Stakeholders meeting in Accra, Ghana. Professor Murdock obtained funding from the Rockefeller Foundation, to organize the meeting, develop a white paper on cowpea, as well as establish a website for cowpea . Although all these activities have been on-going successfully, and a successful partnership has been realized with the AATF, NGICA lacks a legal status, which has created some difficulties in acquiring substantial funding.

PRESENTATION V

Topic: **Socio-economics of Cowpea in Sub-Saharan Africa: Production, Marketing and Trade.**

Presenter: **Ousmane Coulibaly,**
IITA Cotonou Benin

Global challenges in Sub-Saharan Africa include food security and sustainable livelihoods for an increasing population while at the same time protecting the environment. The decreasing per capita food supply and increasing rural poverty require substantial increases in agricultural productivity and improvement in marketing and trade. Scientists, rural development institutions, the private sector and governments are challenged to develop and diffuse technologies, make optimal institutional arrangements and policy reforms and decisions to increase productivity and incomes for sustainable livelihoods. Cowpea can play an important role in efforts to achieve these goals.

Increased cowpea contribution to food security and poverty reduction (incomes) will require :

1) promoting production and distribution of certified high quality cowpea seeds,
2) developing and diffusing cost effective and sustainable integrated pest management technologies,
3) promoting the development of high nutritious and value-added cowpea products,
4) empowering public, private, NGO and various cowpea-related organizations, and
5) strengthening collaboration between stakeholders, including the private sector.

The contribution of the Cowpea Marketing and Trade Task Force will be to 1) review past and on-going socio-economic studies on cowpea across Sub-Sahara Africa, 2) assess key socioeconomic constraints and opportunities for cowpea production marketing and trade, and 3) recommend new proposals for further cowpea research-for-development. The geographical focus will be West and Central Africa, East and Southern Africa for the main activities which will include: Assessment of cowpea marketing performance, consumer preferences analysis, surveys on acceptance of Bt cowpea, trade analysis, training and capacity building of national research and development systems.

PRESENTATION VI

Topic: **Potential Economic and Trade Impacts of Bt Cowpea**

Presenter: **Jess Lowenberg-DeBoer,**
Purdue University & Bean/Cowpea CRSP

Experience with transgenic crops suggests that the economic, marketing and consumer aspects should be considered early in the process of developing a transgenic crop variety. Farmers with access to GM crops may substantially modify farming systems. In some parts of the world, consumers have reacted negatively to products from genetically modified (GM) plants, blocking GM Grains and oilseeds from certain markets.

This presentation is a summary of recent work on the potential economic and trade effects of Bt cowpea. The earliest analysis of the potential impact of Bt cowpea was done by Mbene Faye in 1999. She used a standard economic surplus framework for costs and benefits in Senegal. She assumed that the transgenic cowpea would be developed by a public organization and that it would be made available, without cost to ISRA, for developing varieties appropriate to Senegal and that the cowpea area would remain constant. Her results show a 48% internal rate of return, a net present value of 331 million FCFA, and robustly positive returns in sensitivity testing under a wide range of conditions.

Potential consumer reaction to Bt cowpea is largely unstudied. Kushwaha et al (2004) conducted "person-on-the-street" interviews with some 200 people in Gombe, Jigawa, Adamawa and Kano, Nigeria. The results showed that about 90% of the respondents were familiar with GM terminology. The most common source of information was short-wave radio broadcasts in Hausa by the BBC, VOA and DW. About 70% said that they were "unhappy" with the possibility of consuming GM foods. Preliminary LOGIT analysis suggest that ethical concerns was the variable most closely linked to this negative reaction.

Augustine Langyintuo and Lowenberg- DeBoer (2004) analyzed the potential effect of Bt cowpea on regional trade. In particular, they considered the scenario of Bt cowpea being adopted in Nigeria well before other countries in the region. Their results suggest that if Bt cowpea roughly doubled yields, Nigeria would become a net exporter of cowpea only when Bt cowpea was planted on more than 80% of the cowpea area. Nigeria is currently the largest cowpea importer in West Africa, and in the world. If Nigeria became a net exporter this could seriously disrupt the economies of some of its neighbors, particularly Niger. Resistance management refuge requirements may mean that Nigeria remains a net importer. Worldwide refuge requirements on Bt cotton and maize range from 50% to 80%.

In industrialized countries, seed companies have usually been responsible for resistance management and biosafety. Many observers have questioned whether the seed systems in West African countries are prepared to take on this responsibility. Lambert et al (2002) conducted key informant interviews in Senegal, Ghana and Niger to determine the status of the seed system and their interest in Bt cowpea. In general, they found that: 1) producers were eager for new technology that would boost yields or lower costs, including Bt cowpea, 2) the attitude of politicians and regulators is "wait-and-see" until

the GM debate in industrialized countries has been settled, 3) seed growers and retailers were curious about the concept of a Bt cowpea, and 4) in general, there was a lack of reliable information about the costs and benefits of GM crops.

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Faye, Mbene, "Use of Agricultural Biotechnology to Improve Gain from Cowpea Production in Senegal," Department of Ag. Economics, Purdue University, West Lafayette, IN, 1999.

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Lambert, Dayton, Khonde Mavuangi, Mbene Faye and Germaine Ibro, "Seed Sector Challenges for Introduction of Bt Cowpea in Senegal, Niger, and Ghana, West Africa," Department of Ag. Economics & Bean/Cowpea CRSP, Purdue University, West Lafayette, IN, 2002

Langyinto, Augustine, and J. Lowenberg-DeBoer, "Assessing the Potential Impacts of Biotechnologies on Cowpea Trade in West and Central Africa," Department of Ag. Economics, Purdue University, West Lafayette, IN, 2004

PRESENTATION VII

Topic: **Establishment of a Gene Transfer Protocol for Cowpeas (*Vigna unguiculata* L.)**

Presenter: **T.J. Higgins,**
CSIRO Australia

The aim of this project is to develop an efficient and robust gene transfer system for cowpea to complement conventional breeding programs. The first criterion for success overall will be Mendelian segregation of transgenes that have been selected to confer resistance to two insect pests that are difficult to control. The target pests are cowpea pod borer and cowpea weevil.

Over the past 18 years there have been several reports of gene transfer to cowpea. None have resulted in lines that transmit the gene to the next generation in a predictable fashion. This means that it is still necessary to develop an efficient transformation system with characteristics that make it useful in the breeding program i.e. Mendelian segregation of the transgenes.

We have screened five different explant types, 21 divergent genotypes and five culture media to arrive at an efficient regeneration system that yields multiple shoots at a very high frequency. This was a suitable base on which to begin transformation experiments. Using transient expression of the reporter gene for beta-glucuronidase (GUS) we established that transformation was possible. This confirmed several earlier published reports.

The next step was to establish stable transformation. We found that both the bar and *nptII* marker genes worked well under our conditions when we used phosphinothricin (2 ug/ml) or geneticin (150ug/ml), respectively. We have used GUS expression to monitor stable expression and while initial experiments showed strong GUS expression, this was restricted to mosaic patterns indicating that only some cells were transformed. We imposed a stronger selection regime by using phosphinothricin at 5 ug/ml. We used thousands of explants and obtained several strongly growing plantlets that appeared to be expressing GUS uniformly throughout the plant. This indicates that all the cells in the meristem are transformed and therefore it is likely that seeds on these plants will express the transgenes at 3:1 ratio.

We have constructed a binary plasmid for gene transfer which contains two sets of right and left borders. This should facilitate removal of the selectable marker gene by selecting progeny plants that have segregated to contain only the gene for insect resistance.

An intellectual property rights,IPR audit is being conducted in order to seek licences for each component technology that is proposed for the project.

Several groups in the NGICA have made progress on genetic transformation of cowpea using different protocols. The Zimbabwe/Michigan State University group is using

electroporation for gene transfer. The UC Davis group has developed a promising explant source in epicotyls and IITA and Purdue groups have established systems similar to that described above.

I believe we have at least one, or possibly more, promising transformation systems for cowpea. There are several laboratories around the world that will be able to adopt the most efficient system as soon as the preferred one emerges.

PRESENTATION VIII

Topic: **Dual-Purpose and Fodder Cowpea: Collaborative Research within the CGIAR System-wide Livestock Programme**

Presenter: **Salvador Fernandez-Rivera**
International Livestock Research Institute
P.O. Box 5689, Addis Ababa, Ethiopia

The Systemwide Livestock Programme (SLP) was established in 1995 to support the Consultative Group on International Agricultural Research (CGIAR) goal of alleviating poverty and protecting natural resources in order to achieve sustainable food security in developing countries. Small-scale farmers in these countries have limited assets and opportunities to improve their livelihoods, but one option is broadly practiced. By integrating crop and livestock production they improve their farm productivity, generate income, improve food security and protect their natural resources. By 2010, in the developing world, crop-livestock farmers will produce more than 90% of the milk and 75% of the meat, and their farming enterprises will increasingly depend on dual-purpose (food-feed) crops. The SLP builds and strengthens collaboration between livestock, plant, water, agro-forestry and policy oriented CGIAR centres to develop integrated and coherent strategic and applied research on food-feed crops, within the context of sustainable use of land, water and soil nutrients. Its members include CIAT, CIP, CIMMYT, ICARDA, ICRAF, ICRISAT, IFPRI, IITA, ILRI, IRRI and IWMI. The SLP is supported by The World Bank and the governments of Canada, Denmark, Germany, Japan, Switzerland and the United Kingdom.

In West Africa, cowpea is planted in more than 8 million ha. The ruminant livestock population of the region includes approximately 44 million tropical ruminant livestock units (1 unit = 250 kg live weight), 38% of which are kept in areas were cowpea is produced. An additional 18% of the livestock units are kept in peri-urban and urban areas, where cowpea hay is commonly marketed and used as livestock feed. Cowpea is therefore an important source of nutrients for both humans and livestock. An ex-ante assessment of adoption and impact of genetically improved dual-purpose cowpea in the dry savannah of West Africa, conducted within the SLP, indicated that the net present value of research and extension on dual-purpose cowpea is 606 million US dollars. This study estimated that investing in research and extension on dual purpose-cowpea over a

period of 20 years would have an internal rate of return of 71 % and a benefit:cost ratio of 63 .

IITA, ICRISAT, ILRI and their national partners in West Africa (INERA in Burkina Faso, IER in Mali, INRAN in Niger, and ARI and NAPRI in Nigeria) investigate options to intensify crop-livestock systems in the dry savannas. These options include the introduction of improved dual-purpose cowpea varieties, pesticides, organic and inorganic fertilizers, and feeding systems for small ruminants based on cereal and legume residues. A second project implemented in India and Nigeria aims at enhancing the livelihoods of poor livestock keepers through increased use of fodder. Dual-purpose cowpea is the main source of fodder promoted in Nigeria in this project. Experimental results indicated that by including cowpea hay at levels of 30-50% in the diet of fattening sheep, the growth rate increased by 30-40 g/d and the carcass yield by 2-5 percentage units. Preliminary germplasm evaluations also point to the existence of considerable genetic variation in fodder yield and quality. An improved variety, with dual-purpose characteristics (IT90K-277-2), yielded as much fodder and more grain, and sustained similar weight gains in sheep than a local variety (Singh et al., 2003). On-going work funded by DFID in Nigeria indicates that improved cowpea varieties result in higher household incomes. Developing dual-purpose cowpea varieties can substantially improve the production of food grain and livestock outputs and lead to enhanced livelihoods of poor people.

Improved dual-purpose cowpea can be developed within the AATF/NGICA cowpea initiative. Such an innovation will entail:

- Identification of cowpea traits that are related to livestock production
- Prediction of these traits with high throughput approaches such as the use of near infrared reflectance spectroscopy and simple laboratory measurements
- Identification of sources of genetic variation and molecular markers associated with these traits
- Application of these sources in conventional breeding or marker assisted selection programmes to develop superior dual purpose cowpea varieties

By collaborating with other cowpea improvement programmes involved in the initiative, ILRI, IITA and their partners can contribute to the successful implementation of these activities and the delivery of the superior dual-purpose cowpeas.

PRESENTATION IX

Topic: **Potential and Constraints of improved Cowpea varieties in increasing the productivity of Cowpea-Cereals systems in the dry savannas of West Africa**

Presenter: **B B Singh**
Cowpea Breeder and Head IITA Station Kano Nigeria.

Cowpea is the most important source of nutritious food and fodder in West Africa. Of the world's total of about 14 million ha area under cowpea, West Africa alone accounts for about 9 million ha and 3 million tons of production. Of this, Nigeria has 5 million ha and Niger 3 million ha. Other countries with significant areas under cowpea are Mali, Burkina Faso, Cameroon, Senegal and Ghana. The International Institute for Tropical Agriculture, (IITA) in collaboration with national and regional organizations, has developed high yielding grain type and dual purpose cowpea varieties combining resistance to major diseases, insect pests and to *Striga.* These varieties mature between 60 to 75 days and yield between 2.0 to 2.5 t/ha grains and 2 to 3 t/ha fodder compared with very low yields of local varieties. These varieties have been cultivated in sole crops as well as in strip crops.

Recent participatory research at the IITA in collaboration with other IARCs, NARS partners in Kano, Kaduna and Jigawa Agricultural Development Projects, (ADPs) in Nigeria with financial support from USAID, DANIDA, The GATSBY Foundation and DfID has led to the development of an appropriate model which seems to hold great promise for increasing food production in West Africa without affecting the environment and degrading soils. This model involves a holistic combination of improved varieties, improved cropping systems, with minimum and selective application of fertilizers and pesticides, feeding crop residues to small ruminants in permanent enclosures on the home compound and returning of manure to the field.

Based on this model, two "best bet" options are already becoming popular with farmers in northern Nigeria. These are (i). improved strip cropping system involving 2 rows of densely planted improved sorghum varieties: 4 rows of densely planted improved medium maturing cowpea in the Sudan savanna where the rainfall is about 600 mm and (ii) an improved strip cropping system involving 2 rows of densely planted improved maize variety:4 rows of densely planted double cropping of an improved 60-day cowpea in the northern Guinea savanna where rainfall is about 1000mm. In both systems, a basal dose of 100kg/ha of NPK(15:15:15) and 1 ton manure/ha is given followed by 2 sprays of Cypermethrin (a safe insecticide) on cowpea only to control pod borers. The two cereal rows have no competing border rows and therefore their yield is equivalent to almost three rows. Cowpea does not suffer competition from cereal rows because of its early maturity and the slow initial growth of the cereals. Cowpea fixes atmospheric nitrogen, causes suicidal germination of *Striga hermonthica* and also contributes to improving soil fertility.

These systems have shown up to 300% superiority in productivity and gross income compared to the traditional 1 row cereal: 1 row legume inter-cropping. On average, the sorghum-cowpea system gives about 1.5t/ha sorghum grain and 2t/ha sorghum fodder and 1.2t/ha cowpea grain and 1.5t/ha cowpea fodder. The maize-double crop cowpea

system in the higher rainfall zone gives about 1.3t/ha maize grain and 1.5t/ha maize fodder along with about 2t/ha cowpea grain and 1.5t/hacowpea fodder. The residue from the first cowpea crop is incorporated in the soil which provides additional fertility to the standing maize crop and the second cowpea crop. Since the improved systems involve 2/3 area under cowpea and 1/3 area under cereals, not only the soil fertility is improved but there is substantial reduction in the incidence of *Striga hermonthica* which is parasitic on sorghum and other cereals. The 1.5 t/ha nutritious cowpea haulms and 1.5 – 2t/ha cereal fodder supports sedentary feeding of up to 8 sheep or goats producing over 1 ton manure/year needed to make the system sustainable. Recent experiments have shown that supplementary feeding of only 200 g cowpea haulms per day along with sorghum stover to young rams doubles the weight gain in 70 days compared with feeding them with sorghum stover alone.

Need for Bt cowpea

Although great progress has been made in cowpea improvement, there is a need to protect the cowpea crop with 2 –3 sprays of insecticide from Maruca pod borer, for which no resistance has been found. If the Bt-gene which confers resistance to the pod borer can be transferred into improved cowpea varieties, the need for insecticide sprays in cowpea will be eliminated and small holder farmers can substantially increase their yields and greatly enhance their nutritional and economic status. Thus the AATF initiative to catalyze cowpea transformation with Bt-gene is very timely and a welcome development.

PRESENTATION X

Topic: **Getting Technology into Farmers' Hands** : **Increasing farmers' income through improved quantity and quality grain production**

Presenter: **Ouendeba Botorou**
INRAN Niamey, Niger

Pearl millet and Sorghum continue to be the most important staple food crops grown in Sahel where poor soil fertility and low rainfall are limiting factors. Production of both crops increased significantly during the last two decades because more marginal lands are brought under cultivation. The Western and Central African Millet Network involving fourteen countries, was established in 1991 to promote pearl millet production and utilization. Seven research projects in agronomy, breeding, IPM and processing were implemented in the member countries. Improved technologies developed by the NARS, Networks and the advanced research institutes, are available but the level of adoption is limited and the yields of the local and improved cultivars remain low.

When the network was terminated in 2001, the challenge faced by the steering committee was how to develop remunerative markets for millet and sorghum that can provide sufficient incentives for the Sahel farmers to invest in yield increasing technologies. A rapid diagnosis in the region revealed four main findings: i) experience in production and

utilization research exists; ii) there is an increasing urban population; iii) the inventory credit system (warrantage) is being experimented by NGO's and farmers' associations; iv) there is an expanding class of small processors, mostly women.
Following this diagnosis, a pilot program was launched in 4 countries to increase production of quality grain through the use of improved technologies, to link farmers to market, to provide added value through the production of quality grain and to exchange information. The findings of the one-year program in the four countries revealed that: i) the use of improved technologies (varieties, seed treatments, inorganic fertilizers) increased grain production on the farmers' fields; ii) farmers were able to market quality grain at a good price through contracts; iii) the demand for processed products is increasing (local and export markets) thus requiring higher quantities of quality grain and better adapted processing equipments. Increasing market power of the farmers and helping them to produce premium-quality grain will significantly improve their incomes and therefore their livelihoods.

PRESENTATION XI

Topic: **Kirkhouse Trust fellowships**

Presenter : **Ed Southern**
Kirkhouse Trust
12 School Road
Kidlington, Oxfordshire OX 5 2HB
U.K.

The Kirkhouse Trust will fund a number of post-doctoral scientists to work in laboratories in the UK, as part of its collaborative project scheme. Fellowships would be for a maximum period of two years in the UK laboratory. The Trust would encourage the visiting fellow to return by providing support for continuation of the project in the home country. Pay and conditions will be in line with national norms and may be influenced by the policies of the host organization, which will normally act as the employer.

A project funded by the Trust at Bangalore in India has been highly successful and it is hoped that there will be an opportunity, through the AATF/NGIOCA project , to initiate a similar project in Africa. The Kirthouse Trust will be favourably disposed to consider proposals from African institutions to implement such a project.
Further information on this project may be obtained from the Kirkhouse Trust website in the Internet.

PRESENTATION XII

Topic: **AATF/NGICA Workshop on Cowpea productivity and utilization: Cross-cutting Issues.**

Presenter : Phelix Majiwa
AATF Nairobi, Kenya

In the design of the AATF/NGICA Cowpea Productivity and Utilization Project , it is essential to clearly define the Goals and Objectives of the project so that project implementation will deliver a package of integrated products for sustainable dissemination to benefit cowpea growers, consumers and other stakeholders.
The project development process should start by

- Defining the critical path to the product package
- Identifying possible constraints/issues along the path
- Suggesting options for resolving the constraints/ issues identified and
- Working towards the product

Strategic cross-cutting issues are identified and are elaborated upon during this presentation; these include:

1 Product Concept
2. Project Management Concept
3. Technology Development Pathway
4. Geographic Deployment Strategy
5. Marketing of Inputs and Product
6. Sustainability
7. Funding

Product Concept

The major characteristic of the Project Product is that it should be high quality cowpea seed which is socially acceptable, dual-purpose, with increased productivity and high levels of resistance to biotic and biotic stresses. The dimensions of the project will be elaborated into a Project Concept Note, following a draft that will emerge from stakeholders consultations and deliberations.
AATF has established a 4 step project development process according to the following simplified scheme.
Step 1 . Product Concept Identification - responsibility : *AATF Management*

Step 2. Project Concept Note Development – responsibility: *AATF Management*

Step 3. Legal/Scientific/Technical Peer Review
of Project Concept Note – responsibility: *External Panel*

Step 4. Assessment/Feasibility/Probability
of project Success- responsibility: *AATF Management*

Project Management Concept

Fundamental issues to be considered in designing the project management pattern relate to the following

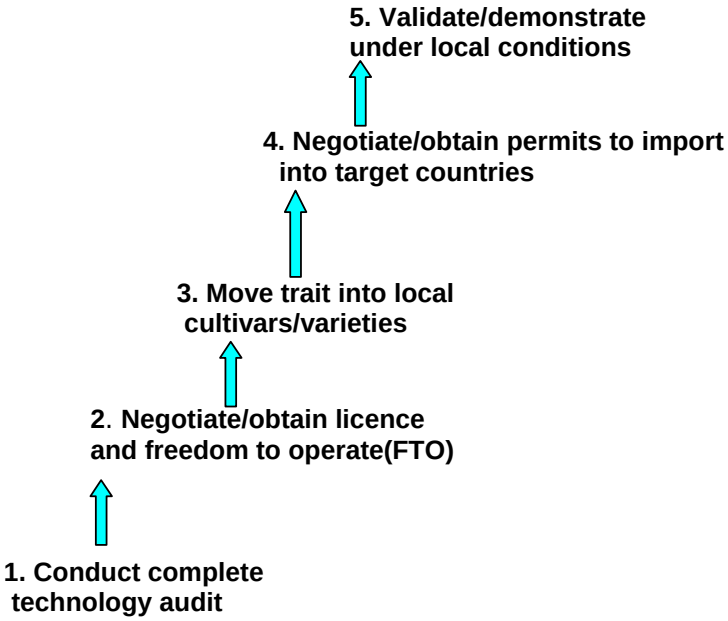
- How all the individuals and institutions interested in cowpea production and utilization can be coalesced into the focused team of distributed investigators to implement the project plan?
- Who takes leadership and responsibility for the project?
- Who will have ownership of the technology developed by the project?
- Who will have liability?
- How will the technical activities be linked to management activities?

Members/partners collaborating in the project should feel responsible for the project activities and remain committed to achieving the project goals and objectives. Commitment will bind the network together and generate the inspiration to provide the momentum to implement the project rapidly and successfully.
For this Cowpea project, the following collaborating partners and their roles are suggested.

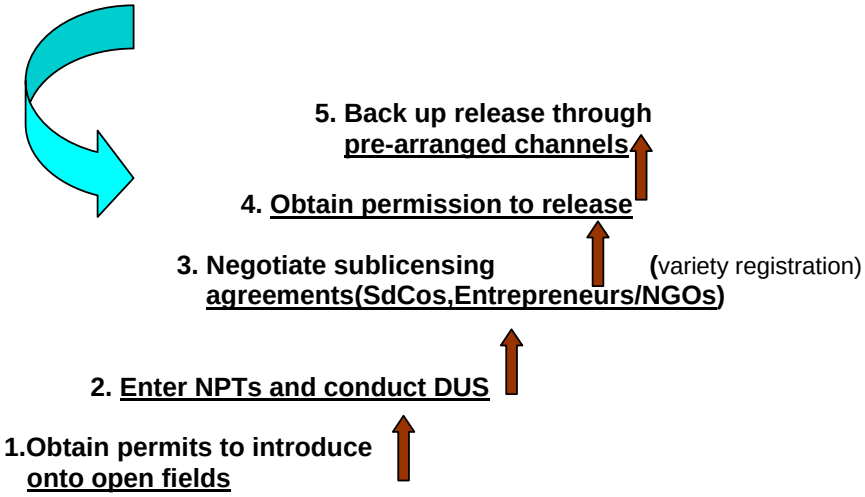
Collaborating Entity	***Suggested/Proposed Role***
AATF	Technology access, transfer and stewardship; facilitation of IP negotiations and regulatory approvals; elaboration of product/technology opportunities; product sustainability and market development. Project oversight(and Coordination?)
NGICA	Product conceptualization, development, validation and demonstration; product adaptation, promotion and adoption
Bean/Cowpea CRSP	Product conceptualization, development and validation, technology development and elaboration
IITA	Technology development, validation and demonstration adaptation and refinements
FAO/UN	Popularization of technologies; product promotion; deployment and dissemination; product/technology advocacy, resource mobilization; project oversight and coordination
NGOs	Popularization of technologies; product deployment and dissemination of technologies; advocacy
Private Sector	Ensuring availability of the product; promotion and expansion of markets.
Public Sector	Product/technology improvements and refinement; product back-up innovations and support.

Technology Development Pathway

When the product (seeds) development in completed, including validation under contained conditions, the minimum steps to be undertaken before improved seeds reach farmers and /consumers will include some or all of the following:



Follow up activities will involve the following steps:



Geographic Deployment Strategy

The criteria to be taken into account for identifying and evaluating candidate countries for project implementation are

- Cowpea productivity maps
- Poverty maps to identify areas where the product will have the highest impact on poverty and human welfare
- Be within cowpea productivity zone
- Have operational biosafety regulatory instruments
- Where the product is likely to have significant impact on livelihoods of smallholders, growers and consumers(from ex ante assessments)
- Posses developed channels for seed marketing and distribution with potential for growth
- Where the product is socially acceptable

Marketing of Inputs and Product

When the product is finally made available through various forms of marketing and distribution, constraints in product adoption may be experienced in primary and secondary adopters; these constraints include:

Primary adopters – Farmers who may be confronted with

- predictable availability of farm inputs(fertilizers, pesticides, sprayers)
- affordable stable prices
- credit facilities
- harvest-time need for capital
- information and training
- market information etc

Secondary adopters – Traders, Processors and Consumers

Traders:

- product availability, reliability, and consistency
- packaging materials
- market information
- distribution channels and transport infrastructure
- product pricing and seasonal price fluctuations(including possible crashes)
- credit facilities
- harvest-time need for capital
- pesticides and post-harvest or storage technologies

Processors:

- packaging materials(plastic sheets and bags
- pesticides
- appropriate machinery with spare parts and efficient after-sales service

Consumers:

- social acceptability
- palatability and nutritional content
- affordability
- consistency
- training

Sustainability

Sustainability is important for ensuring that the benefits of the technology developed from the project are available over the long term; sustainability issues include

- Environmental safety
- Food safety
- Insect pest resistance management
- Business viability and profitability
- Continuous public education and information dissemination about the product
- Private sector involvement
- Government interest in and support for the sector

Stewardship : Post-deployment issues

- physical containment
- biotic containment
- socio-economic factors that might limit deployment or shorten usefulness

Funding

The various components of the project may be funded from a variety of sources, for example

- Traditional funding sources
- Non-traditional sources
- Size of funds obtained and
- The duration of funding received.

Report of task force deliberations

Task Forces were provided guidelines to assist them in their deliberations and a standard format to guide the presentation of the task force reports. These guidelines are outlined here followed by individual reports from the task forces.

Guidelines for task forces

1. Each Task Force Chair should designate a co-chair to assist in conducting deliberations.

2. For each TF, a Rapporteur should be identified who will make a written synopsis of the discussions and recommendations emerging from the group.

3. At the start of the first afternoon session each TF Chair will present a 10 minute (or less) synopsis of the tasks his/her TF will address. The idea of this is to get everyone into the same rough picture, to see the whole complex of challenges and opportunities facing the cowpea sub-sector. This 10 minute presentation can be done in many ways, but one approach is to provide (1) an overview of the problem(s) and challenges faced by the TF and opportunities available (2) a summary of the ultimate benefits and the categories of beneficiaries? of finding solutions to the problem(s) (3) some possible approaches to address the problems including potential partners and networking arrangements

> To provide an example: *As TF leader for the Field Constraints Task Force I will say that field productivity of cowpeas is substantially less than it could be, giving several examples of constraints (Maruca, Striga, diseases, etc.). I'll point out that traditional breeding and screening has been successful in addressing certain field constraints, but not successful in others. New technologies built on the plant molecular revolution of the last 30 years are on the horizon for cowpea, including (i) marker assisted selection to combine useful genes in ways that can't be done by traditional breeding and screening (ii) genetic transformation of cowpea to introduce new and useful traits such a Maruca resistance or cowpea weevil resistance. If implemented, these technologies could markedly increase cowpea productivity, increase the supply of an excellent indigenous African food, and benefit not only farmers and consumers but traders and food processors as well. The big challenges are probably not the technical ones, but organizational. How to we get maximum benefit out of scarce resources, how do we help one another more effectively. But implementation of these technologies must be done in the context of traditional cowpea breeding, as a component of it.*

It is suggested that at your first session you spend some time defining the problems and tasks before your group. This will serve to get all of the issues of your constraint area on the table, and bring all of the participants into the same bigger picture. You may want to write ideas on a flip chart or the chalk board as they are suggested. After this you may wish to move on to prioritizing the constraints. What needs to be dealt with first? What can be deferred? In prioritizing, it is well to remember that important problems are sometimes intractable, so priorities may be a combination of importance modified by the

feasibility of a solution for the problem. Once priorities are established, your TF can proceed to inventorying existing or ongoing activities that are attempting to address the problem. Are these activities sufficient, or are additional activities or resources needed for progress? Once you have identified activities, you need to suggest how they can be linked into a project, or linked better than they currently are. Possible sources of funding should be considered. Finally, you need to consider how all of the project outputs link to other projects such that impact can be achieved. For example, if Bt cowpea is achieved by plant transformation, how is the new germplasm going to be brought into cowpea breeding programs. How will it then move through biosafety and regulatory processes, and how will resistance management issues be dealt with. Obviously not all issues can be comprehensively dealt with in a brief workshop. Nevertheless, the problems can be defined more sharply and initiatives organized to deal with them.

Format for Reporting

Title of Task Force
List of members of the Task Force
Summary of recommendations
Overview of the problem
Major constraints – prioritized with brief explanations
Challenges posed by constraints
Opportunities available to address constraints
Approaches to address the constraints; potential partners and networking arrangements
Benefits derivable from alleviating the constraints, categories of beneficiaries, namely primary, secondary, tertiary
Estimated cost of approaches and potential funding sources

1 Marketing and Trade Task Force

Membership of the Task Force

Ousmane Coulibaly - *Chair*
Jess Lowenberg-DeBoer- *Rapporteur*
Ouendeba Botorou
Sika Gbegbelegde
Nancy Muchiri
Salvador Fernandez-Rivera

Summary of Recommendations: Actions required

The actions required are organized into the three timelines recognized by AATF as follows

1 ***Short Term 1 – 3 years***
- Seed sub-sector study
- Potential consumer acceptance of GM cowpea and willingness to pay premium price

2 Medium Term 4 – 7 years
- Prepare seed sector for radical change
- Consumer reaction to Bt cowpea
- Estimate value added by Bt cowpea

3. Long Term 8 – 10 years
- Build demand for processed cowpea products

4. ***Cross cutting Issues*** – education and training for researchers, technicians, farmers and consumers.

Overview of the problem

The impact of the AATF/NGICA cowpea effort will depend on careful attention to economic, trade and consumer issues; these include

- Input supply, particularly seed
- Changes in farm/crop management following introduction and adoption of new cowpea technologies
- Consumer acceptance of improved and GM cowpea varieties
- Acceptance of GM cowpea in regional trade in cowpea.

Several constraints influence successful cowpea marketing and trade; the major constraints are identified as follows:

i. Market Information - consisting of price information between countries, poor information in some countries, mainly outside the Nigerian GrainShed

ii. Consumer acceptance - poorly documented price and visual quality relationships; information gaps are evident in (a) the value placed on

biochemical characteristics, including protein, sugar, cooking time(b) consumer reaction to GM crops.

iii. Barriers to trade- informal taxes, phytosanitary regulations,
iv. Seed Sector – It is hard to make money on non-hybrid seed anywhere in the world. In West Africa this is affected by (a) high transaction costs(b) substantial government involvement in seed production(c) weak seed certification processes
v. Pesticides - use of synthetic pesticides which is costly and with associated health and environmental risks due to misuse; lack of standard dosage rates for the use of botanical pesticides
vi. High Labour requirement – especially during cowpea harvest
vii. Fertilizers – particularly phosphates

Major opportunity

A major opportunity to improve and create more impact on cowpea marketing and trade is through building socio-economic concerns into cowpea improvement from the beginning in the following areas
- Farming systems
- Seed sector profitability
- Consumer preferences and acceptance by trading partners.

Approaches to be adopted

Specific approaches to achieve this include
(a) Helping to build a viable and profitable West African seed sector; Bt cowpea may have a large enough benefit to overcome the high transaction costs
- Developing a region wide perspective on cowpea seed
- Linking national cowpea seed systems to international partners and markets

(b) Using information from consumer preference studies to help develop education programmes on GMOs for West African consumers.

Product Focus

The product focus would be as follows:

i. Bt Cowpea or other genetic improvement that radically changes cowpea economies, for example, the kinds of changes in hybrid maize that were introduced into maize systems
ii. All other activities that contribute to achieving that goal including
- Contributing to cowpea seed systems development.
- Responding to consumer concerns about GM cowpea.
- Building regional capacities

Geographic Focus and Priorities

The efforts will be made in a stepwise geographic expansion in the following pattern
1st Nigeria cowpea GrainShed
2nd Senegal cowpea GrainShed
3rd Eastern and Southern Africa

The Priorities identified of the Marketing and Trade Task Force activities will be

1 Cowpea Seed Sector Studies
2 Consumer Preferences studies
3. Farming System changes
4. Development of demand for processed cowpea

Milestones to be achieved

Timelime : Short Term

Year 1

- Initiate seed sector study- build on Lambert at al study .Key informant interviews in Nigeria, Cameroon, Mali, & Burkina Faso. Regional economic study and analysis of cowpea seed sub-sector : Coulibaly & LDB
- Launch consumer willingness to pay study in Benin and Niger: Gbegbelegbe & LDB
- Collaboration with other scientists on storage extension, harvest mechanization, demand for processed cowpea etc: Coulibaly & LDB

Year 2

- Seed subsector – consultations with seed sector participants in the region on economic analysis. Discussions with seed formal sector in West Africa(eg Pannar Seedco): Coulibaly & LDB
- Consumer education based on concerns identified in willingness to pay study: Gbegbelegbe
- Collaboration with other scientists on storage extension, harvest mechanization, demand for processed cowpea etc: Coulibaly & LDB

Year 3

- Seed subsector conference- Coulibaly & LDB
- Consumer education based on concerns identified in willingness to pay study: Gbegbelegbe
- Collaboration with other scientists on storage extension, harvest mechanization, demand for processed cowpea etc: Coulibaly & LDB

Timelime : Medium Term

Year 4

- Collaboration with other scientists on value added by varieties developed with marker assisted breeding, Bt cowpea, crop management changes, cowpea processing: Coulibaly & LDB
- Collaboration with other scientists on economic issues and education related to cowpea technology: Coulibaly & LDB

Year 5

- Incorporating pest geographical information in trade analysis- Little Maruca in parts of the Sahel?: Coulibaly & LDB
- Collaboration with other scientists on economic issues and education related to cowpea technology: Coulibaly & LDB

Year 6 & 7

- Initial Bt cowpea consumer testing with actual product-experimental economics: Gbegbelegbe,Lusk & LDB
- Collaboration with other scientists on economic issues and education related to cowpea technology: Coulibaly & LDB

Timelime : Long Term

Years 8 to 10

- Market development for cowpea processed products : Coulibaly & LDB
- Collaboration with other scientists on economic issues and education related to cowpea technology: Coulibaly & LDB

Estimated Costs

- Willingness to pay – US$ 40,000
- Consumer education- ?
- Seed subsector – US$ 100,000
- Seed subsector Conference – US$100,00
- Bt Cowpea consumer preference study- US$ 50,000
- Trade analysis incorporating pest GIS- US$ 50,000
- Capacity Building – US$ 100,000

General Discussion

Participant : The Bt cowpea seed will not be available for another 7 years, is the TF timeline therefore not out of frame?
TF: In 4 years, there will be at least some transformed plants available and this would be the period when the technology will kick in, to make it feasible to design consumer education. It is necessary to understand consumer perceptions before designing consumer education programmes, therefore obtaining early information on Bt cowpea will be very important
Participant: What kind of entity will be responsible for producing and disseminating the business/model Bt Seed? And how will market information be managed?
TF: No new market information system will be created, rather, the project will link up with existing systems from which data will be obtained for analysis.
Participant: Bt is 7 years away but the GMO controversy is now with us, is it therefore appropriate to ask questions about Bt acceptability at this early stages of development?
TF: The results of studies on the potential benefits of Bt Cowpea will provide useful information about how the technology fits into the entire project.
***Participant*:** Cowpea traders are not currently well organized, but they are all cereal traders. If the findings of the market study show that these cowpea traders need support to trade effectively how will they be assisted?
TF: Successful models from other African countries could be adapted to deal with this issue.

Sub-project proposal: Trade and Marketing

Title: Enhancing Livelihoods in Sub-Saharan Africa through Integrated Use of Emerging Cowpea Technologies

Background

Global challenges for agriculture in Sub-Saharan Africa include food security and sustainable livelihoods for an increasing population while protecting the environment. The decreasing per capita food supply and increasing rural poverty require a substantial increase in agricultural productivity and improvement in marketing, trade and policy. To meet these goals, scientists, rural development institutions, private sector and government are challenged to develop and diffuse new technologies, make optimal institutional arrangements and policy decisions to increase agricultural productivity and incomes for sustainable livelihoods. Cowpea can make a substantial contribution to food security and poverty reduction (incomes). This requires the promotion and diffusion of certified high quality cowpea seeds, the development and diffusion of cost effective and sustainable integrated pest management technologies, the development of trade and marketing of high nutritious and value-added cowpea processed products, the empowerment through capacity building of public, private, NGO and various cowpea-related organizations. Increasing cowpea productivity requires also the strengthening of collaboration and linkages with all key stakeholders in the cowpea sub-sector including the private sector.

Objective

To increase the contribution of cowpea to food security and enhanced sustainable livelihoods through integrated use of emerging technologies, information on the constraints and opportunities of production, marketing and trade and the likely impact of the new technologies will be valuable.
The main objective of this project is to provide socio-economics information to all stakeholders on: 1) the constraints and opportunities of efficient input supply particularly high quality seed, 2) the potential farm/crop management changes with new cowpea technology (Bt cowpea), 4) the consumer acceptance of improved and GM cowpea varieties, 5) the potential for marketing and regional trade and the likely impact of GM cowpea on the different cowpea producing and consuming regions. This project will also 6) build the capacity for national agricultural research and extension systems, NGOs and the private sector in developing, diffusing and assessing the impacts of new cowpea technologies.

Deliverables

Market plans for cowpea seed production and distribution
Information for business opportunities for cowpea grain and processed products
Well trained analysts in social sciences for informed decision making in rural development

Activities

The main activities will be:
4.1) Seed sub-sector analysis with a focus on assessing the structure, conduct and performance of on-going and potential high quality seed supply and related capacity building. This information will help to build small seed enterprises and distribution networks.
4.2) Collect and disseminate information and knowledge on consumers acceptance for improved and Bt cowpea products
4.3) Collect and disseminate information for investment options in cowpea marketing, trade and processing
4.4) Assess the potential impact of changes in farming systems, production and incomes linked to the wide diffusion of *Bt* cowpea and make recommendations to stakeholders and policy makers
4.5) Capacity building in marketing, policy and economics analysis of national research and extension systems including staff from rural development projects sponsored by USAID, IFAD, AfDB, World Bank..
Time frame for activities

- Short Term – 1 to 3 years
  - Seed sub-sector study
  - Potential consumer acceptance of GM cowpea – willingness to pay
  - Collect and diffuse information for investment options in cowpea marketing, trade and processing
  - Capacity building in marketing, policy and economics analysis of national agricultural research and extension systems and NGOs

- Medium Term – 4 to 7 years
  - Prepare seed sector for radical change
  - Consumer reaction to developed Bt cowpea
  - Estimate value added by Bt cowpea
  - Assess the potential impact of changes in farming systems, production and incomes linked to the wide diffusion of *Bt* cowpea and make recommendations to stakeholders and policy makers
  - Capacity building in marketing, policy and economics analysis of national agricultural research and extension systems and NGOs
- Longer Term – 8 to 10 years
  - Build demand for processed cowpea products

Geographical Focus

The project will use a geographical stepwise approach. It will focus first on the Nigeria cowpea grain-shed and will be extended later to Senegal cowpea grain-shed and then Eastern and Southern Africa.
The Nigerian cowpea grain-shed is the largest in Africa for cowpea production, trade and consumption. It covers Nigeria, Niger, Burkina Faso, Mali, Ghana, Togo and Benin, Cote d'Ivoire.

Budget

Rough estimates of the costs of the various activities are shown below.

Activities	Costs (US$)
Consumer willingness to pay study	70,000
Consumer information/awareness	60,000
Seed sub-sector Analysis	120,000
Seed sub-sector Conference (Information Dissemination)	120,000
Bt Cowpea consumer preference study	70,000
Trade analysis incorporating pest GIS	70,000
Capacity building – social scientists	110,000
Total	620,000
Overhead (30%)	186,000
Grand Total	**806,000**

Partners

The project will be carried-out with partners in national agricultural research and extension systems (NARES), NGOs, rural development projects, private sector and farmers' organisations. Complementary resources will be sought from rural development projects and other partners which can contribute to a large diffusion of improved cowpea technologies. Specific NARES include INRAB (Benin), INERA (Burkina Faso), INRAN (Niger), IAR and University of Bauchi (Nigeria), IER (Mali), ISRA (Senegal), SARI (Ghana), ITRA (Togo), CNRA Cote d'Ivoire)c

Methodologies

The seed sub-sector analysis will build on past studies and key informant interviews will be carried-out in Nigeria, Benin, Cameroon, Mali & Burkina Faso with a regional economic analysis of seed sub-sector (structure, conduct and performance analysis). Consumer willingness to pay studies will be the main framework for consumer acceptance assessment. Collaboration with other scientists in NARS will be key in lowering the cost of data collection. GIS will be used to incorporate geographical information on cowpea pests in trade analysis. Training courses will be organized for capacity building for public and private sectors and NGOs

Milestones

- Year 1
  - Initiate seed sub-sector study – Build on Lambert et al study. Key informant interviews in Nigeria, Benin, Cameroon, Mali & Burkina Faso. Regional economic analysis of seed sub-sector - IITA and Purdue University and NARS
  - Launch consumer willingness to pay study in Benin & Niger IITA and Purdue University and NARS
  - Collaboration with other scientists on storage extension, harvest mechanization, demand for processed cowpea, etc. IITA and Purdue University and NARS

- Year 2
  - Seed sub-sector – Consultations with seed sector participants in the region on economic analysis. Discussions with seed formal sector in West Africa (e.g. Pannar, Seedco) – IITA and Purdue University
  - Consumer education based on concerns identified in willingness to pay study – IITA and Purdue University and NARS
  - Collaboration with other scientists on storage extension, harvest mechanization, demand for processed cowpea, etc. IITA, Purdue University and NARS
- Year 3
  - Seed sub-sector conference – IITA and Purdue University
  - Consumer education based on concerns identified in willingness to pay study – IITA, Purdue University and NARS
  - Collaboration with other scientists on storage extension, harvest mechanization, demand for processed cowpea, etc. – IITA, Purdue University AND NARS
- Year 4

  - Collaboration with other scientists on value added by varieties developed with marker assisted breeding, Bt cowpea, crop management changes, cowpea processing, etc. IITA, Purdue University and NARS
  - Collaboration with other scientists on economic issues & education related to cowpea technology – IITA, Purdue University and NARS
- Year 5
  - Incorporating pest geographical information in trade analysis IITA, Purdue University and NARS
  - Collaboration with other scientists on economic issues and education related to cowpea technology – IITA, Purdue University and NARS

- Year 6 & 7
  - Initial Bt cowpea consumer testing with actual product – experimental economics Purdue University/IITA and NARS
  - Collaboration with other scientists on economic issues and education related to cowpea technology – IITA, Purdue University and NARS

- Years 8 to 10
  - Market development for cowpea processed products – Purdue University, IITA and NARS
  - Collaboration with other scientists on economic issues and education related to cowpea technology – IIITA, Purdue University and NARS

2 Seeds Sector Task Force

Members of the Task Force

Mohammad Ishiyaku – *Chair*
B B Singh
Jeff Ehlers
Ngiaga Cisse
Issa Drabo

The Goal of the seeds sector task force activities is to ensure delivery of improved cowpea seeds to small holder farmers in sub-Saharan Africa.

Constraints: Cowpea seed production is constrained by a variety of factors including

- Lack of Seed Laws and Biosafety regulations, even where they are available, enforcement of the laws is weak
- Absence of systematic and efficient seed production and delivery systems
- Poor access to credit and production inputs by seed producers
- Low level of awareness by farmers of the benefits from improved, high quality seeds
- Inadequate extension services to facilitate the distribution of cowpea seed
- Poor infrastructure and financial conditions of NARS to produce breeder and foundation .
- Lack of insufficiently trained manpower in seed production and certification
- Most farmers lack knowledge of improved seed storage technologies.
- Poor seed market information
- Lack of efficient varietal release protocols
- Absence of Biosafety Regulatory systems.

Challenges

Key challenges posed by these constraints were identified as follows:

- Enactment /enforcement of Seed Laws and Biosafety regulations
- Raising awareness of farmers of the benefits of improved cowpea seeds
- Increasing extension services activities in the distribution of improved cowpea seeds
- Improving the training of seed persons
- Strengthening NARS breeders in the production of nuclear seeds.
- Disseminating seed storage techniques information amongst farmers
- Linking farmers to seed marketers
- Developing efficient seed release protocols

Programme approaches to address the constraints

Objectives of the programme

In order to address these constraints and the challenges that they pose, a programme consisting of 8 main activities is proposed. The objectives of this programme are to

1 Facilitate the enactment/and or implementation of Seed Laws and Biosafety Regulations and
2 Strengthen the formal and informal seed distribution and marketing systems.

Activities

Activity 1 : Survey of existing seed laws and biosatefy regulations in selected cowpea producing countries

- Partners : AATF,ABSPII,WASNET
- Milestones : Comprehensive auditing of seed laws and biosafety regulations by February 2005
- Geographic area: Nigeria, Niger, Burkina Faso, Senegal, Mozambique, Cameroon

Activity 2 : Regional workshop to create awareness amongst policy makers/private sector on biosafety

- Partners: AATF, ABSPII
- Milestones: By February 2005, 25 persons will have been sensitized on biosafety
- Geographic area: Ghana, Nigeria, Niger, Burkina Faso, Senegal, Mozambique, Cameroon.

Activity 3: Training of extension staff and Private Industry in seed production and certification

- Partners: AATF, NSS, NES, Seed Co
- Milestones: By December 2006, 25 persons will have been trained in seed production and certification in each country.
- Geographic area: Ghana, Nigeria, Niger, Burkina Faso, Senegal, Mozambique, Cameroon.

Activity 4: Identify micro-credit schemes and link them with seed producers

- Partners: Micro-credit schemes , small holder farmers
- Milestones: By December 2005, at least 2 credit schemes identified and linked to 5 farmer groups in each country
- Geographic area: Ghana, Nigeria, Niger, Burkina Faso, Senegal, Mozambique, Cameroon

Activity 5: On-farm demonstration of promising cowpea

- Partners: NARS, NES, NGOs, Farmer Groups
- Milestones: By December 2005, at least 100 on-farm demonstrations of 2 cowpea varieties mounted.
- Geographic area: Ghana, Nigeria, Niger, Burkina Faso, Senegal, Mozambique, Cameroon

Activity 6: Mass awareness campaign for importance of high quality seed/improved varieties through farmer field days and mass media.

- Partners: Mass media, NGOs, NSS, NES, Seed Co.
- Milestones: By December 2005, at least I mass field day held and 2 radio and TV programmes aired in each country.
- Geographic area: Ghana, Nigeria, Niger, Burkina Faso, Senegal, Mozambique, Cameroon

Activity 7: Catalyzing production of Breeder and Foundation seed

- Partners: IITA, CRSP, NSS
- Milestones: By December 2004, one ton of Breeder seed of up to 4 varieties and by December 2005, 20 ton of Foundation seed produced in each country.
- Geographic area: Ghana, Nigeria, Niger, Burkina Faso, Senegal.

Activity 8. Provision of small-scale seed processing equipment.

- Partners: AATF
- Milestones: By December 2005, at least I thresher and 1 seed cleaning equipment acquired.
- Geographic area: Ghana, Nigeria, Niger, Burkina Faso, Senegal, Mozambique, Cameroon.

Time frame for program implementation

Activity	Short term	Medium term	Long term
1	xxx		
2	xxx	x	
3	xxx	xx	X
4	xxx	xxx	xxx
5	xxx	xxx	xxx
6	xxx	xxx	xxx
7	xxx	xxx	xxx
8	xxx	x	

General Discussion

Participant: What is the product focus for this programme?

TF: The product focus is both improved and Bt cowpea seeds. In order to initiate this programme and move forward, it is necessary to use material that is already

available through conventional breeding while awaiting the development of other materials such as Bt cowpea.

We like to stress that improved cowpea varieties are produced but farmers re not very much informed about the availability of these varieties. The progrmme proposed will ensure access to improved cowpea seeds across sub-Saharan Africa, production of seeds of improved cowpea varieties will be sustained through involving Farmer-Based Organizations(FBOs) in seed production, creation of markets for seeds and promoting seed enterprises for profitability. Participatory research for Breeder and Foundation seeds involving NGOs and Farmer Groups is encouraging and could be promoted.

Participant: Mozambique features prominently in the geographical areas, what is the basis for selection of this country? Is it because of its trade interests in cowpea? Note that Tanzania has a larger cowpea growing area and seed system , it would be useful to include Tanzania in the selected countries.

TF: Mozambique expressed considerable interest in developing a cowpea programme although there is no cowpea breeding programme at present. The task force notes this comment and would re-organize the priorities and geographical focus of activities. Farmer education and Biodiversity conservation will be emphasized.

Sub-project proposal – Seeds Sector Task Force

Goal

To Ensure Delivery of Improved High Quality Cowpea Seeds to Small-Scale Farmers In Africa

Overview

In collaboration with NARs, international centers such as IITA and other partners such as CRSP, have developed high yielding cowpea varieties with resistance/ tolerance to some of the major constraints of production as well as with acceptability by farmers in sub-Saharan Africa. Recent developments in cowpea transformation research suggests that very soon varieties resistant to the recalcitrant pest, legume pod borer will be developed. However, the already developed varieties and those to be developed are and will continue to be grown by only a handful of farmers who live close to research centers. This is mainly because of poor access by the majority farmers to the seeds of these improved varieties and or unavailability of the seeds. Inefficient seed supply and marketing outfits with their attendant poor quality control regulation have made seed business especially cowpea, unattractive for heavy investment for now. The seed supply sector where it exists, is often based on non-sustainable structures evolving outside the real needs of the critical stakeholders-farmers. This is why several, passed, efforts aimed at solving the seed problem have been rendered ineffective in the various countries on the continent. Formal seed marketing structures such as big seed companies, government-owned Farmer supply companies, seed multiplying and distributing NGOs etc, do exist in some countries in Africa. However, these structures have not been able to address the seed constraint in most part of Africa. In Nigeria for example, formal seed companies provide less than 30% of cowpea seed required by farmers. These companies multiply seeds of one or two varieties popular in the immediate vicinity where the seed company is located.

Only few well-to-do farmers patronize such products because the majority resource poor farmers complain that these companies charge them unreasonably high price for the seed.

Objective of the sub-project

•Facilitate enactment and/or implementation of Seed Laws and Biosafety Regulations

•Strengthening of the formal and informal seed dissemination and marketing systems

Deliverables

Efficient system for delivery of improved high quality seeds to farmers in Africa

Activities leading to deliverables

Activity 1: Survey of existing seed laws and systems as well as bio-safety regulations for countries of the region.

Partners: WASNET, INSAH

Derivable benefits: Requisite information needed for development of a sustainable seed sector

Milestones: By Dec. 2004 a comprehensive aduit of existing seed laws and bio-safety regulations will have been compiled and countries where such laws are needed will have been identified and recommendations made to address deficiencies.

Budget: $55,000

Activity 2: Sensitization workshop for policy makers, seed service officials and private sector.

Partners: NSS, NGOs, Seed Companies

Derivable benefits: The importance of Bt cowpea and other issues understood fully by stakeholder

Milestones: By 2006 at least 25 officials of NSS, NGOs and Seed companies sensitized on Bt cowpea and Biosafety and resistance management

Budget: $35,000

Activity 3: Training of staff in the enforcement of seed laws, Certified Seed Production, and in understanding bio-safety regulations and the need to observe them.

Partners: NGOs, Private Seed Companies, Informal Seed Sector, Extension Services.

Derivable benefits: Enhance quality control of seed delivery system.

Milestones: By Feb. 2006 at least 25 staff of the seed certification agency, NGOs, Private Seed Companies, and member of the Informal Seed Sector will have been trained.

Budget: $35,000.

Activity 4: Identification of Micro credit schemes and input marketers then link with seed producers

Partners: NGOS, Finance Institutions, Seed Growers

Derivable benefits: Seed Growers have access to credit and input supply

Milestones: By Feb. 2005 at least 2 credit schemes and 4 input marketers identified and linked with seed growers

Budget:$8000

Activity 5: On-farm demonstration of promising cowpea varieties

Partners: IITA, Farmers, NGOS, ADPs

Derivable benefits: Farmers will know about the potential benefits of improved varieties

Milestones: By Feb 2004 at leat 100 on-farm demonstrations of two varieties mounted

Budget: $55000

Activity 6: Mass awareness creation on the availability, value and benefits of high quality seeds of improved varieties through Field days, Seed fair, Television and Radio Broadcast

Partners: National Extension Service, Farmers, Mass Media, NGOs

Derivable benefits: Importance of high quality seed and benefits of Bt cowpea appreciated

Milestones: By 2005 at least one mass farmers' field day, and 2 each radio and television broadcast on the importance and benefits of high quality seeds and biosafety issues concerning Bt cowpea conducted

Budget:$12000

Activity 7: **Catalyzing of the production of Breeder and foundation seeds of released varieties by NARs**

Partners: IITA, State Seed Service

Derivable benefits: The basis for certified production

Milestones: By Feb. 2005 up to 1 ton of breeders of 3-4 varieties produced
By Feb. 2006 up to 20 tons of foundation seeds of up to 4 varieties produced

Budget: Breeder seed $60,000: Foundation seed $ 110,000 :Total =$170,000

Activity 8: Provision of small-scale seed handling and processing equipment

Partners: AATF

Derivable benefit: Processing of Breeder and foundation seed will be enhanced

Milestones: By Feb. 2005 at least one thresher and one seed cleaner purchased

Budget: $90,000

Source of Funds: AATF

Geographic Strategy

The seed sector sub-project will be concentrated first within the Nigerian Grain Shade-Nigeria, Niger, Mali and Burkina Faso and then the Senegalese Grain Shade-Senegal and Lastly the Eastern African Grain Shade

3 Field Constraints Task Force

Members of the Task Force

Eugenia Barros – *Chair*
Jeremy Ouedrago – *Co-Chair*
Larry Beach - *Rapporteur*
T.J. Higgins
Phil Roberts
George Bruening
Ivan Ingelbrecht
Mike Timko

Summary of recommendations

- Use the existing inbred lines to develop markers linked to traits for which they have been selected, using conventional marker development technology.
- Use the technology based on the existing library that was constructed in a laboratory in the USA to develop a genome DNA marker set(breeders with molecular biology background could be trained to do this work by working in the laboratory where the work will be done)
- Transform cowpea with Bt gene that will be obtained from Monsanto
- Introgression of Bt gene from the transformed lines of cowpea breeding varieties of choice using MAS
- Capacity building in the use of MAS in breeding programmes throughout cowpea growing areas and capacity building to do transformation of cowpea in one of the National Centers.

Overview of the problem by Larry Murdock

- Big losses of cowpea grain occur in the field

1. Insects are the major cause of losses. Spraying cowpeas with a soft insecticide can boost yields markedly, sometimes many-fold.
2. Parasitic plants also cover substantial losses. *Striga gesneroides* and *Electra*
3. Viruses and bacterial and fungal diseases take their toll as well.
4. As regards insects, one might think insecticides are the answer, but there are many problems with them. They are expensive, sprayers are required, few of them have been approved for use in food crops like cowpea, and they often are simply not available to farmers in many areas.
    - Plant breeding has helped to ameliorate the cowpea pest problem, but some insect problems like *Maruca*, thrips and pod-sucking bugs have been recalcitrant to traditional breeding – good resistance genes are scarce or lacking, especially for these insects.
    - With the advent of biotechnology, we now have new cellular and molecular tools to use in plant improvement, tools which will help

breeders address those constraints not easily amenable to conventional breeding approaches.

- Marker-assisted selection (MAS) – the discovery and use of molecular tags linked to specific valuable traits, offers a promising tool. We believe the MAS can help improve cowpea in ways that were impossible or at least very difficult in the past.
  For example: It should be possible to identify markers linked to resistance genes to *Striga* and to use these markers in a cowpea breeding program to pyramid into cowpea – or simply to introduce a single gene much more easily, avoiding slow and cumbersome bioassays.
- Genetic transformation to introduce novel sources of resistance into cowpea.

For ***Maruca***, we are confident that Bt genes will confer a high degree of resistance and can prevent the major losses this pest causes in cowpea growing areas of Africa.
The field constraints TF - - led by Eugenia Barros will:

1. Review and prioritize targets for the application of biotech tools.
2. Inventory work of this kind currently underway.
3. Identify plans for specific activities in the area of MAS.
4. Determine what needs to be done now to get a practical and useful transformation system in hand.
5. Anticipate needs down the road in terms of steps that can be taken to prepare the way for the adoption of Bt cowpea or any other GMO cowpea.
   - Food safety
   - Environmental safety
   - Preservation of biodiversity

Task Force Report

Cowpea plants suffer from insect pests, form the plant parasitic weed, *Striga*, as well as from viruses, bacterial and fungal diseases and plant parasitic nematodes. After harvest, cowpea grain may be lost to cowpea weevils and other vermin. Collectively, these biotic pests severely constrain cowpea yields or otherwise reduce the availability of cowpea as food.
Major constraints to cowpea production

1. *Maruca vitrata*
2. Weevil (bruchids)
3. *Parasitic weeds *Striga / Alectra*
3. *Pod sucking bugs
3. *Thrips
4. Viruses
4. Bacterial blight
4. Fungal diseases: “brown blotch”
5. Drought / Heat tolerance
6. Efficient nutrient uptake (e.g., P)
6. Plant architecture
6. Dual purpose

Nematodes (cannot be prioritized due to the lack of data)

*Approximately equal importance

[#]Approximately equal importance
[]Approximately equal importance

Table 1. General technology to be applied

Conventional breeding	Marker Assisted Selection	Genetic Engineering
Field Constraints		
Pod sucking bugs	Pod sucking bugs	*Maruca*
Striga	Weevil*	Weevil
Nematode*	*Striga***	Viruses
Bacterial blight*	Aphids*	Efficient nutrient uptake (e.g., P)
Fungal diseases: "brown blotch"	Thrips	Drought / Heat tolerance
Drought / Heat tolerance	Drought* / Heat tolerance	
	Viruses	
Other Constraints		
Dual purpose	Dual purpose	
Plant architecture	Plant architecture	
Nutritional quality		

*Indicates recombinant inbred lines (RILs) available for development of DNA markers (for viruses RILs only available for Cowpea aphid borne mosaic virus, Cowpea mosaic virus, and Cowpea severe mosaic virus)
**Closely linked DNA markers have been developed

Challenges posed by constraints

Cowpea is a crop whose importance in the African context dwarfs the research attention it has received. For example, genetic transformation, though advanced to the point at which achievement is within view, has not actually been achieved. A genetic map of cowpea has been developed and a bacterial artificial chromosome (BAC) genomic library is available, but DNA markers of the most valued co-dominant PCR (polymerase chain reaction) type are very few, and no EST (expressed sequence tag, copy DNA) library has been prepared for cowpea. Conventional breeding of cowpea must be made more facile by advancing marker-assisted selection (MAS), particularly by providing access to, and the ability to discover, many more co-dominant PCR markers.

For those traits not available in domesticated cowpea, e.g., the all-important resistance against the Maruca bug, it appears that only transgene approaches are viable. Because genetic transformation of cowpea is only now being achieved, transgenic approaches inevitably will extend beyond the 1-3 year period of phase 1 and into phase 2. In contrast, some aspects of MAS can be advanced by PCR marker deliverables that can be available within one year. When cowpea transformation becomes an available technology, MAS remains the method of choice for cowpea improvement for genes already available in some form in the cowpea pool, and, MAS will be essential for the deployment of Maruca resistance and other new transgenic traits in elite cowpea cultivars.

Thus, genetic improvement of cowpea requires an integrated program that will simultaneously advance transgene introduction and MAS. Specifically, we propose the

goal of facilitating MAS and transgene technology by developing valuable DNA markers, transforming cowpea to resistance against Maruca and for other traits, and applying MAS to the creation of elite cultivars bearing valued conventional genes and transgenes.

Marker Assisted Selection (MAS)

- MAS is poised to have an immediate impact on production and delivery of improved cultivars to the growers increasing food security and productivity.
    - Within 1-3 years markers for many major constraints can be made available (Horizon 1).
    - Within 3-5 years use of MAS can be integrated into breeding activities across Cowpea breeding areas in Africa (Horizon 2).
- To establish effective MAS one requires improved marker development techniques as well as capacity building in both marker development and its application in breeding programs.
- As a general principle, it must be recognized that MAS will not be applicable in the absence of an unequivocal assay for the desired trait. The least developed assays are for pod sucking bugs and viruses.
- There is a need to establish an easily accessible database of advanced breeding populations that have been scored for various traits. These would be used for: 1) MAS testing and verification and 2) Marker development.

1) MAS testing and verification - Horizon 1

Markers for Striga are the most developed.

- Markers exist for races 1 & 3, need testing / verification, in 9 to 12 months should have verification. ($20K)
- Markers are under development for race 2 & 4; this should be done in 12-18 months. ($75K)
- Markers for race 5 exist but not the testable assay, expect these in 6-9 months. . ($25K)

2) Marker development – Horizon 2

- Populations (RILs) segregating for many important traits already exist (*Striga*, root knot nematode, bacterial blight, weevil, CABMV, aphids, drought). Parents have been characterized, but the progeny lines have not all been scored.
- Development of markers using populations is estimated $70K.
- PCR-based co-dominant markers do not exist for most for most traits. A global set of >250 markers (one marker per <2 Mbp of DNA; average of <5cM from any gene) is needed. The set can be rapidly screened to discover markers that are useful in cowpea breeding and that can be exploited to generate closer markers (Appendix A presents details). Annotation of R-gene data needs to be done on the existing BACs libraries. A one year program is proposed.
    - Obtain sequences of single ends from >5000 members of the existing bacterial artificial chromosome (BAC) library [single nucleotide polymorphisms (SNPs) are too rare in cowpea protein-encoding sequences to expect to generate markers from cDNA libraries] (US$40K)
    - Primers for sequencing genomic DNA (discovery of sequences suitable for cleaved amplified polymorphism sequences (CAPS) and for other

sequencing and CAPS primers to be distributed to AATF community members, including breeders (US$70K)
    - PCR sequencing of genomic DNA from 2-3 parental types, 15,000 sequences (US$75K)
    - Robot time, bioinformatics and supplies (US$45K)
    - Technical assistance (US$55K)
    - Indirect costs (possibly partially or wholly avoided) (US$138K)
- Researchers at two sites in Africa to apply CAPS markers to two specific cowpea breeding goals of interest; travel to CAPS generating laboratory for training if necessary, per diem (US$90K) (see Appendix A)
- Some breeders are already trained in the use of MAS in some African countries, for example, Burkina Faso -Jeremy Ouedraogo, Ghana-Francis Padi, Cameroon-Ousmane Boukar. Other breeders need to be identified in other regions/countries.
- In some of these countries the physical capacity can be easily strengthened to use for MAS, but in many countries there is a need to develop capacity.

Genetic Engineering

- Transformation will be done in specific varieties that will then need to be backcrossed.
- IP and Biosafety audits need to be done for each transgenic event which is expected to be released as a product.
- *Maruca* resistant cowpea (Bt)
    - Obtain Bt gene from Monsanto (soybean optimized sequence)
    - Construct expression cassettes and vectors (flower preferred promoter, 6 m, $10K.)
    - Transform large number of explants (2-3 y, $400K)
    - Field testing and backcrossing (2-3 y, $150K/country)
    - Seed increase for biosafety (done in parallel with field testing, $10K/country)
    - Environmental affects / gene flow (done in parallel with field testing, $300K/country?)
    - Biosafety testing (done in parallel with field testing, $300K/country?)
    - Integrated pest management studies (done in parallel with field testing, $300K/country?)
    - Agronomic testing of transgenics, including efficacy of trait (2-3 y, $75K/country)
    - Variety registration (1-3 y, $5K/country)
    - Seed increase and distribution (done in parallel with registration, $20K/country)
    - Farmer participatory education (done in parallel with release,)
    - 7.5-12.5 y, $1,570,000 (approx. $1,160,000/country after initial events selected)
- The best long term approach to developing a *Maruca* resistant cowpea is one that incorporates two different genes that are effective against *Maruca*. Thus, another gene needs to be identified and incorporated in addition to the *Cry*1A(b) gene. This will reduce the likelihood of development of resistance.

Estimated cost of approaches and potential funding sources

Development of *Striga* Markers - $120K
Development of markers using RILs and verification - $350K
Global markers - $423K
Capacity building - $400K
Transformation - $1,570K

General Discussion

Participant: The geographic focus of the FT activities is not clear, what would this be?
TF: The geographic focus covers all areas in which *Maruca* affects cowpea.
Participant: The budget needs more detailed elaboration. There is also need to re-structure the task force report to conform with the pattern in other TF reports.

Sub-project Proposal – Field Constraints
Activity : Improved Varieties

Title – Enhancing livelihoods in Sub-Saharan Africa through integrated use of emerging cowpea technologies

Introduction

Cowpea plants suffer from insect pests, from the plant parasitic weed *Striga*, as well as from viruses, bacterial and fungal diseases and plant parasitic nematodes. After harvest, cowpea grain often is lost to cowpea weevils and other vermin. Collectively, these biotic pests and diseases, together with abiotic stresses like drought, severely constrain cowpea yields and reduce the availability of cowpea as food. To address these constraints potential biotechnological interventions are proposed and prioritised.
For those traits not available in domesticated cowpea, e.g., cowpea resistant to *Maruca*, the transgenic route is the only viable approach to obtain the desired trait. A cowpea transformation system is being developed for the introduction of *Bt* genes: this will result in the production of a cowpea variety that is resistant to *Maruca*. For those traits whose genes are already available within the cowpea germplasm pool marker-assisted selection (MAS) is the method of choice. DNA markers will be developed for specific traits using 2 different approaches – the inbred line approach and the genome-wide approach. MAS will be used to fast track backcross selection in both conventional and transgenic breeding.

Objectives/Goals

To produce superior-performing cowpea varieties that will be resistant to *Striga,* cowpea weevil, aphids, root knot nematodes, bacterial blight, cowpea aphid borne mosaic virus, *Maruca* and drought. These varieties will be made available to all cowpea breeders and subsistence farmers. Capacity building for marker-assisted selection will be developed in different regional centres. The capacity to genetically engineer cowpea will be developed at IITA and The University of Zimbabwe in the first instance. Selected aspects of genetic engineering will gradually be introduced to National centres to assist with its breeding programs.

Development of DNA markers linked to specific traits using inbred lines

Recombinant inbred lines are available for the following traits: resistance to the cowpea weevil, aphids, nematodes as well as drought tolerance. These recombinant inbred lines are excellent material for marker development. Markers closely linked to the above traits will be developed using either the AFLP technology or the cDNA-AFLP technology, depending on the trait. Using AFLPs a large number of loci is produced from a single assay with no requirement for prior sequence data. Using cDNA-AFLPs a large number of differentially expressed transcripts (ESTs) is produced. The markers will be converted to SCARs, or other forms that are easily applied in MAS. This work will be done in South Africa at CSIR using the above technology. This work could be shared with other laboratories that offer a similar marker development technology using inbred lines.

Striga markers have been developed for races 1 and 3 and need to be verified in segregating populations. Markers are being developed for races 2 and 4, for race 5 markers are available but the testable assay is under development. This work will be done in the USA at University of Virginia using the existing technology.

Development of a genome-wide DNA marker set.

A set of 600 co-dominant DNA markers and rapid screening techniques will allow breeders to obtain markers that are on the average within 3 cM of their locus of interest.

*1.*Obtain >600 DNA markers**.**

12,500 BAC single-end sequence reads and PCR sequencing of parental lines is expected to reveal >600 co-dominant markers of the simple sequence repeat (SSR) and cleavable amplified polymorphic sequence (CAPS) types.

2. Place 600 DNA markers on the cowpea map

Map the 600 markers on an existing cowpea map using available recombinant inbred lines. Select a 60-marker uniformly distributed "signpost" subset. Distribute subset and the remaining >540 primer pairs to the cowpea research community.

3. Select markers most closely associated with loci of interest to breeders

Using DNA bulks segregated for their traits of interest, African cowpea breeders identify the most closely associated signpost markers. These results direct analysis of a few map-selected markers out of the >540 primer pairs and identification of those markers in the entire >600 set that are most suited to MAS of the trait of interest.

Genetic engineering of cowpea with *Bt*

Selected cowpea varieties will be transformed with *Bt* gene using *Agrobacterium tumefaciens.* This work will be done in Australia at CSIRO. Current research is focused on the development of an efficient genetic engineering (transformation) system using model genes and different selectable marker genes. The next phase is to obtain and re-construct two *Bt* genes with different mechanisms of action so that they will be expressed in flowers and young developing pods of cowpea.

IP

In order to address legal and regulatory issues a preliminary intellectual property list has been assembled and it needs to be formulated fully in order to secure the freedom to operate (FTO). The AATF Legal Counsel in collaboration with an outsourced law-firm will carry this out. The external law firm will perform an extensive search and determine what needs to be negotiated and what will already be in the public domain. Furthermore it will determine the constraints under which the African countries can access the IP and offer advice on how to proceed. Additionally, this IP list needs to be subjected to a biosafety audit in order to look at issues such as: conditions for contained use; field trials; commercial approvals, food and feed safety; environmental impact; socio-economic impact and molecular characterization of the transgenic materials thereof. A Biosafety Plan will be developed and implemented.

Introgression of genes using MAS

The *Bt* gene that will be initially introduced into transformable cowpea line will be introduced into the other cowpea varieties and local cultivars by backcrossing and by making use of MAS. This work will be done in the identified regional centres where capacity is available and where the resistance to *Maruca* is required.

Capacity building

1-Use of MAS in breeding

- Provide cowpea breeders with molecular markers linked to traits of interest.
- Provide several West Africa cowpea breeders with training on the use of markers in MAS.
- Where needed, provide several cowpea-breeding facilities with equipment for MAS: PCR thermocycler, capabilities for rapid cowpea DNA purification, gel electrophoresis apparatus, gel documentation instrument.
- Train breeders to apply bulk-segregant analysis using the subset of 60 primer pairs to identify markers most closely associated with their loci of interest (crude mapping).

2-Use of transformation techniques

2.1. Transformation system will be transferred to the IITA lab at Ibatan and the Biochemistry Department at the University of Zimbabwe where additional genes will be introduced to cowpea germplasm.

2.2. Selected aspects of the genetic engineering protocols such as analysis of the transgenic plants that are needed for back crossing programs will be transferred to additional African labs on an as needed basis. This will overlap with, and complement the capacity building in MAS breeding.

3-IPR

- Collaborating partners will be trained in IPR during the course of the year, preferably as a satellite meeting during a workshop
- Biosafety regulatory framework will be enhanced through collaboration with existing initiatives in the region (Program in Biosafety Systems, PBS).

Deliverables

Improved cowpea varieties resistant to *Striga,* cowpea weevil, aphids, root knot nematodes, bacterial blight, cowpea aphid borne mosaic virus, *Maruca* as well as drought. Molecular markers linked to the above traits that will enable the efficient selection of newly bred cowpea plants that were produced from the donor varieties by

backcross breeding. These markers will enable gene pyramiding of more than one trait in one variety.
Trained breeders in MAS, including the deployment of transgenic varieties, with the ability to convert their local varieties into improved varieties by backcross breeding.

Milestones and time-frame

Short term – Horizon 1 – 1 to 3 years
1-Development of DNA markers linked to specific traits using inbred lines
Milestone 1 – *Striga* markers.
Striga markers for races 1 and 3 → 9 to 12 months
Striga markers for races 2 and 4 → 12 to 18 months
Striga markers for race 5 → 6 to 9 months
Milestone 2 – Markers (single trait) linked to specific traits using the cDNA-AFLP technology.
Markers (single trait) linked to weevil, to aphids, to root knot nematode, to bacterial blight, to cowpea aphid borne mosaic virus and to drought → 12 to 18 months.
Milestone 3 – Training of breeders to implement MAS in their breeding programmes at Regional and National Centres or even in other African labs like CERASS (Senegal) and CSIR (South Africa) → 24 to 36 months
2-Development of genome-wide DNA marker set
Milestone 1 – A set of 250-300 CAPS markers distributed across the cowpea genome that could be potentially used in MAS, using the CAPS technology → 12 months
Milestone 2 – Linkage of the above set markers to specific traits using the inbred lines available for resistance to weevil, aphids, root knot nematode, bacterial blight, CABMV and drought → 12 to 24 months.
3-Genetic engineering of cowpea with *Bt*
Milestone 1 – Obtain *Bt* gene from Monsanto or other providers and construction of expression cassettes and vectors → 6 months.
Milestone 2 – Transformation of *Bt* genes into a large number of cowpea explants from specific transformable varieties → 24 to 36 months.
4- Introgression of genes using MAS
Milestone 1 – Backcrossing of *Bt* transformed cowpea varieties into local varieties using MAS → 30 to 36 months.
Medium term – Horizon 2 – 3 to 6 years
Milestone 1 – Environmental effects/gene flow studies while field-testing *Bt* cowpea varieties, done in different countries in parallel → 3 to 4 years.

Budget

Activity	Amount in US$ required	Comments
Development of *Striga* Markers	**120, 000**	
Global markers	**635,000**	For development of >600 DNA markers and providing marker sets

		to African cowpea breeders in a 2 yr effort
Capacity building	**400,000**	
Development of markers	**350, 000** (@$50,000/ marker)	The markers to be developed are those inked to weevil, aphids, root knot nematode, bacterial blight, CABMV and drought using RILs (recombinant inbred lines) and verification of the markers
Transformation	**1,570, 000**	
IPR	**139**	
Total	**3,075,390**	

Annex to Field Constraints TF Report

Proposal for development of a global set of cowpea CAPS DNA markers for marker assisted breeding (MAS)

A global set of co-dominant DNA markers, covering the cowpea genome, is needed to accelerate the application of MAS to numerous cowpea breeding efforts, including gene pyramiding and selection for single and multiple recessive genes. CAPS (cleaved amplified polymorphic sequences) are PCR (polymerase chain reaction)-based DNA markers that are co-dominant. A codominant marker is more reliable than a dominant DNA marker (which is interpreted as PCR product versus no PCR product), because absence of the PCR product may result from a PCR failure as well as from absence of the marker in the DNA template.

CAPS reactions are easy to perform, requiring only the materials and instruments (PCR, electrophoresis, restriction enzymes) that are typical of other DNA marker assays. The target sequence is amplified by PCR from genomic DNA, and the PCR product is incubated with a restriction enzyme targeted to the polymorphic sequence. After gel electrophoresis of the incubated PCR product, the pattern for each DNA template is scored as representing cleaved or un-cleaved product.

We propose an AATF-approved near term (1-3 years) project in which a set of 250 or more CAPS DNA markers (PCR primer pairs) would be prepared, corresponding to one CAPS marker per 2Mbp or less of cowpea DNA on the average and one CAPS marker per 10 cM on the average. The primers be made available to the cowpea research community. The CAPS markers would <u>not</u> be selected for their close association with any particular gene but would be a community resource of randomly distributed markers available for screening DNA from any polymorphic cowpea population. The source for discovering the CAPS markers will be a cowpea BAC (bacterial artificial chromosome) genomic library. (Note: a cowpea cDNA library will not have a sufficient frequency of polymorphisms).

Approach to preparation of CAPS markers. If a BAC library were to be the source of the CAPS markers, 4000 or more BAC single end sequences of 600 or more bp would be determined. Four thousand BAC end sequences are expected to yield 250 CAPS, based on the frequency of single polynucleotide polymorphisms (SNPs) in cowpea. The determined sequences would direct the synthesis of 4000 primer pairs. These primer pairs would be tested with genomic template DNA from 2-4 cowpea parental lines in a search for polymorphisms suitable for cleavage by a restriction endonuclease, seeking >250 restriction polymorphisms.

The preparation of 250 CAPS markers (500 primers) would require robot use, sequencing of BAC ends and PCR products, bioinformatics management and analysis of sequences, synthesis of 9000-10,000 primers (including high scale synthesis for CAPS primers to be distributed), PCR reagents, restriction endonucleases, various supplies, and technical assistance. The deliverables at this stage in the project will be annotated cowpea genomic sequences filed to public databases (e.g., NCBI) and CAPS primer pairs distributed into three 96-well plates and made available to interested AATF members at no charge for the first set. Additional CAPS primer sets to AATF members and sets to other qualified investigators would be made available at the cost of synthesis, plating, handling and shipping of the primers.

With contingencies for failed sequences and re-synthesis of some primers, and at the proposed scale of 250-300 CAPS, the cost for preparing the set of primer pairs is estimated to be about US$250,000 to US$300,000 exclusive of indirect costs, or about $1000 per CAPS marker. This is significantly less than the typical cost of discovering RAPD, AFLP and other markers and converting them to co-dominant, single-product-priming markers (>US$40,000). The project period should be 1 year, but the CAPS primers would be available within 6-9 months of initiating the project.

CAPS marker demonstration project. To encourage greater application of MAS and the value of the CAPS markers in cowpea breeding, one or more actual cowpea breeding problems are to be selected and addressed. It is preferable that this part of the project be carried out in Africa, with a training component or other capacity building component. We present here an example of a search design capable of identifying CAPS markers located as close as 1cM from a particular trait. DNA would be prepared from 96 F2 cowpea progeny that had been scored unequivocally for the trait in question. The F2 DNAs would be pooled in 12 sets of 8 for "bulk segregant analysis." The 250 CAPS primer pairs would be used in 14 PCR reactions, using the 12 "bulks" and DNA from the two parents. Products are analyzed by gel electroporesis. Primer pairs that give rise to patterns most closely correlated with the pattern seen for the trait-positive parent, i.e. for the greatest proportion of bulks, would be tested on all 96 progeny DNA samples individually. From the results, the approximate distance of the marker from the trait-specifying gene would be calculated in cM. Where the scored F2 progeny already are available, identification of linked CAPS markers could be done at a cost of a few thousands of dollars per trait.

Other outcomes. The >4000 BAC end sequences and polymorphisms, that are to be identified and made publicly available as outcomes of the proposed project, are deliverables of value both generally in cowpea research and for the development of non-CAPS DNA markers. The value of the cowpea CAPS markers themselves would be increased substantially by their location on the existing cowpea genetic map and eventually by their assembly into a physical map. When prepared as suggested here, each CAPS marker already is mapped to a BAC. Genetic and physical mapping of the CAPS

markers could be an expanded and longer-term part of this proposed project. However, we believe the mapping should be a distributed and community effort. Recipients of the CAPS primer set should pledge to make results of utility in mapping available on the AATF web site as soon as possible after they become available.

4. Intellectual Property Task Force

Members of the Task Force
Ida Sithole-Niang – *Chair*
Eugene Terry
Ed Southern
Patricia Kameri-Mbote
Joe Huesing
Walter Alhassan

Summary of recommendations

AATF to secure IP position
- FTO
- Ownership

AATF to deal with liability
- AATF legal status
- Insurance

AATF to work on Biosafety plan
- Biosafety audit
- National capacity building

Agree on projectn management plan
- Networks and linkages

Overview of the Problem

- Project management
- IP belonging to others
- IP generated in the project
- Regulatory concerns
- Costs and timelines

- Context: Cowpea productivity and utilization project

Preamble

This Task force defined legal issues as covering all aspects of contractual, regulatory and IP issues related to proprietary technology and non-proprietary technology (chemical, mechanical, and biological) as they relate to the cowpea productivity and utilization project.

How and Who to Manage Particular Aspects of the Project?

The overall management of the project should be interpreted to mean: reporting, Monitoring and Dissemination of Information regarding progress in this project. Among the instruments to use will be:

1. Overall project coordinator and individual principal investigators for the specific aspects of the project.
2. This stakeholder meeting is a good start and should continue in that fashion with the AATF as a core coordinating instrument linking the activities of the wide range of stakeholders in a coherent way. The projects approved are pilot projects and the AATF works with well established networks and adds the value through coordination.
3. Website
4. Annual general stakeholder meeting and meeting of coordinators (as progress tracking mechanisms); [the Bean/ Cowpea Collaborative Research Support Program (B/C CRSP), the Network for the Genetic improvement of Cowpea for Africa (NGICA); the AATF; Consultative Group Centers (CG Centers); Sub-Regional Organizations (SROs); National Agricultural Research Centers (NARS); National Agricultural Research and Extension (NAREs); Kirkhouse Trust; IP holders; International Funding Agencies, Non-governmental organizations (NGOs) and other biotechnology support programmes); and articulation of stakeholders
5. Group mandated with the task of management of genetic manipulation, modification, and transfer.

Other Proprietary Technology relating to the project

a) Genes and constructs: α-amylase inhibitor gene; *galactinol synthase*; *Bacillus thuringiensis* toxin gene and vectors
b) Methods : agrobacterium-mediated and biolistics transformation
c) Marker assisted technologies including novel genes and methods of detection

- Liability, FTO, ownership, biosafety as described for Bt relate to (a) (b) and (c) above.

IP generated in the project

- The arrangements for ownership of IP developed in the project will recognize the rights of the Institute of the principal investigator.

- There will be an expectation that the institution will grant a royalty-free license to the AATF for exploitation of the technology in Africa.

Other IP Issues

- IP Awareness critical
- IP group recommends that there be IP training for project partners

Problem overview

1. Need to secure FTO for Bt cowpea
2. AATF needs to define its IP statement
3. Regulatory plan: Understand regulatory landscape and tailor the AATF to work towards that.
4. The AATF needs to participate in developing regulatory systems
5. To be determined depending on what is in existence in the countries of focus.

Major Constraints-Prioritized

1. Freedom to operate: formulate an IP plan in order to ensure that FTO is fully secured.
2. Ownership
3. Liability
4. Biosafety: formulate an insect resistance management plan
5. National regulatory capacity: human resources; infrastructure, absence of legislation etc.

Approaches to Addressing the Constraints, Potential Partners and Networking Arrangements

1. Freedom to operate: Formulate IP plan
2. Ownership: formulation of negotiation strategy
3. Liability: subject to liability regimes in different countries. Richard Boadi to look at Incorporation agreement for the AATF
4. Biosafety audit: see Audit by Muffy Koch; Conditions for Contained Use; Field Trials; Commercial Approvals; Food and Feed Safety; Environmental Impact; Socio-economic impact and molecular characterization; conclusion of the biosafety audit.
5. National regulatory capacity: Network connections with regional and sub-regional organizations (UNECA; NEPAD; ASARECA; CG Centers; and National institutions (NARS; NARES & Universities).

The AATF is promoting the creation of long-term networks to manage long-term deployment of technologies at all stages in the value chain.

Opportunities Available Now or in the Future to Address the Constraints

1. Freedom to operate: Process towards providing substantive response to select technology request(s) in progressing well.
2. Ownership: AATF legal status provides for ownership of IP (Richard Boadi). The way the AATF is structured provides an opportunity to broker collaboration across a wide range of stakeholders; including the private sector, for technology generation; AATF provides the mechanism for management of individual project IP portfolio.
3. Liability: AATF legal status offers substantial liability protection to collaborators (Richard Boadi); opportunity to contribute to ongoing liability framework/regulation development in partner countries.
4. Biosafety audit: This pilot project provides an opportunity to develop and test a realistic template of the biosafety regulatory framework in collaborating countries.
5. National regulatory capacity: This and other pilot projects will provide a realistic opportunity for regional and national capacity building in biosafety framework development and implementation.

Benefits Derivable from Alleviating the Constraints, categories of Beneficiaries, Namely Primary, Secondary and Tertiary

1. Freedom to operate: Those free to operate, this covers a wide range of users across the entire value chain; scientists in particular
2. Ownership: AATF, collaborating institutions; breeders
3. Liability: AATF by dint of its legal status; IP holders/donors; Sub-licensee? (Richard Boadi)
4. Biosafety audit: public; scientists, policymakers; AATF; all other stakeholders.
5. National regulatory capacity: public; AATF; policymakers; scientists; Regulatory Agencies; Resource poor farmers; and all other stakeholders.

Milestones and Time to Products

1. Freedom to operate for Bt cowpea
    a) Identification and audit of IP needs;
    b) Review of IP required; identification of IP holders (Joe Huesing 4-6 weeks)
    c) Formulate and finalize the IP plan (6-8 weeks)
    d) (i) Approach technology holders
       (ii) Agree on Heads of Terms
       (iii) Draft License agreements (6 -12 months)
    e) Sign agreement (4 weeks after draft agreement)
    f) Transfer/acquisition of technology

2. Ownership: N/A
3. Liability: N/A
4. Biosafety audit
    a) AATF to consult Muffy Koch/NGICA on results of the biosafety audit (4 weeks)

b) Consultation between AATF and appropriate bodies for identification of the biosafety requirements for this project (8 weeks)
c) Development of biosafety plan
d) Implementation of biosafety plan

To be discussed in plenary for those next steps

5. National Regulatory Capacity, here geographic focus will determine timeline

Estimate Cost of Approaches and Potential Funding Sources

Freedom to operate		
Activity	**Party**	**Cost**
1. IP audit	Law Firm	$9 400.00
2. IP Plan	AATF	
3. Negotiation strategy	AATF	$100 000.00
4. Draft agreement	AATF & Law Firm	
5. Negotiation and agreement	AATF & Law Firm	
6.Signing agreement	AATF	
7.Consultancy costs	consultants	$100 000.00
Sub-total for FTO		**$209 400.00**
Ownership		
1. Negotiation	Law Firm to Law Firm	$3 000.00 per case
2. Licensing	AATF	$3 000.00 per case
Sub-total for Ownership		**$ 6 000.00 per case**
Liability		
1. Insurance	AATF	$15 000.00 per year
Sub-total for Liability		**$15 000.00 per year**
Biosafety		
1. Biosafety audit (identification of biosafety requirements)	Consultant	$12 000.00
2.Consultation with appropriate regulatory bodies	AATF	$2 000.00
3. Development of Biosafety Plan		$12 000.00
4. Implementation of biosafety plan	AATF	????
• Acquisition and creation of containment facility	AATF	????
• Miscellaneous • Outreach	AATF	????
• Presentation and cost for staff	AATF	$20 000.00
Subtotal for Biosafety		**$46 000.00**
Capacity Building		
IP Training	AATF	$30 000.00
Sub-total		**$30 000.00**
Grand total		**$306 400.00**

McKnight Foundation IP Statement

Statement on Expectations Regarding Protection of Intellectual Property

Overview. This statement sets forth The McKnight Foundation's expectations regarding protection of intellectual property (IP) resulting from work it funds through the Collaborative Crop Research Program (CCRP). We expect each grantee and its partners to subscribe to this policy and to develop a management plan based on the implementation principles listed below. IP management plans will be reviewed by the Foundation, and release of year two funds will be contingent upon the Foundation's approval of the plan.

IP and How it is Protected. Intellectual Property is a term that collectively includes all the products of creativity, invention, and know-how (intellectual property) as well as biological materials and devices. Means of formally protecting such property that results in the creation of intellectual property rights (IPR) can include patents, trade secrets, and copyright. [1] Access to protected IP often involves the use of various agreements, such as IPR License or Royalty Agreements to control their distribution. IP assets such as cell lines, plant varieties, or monoclonal antibodies often are not protected formally and their dissemination can be controlled by material transfer agreements, signed by both the providing and receiving parties. [2]

In addition, biological materials are often subject to international and national legislation governing the ownership of biodiversity assets.

Values Underlying the Collaborative Crop Research Program. The Foundation's mission is "to improve the quality of life for present and future generations and to seek paths to a more humane and secure world." Values specific to the CCRP include:

- Encouraging and supporting the free flow of advanced scientific knowledge and research materials, primarily in the form of public goods.
- Empowering resource-poor people in less developed countries to make their own decisions regarding food security that are appropriate to their circumstances.
- Building and sustaining a strong public agricultural sector in developing countries.
- Valuing, conserving and utilizing genetic resources, while upholding national and international biodiversity regulations.

McKnight Policy on Protection of IP. The McKnight Foundation's Collaborative Crop Research Program seeks to contribute to the security of food production and human nutrition in the developing countries of Asia, Africa and Latin America through sustained support of research and training that is closely and strategically linked to issues of food crop production in those countries. The Foundation requires that knowledge and materials resulting from the research and training that it funds be used for the maximum public benefit of resource-poor people in less developed countries. Results of research supported by the Foundation should contribute, through a series of collaborative projects and transfers of technology, to the production of improved seed and other material and know-how used by farmers. Participants in the program must commit to facilitating the sharing and transfer of technology and research products for both research and commercial use benefiting resource-poor people in developing countries. McKnight Foundation Grantees should also use IP that belongs to others, in a responsible manner [3] that respects the rights of the IP owners.

Implementation of This Policy. Through implementation of this policy, we expect grantees to increase their capacity to understand the various approaches to, advantages of, and limitations surrounding legal protection of intellectual property in the context of their research, institution and country.

Each partnership shall propose a plan for management of intellectual property that best fits its situation and the policies of the partner institutions. In doing so, projects shall ensure that ownership of all intellectual property rights (IPR) arising directly or indirectly from the project is equitably allocated. Equitable allocation considers:

- the intellectual contribution of each partner in the collaboration to the ongoing project (foreground IP);
- the contribution of intellectual property, materials, research effort, and preparatory work of each partner brought to the project (background IP);
- the facilities provided by each partner;
- to a lesser degree, the financial contribution of each partner; and
- other considerations determined by the partners to be relevant.

Grantees should be guided by the following principles in developing their plan for protection of intellectual property:

Ownership. The McKnight Foundation does not hold or claim ownership rights over intellectual property or intellectual property rights resulting from research it funds. The Foundation instead requires that investigators and research institutions it supports protect their McKnight-funded IP only if protection is needed to ensure that this IP will be available for their own future research and for public-sector benefit. All IP arising from McKnight-funded projects should be clearly identified and inventoried to assure that ownership is clearly documented.

We require that valid and enforceable mechanisms be in place to ensure that inventions, improved germplasm, know-how, and materials developed with funding from the McKnight Foundation be protected from any limitations on their use to advance the causes of food security and the improvement of the lives of poor people around the world.

In some cases, the interest of food security and the improvement of the lives of the poor can best be advanced by placing the results of work supported by the Foundation rapidly in the public domain, such as through scientific publication. In such cases, appropriate publication effectively prevents others from patenting the same or similar inventions.

In other cases, the public interest will be advanced by applying for statutory protection, such as patents owned by or assigned to public institutions. In these cases, we require that mechanisms be adopted so that inventors will disclose, license, or assign ownership of their rights to their invention to their public-sector employer, or, where appropriate, to another institution whose mandate for a transfer of rights is to benefit resource-poor people in the developing countries. When rights are allocated in this way, employment agreements or other forms of commitment should be in place between the investigators and the research institutions, ensuring that any IP generated through work funded by the Foundation will be appropriately managed according to the IP Plan developed by the project partners.

All patents or other forms of claiming formal ownership of the results of McKnight-funded research shall be managed by the owner in a manner that ensures a reasonable time of royalty-free access for public (non-commercial) entities operating in developing countries, and/or shall give McKnight royalty-free license with the ability to sub-license for humanitarian purposes. The Foundation also requires that institutions be willing to license or assign rights to an appropriate international public agricultural research system ITP portfolio, should one be developed, to facilitate use of research results to help food insecure subsistence farmers in developing countries.

Use of Materials for Public Benefit. Within the context of existing institutional IP policies, project partners shall take all reasonable steps to:

- provide reasonable and ready access by public-sector beneficiaries to property, materials and processes;

- avoid unreasonable commercial exploitation of such material and processes for purposes that diminish growth of public-sector agriculture in developing countries; and
- avoid encumbering materials and processes in statutory protection such that they cannot be used

for public benefit.

Respect for Biodiversity Regulations. The exchange of genetic materials is governed by national and international legislation. Grantees must be informed about, and fully respect, all relevant regulations, laws and procedures (both national and international). Regulated genetic materials may include wild relatives of crops, land races, varieties, and breeding lines; other organisms; and derived genetic material such as DNA and DNA sequence information.

Publication. We strongly encourage public disclosure of results from McKnight-funded research through publications in the scientific literature, in print and/or electronic form. We prohibit maintaining such results as trade secrets. We encourage timely publication of research results, but recognize the prerogative of scientists to retain control of their data prior to publication.

Costs. The project budget shall make allowance for costs relating to registration and maintenance of intellectual property and to manage licensing of protected property. The Foundation will not make available additional funds for this purpose.

Partnership. In developing plans for protection of intellectual property, partnerships should bear in mind the collaborative nature of the McKnight program and their work and all partners are encouraged to take reasonable steps to meet the needs and comply with the regulations of all project partner institutions.

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[1] Statutory protection regulations will vary according to national legislation. Types of IP protection mechanisms may include utility patents, innovation patents, trademarks, copyrights, database rights, and trade secrets, as well as other types of protection mechanisms. [Return.]

[2] These materials sometimes are referred to as "tangible property or TP" to reflect their inherent tangible nature. [Return.]

[3] IP for which ownership has been established is often referred to as "Proprietary property or technology." [Return.]

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Annex to IP Task Force Report . Background document distributed and discussed by the IP Task Force

Biosafety review of the constructs to be used in the Cowpea insect tolerance project.

General

The project needs to subscribe to a high level of biosafety integrity and practice. Movement of genetically modified biological strains, tissue culture material and planting material may all require an advanced informed agreement (permit/letter) from the receiving country. In general, developed countries do not require this for research materials, but some developing countries do. Greenhouse trials, field trials, commercial releases and commodity imports mostly require permits.

Permit reviews, especially for new crops, may take many months; this needs to be worked into the project planning. For example, in South Africa, even with a fairly experienced review process, we allow 7 months and two sittings of the decision makers, for field trial approvals and permit issue. This gives enough time to address additional information needs without missing the planting date for the crop.

Genetic elements

Element	**Previous commercial approval**
Vector backbone (pPZP200)	Not found
CaMV 35s promoter	Approved
bar – phosphinothricin tolerance	Approved
ocs terminator	Approved for trials
*SCSV*1 promoter – subclover stunt virus1	Not found
*npt*II – neomycin antibiotic marker	Approved
*SCSV*3 terminator	Not found
PHA-L prom, bean phytohemagglutinin L gene promoter, seed specific expression	Not found
α-AI-1 – bean α–amylase inhibitor 1 gene	Not found
PHA-L term, bean phytohemagglutinin L gene terminator	Not found
*Vsp*2 prom – *Arabidopsis* vegetative storage protein promoter	Not found
*Cry*1A(b) CDS – from MON810 event	Approved
vic term – pea vicilin gene	Not found

Contained use

The biological activity of the amylase inhibitor gene was not specified, but needs to be assessed for possible negative impact on human health in the lab. It is also necessary to assess mobility of the genes, if accidentally released from the contained facility and possible negative environmental impact of accidentally released GM strains.

The biological activity and human and animal safety of the *cry*1A(b) gene are well understood. Possible negative environmental impact of accidental release of the gene will need to be assessed.

Monitoring for accidental release may be required.
This risk assessment, including accident clean up procedures, may need to be documented.

Field trials
Approval for the field trials will need information on

- sexually compatible wild relatives;
- pollination range and pollinator activity in the release area;
- confinement conditions to minimise pollen flow;
- mechanisms to prevent seed distribution;
- procedures for monitoring and destruction of volunteers;
- recommendations on land use following the trial, etc.

Commercial approval
The regulators will look closely at all elements that have not received previous regulatory approval (see table). The sort of questions that will be asked are:

- Might this element facilitate the development of new plant pathogens?
- Might this element enhance mobility of the gene in and between organisms?
- Might this element enhance instability in the gene or genome?

Full molecular characterisation will be needed for varieties that are commercialised, including:

- copy number,
- insert characterisation
- unintended fragments,
- insert position
- additional, non-functional DNA in the insert
- gene stability,
- expression levels in tissues and with time,
- biological activity of the new proteins
- any other requirements raised by these genes in this crop..

Food and feed safety data will need to be collected for all new, expressed proteins. These data will include

- toxicology studies,
- digestibility,
- allergenicity,
- nutritional changes, including endogenous anti-nutritional factors,
- unintended effects,
- processing changes
- any other concerns raised by these genes in this crop.

Many of these require comparison with statistical standards in the conventional crop. Are these baseline data available? Some whole food studies may be required.

Environmental impact of the GM crop will need to be assessed. This will include

- the stability of the gene in the field,
- the likelihood and consequence of gene flow (especially important for GM crops released in their centre of origin),
- ecotoxicity studies and impact on non-target organisms,
- impact on weediness,
- impact on invasiveness,
- impact on biodiversity (natural and agricultural) in the release area,
- impact on non-living components of the release environment, e.g. air, soil, water,
- any other concerns raised by these genes in this crop.

Socio-economic impact – if required/allowed by the national review process

- Comparison of the benefits of the new crop with respect to the needs of the target group, the current farming practices and other available technology.
- Accessibility of the technology to farmers i.e. technology delivery.
- Sustainability of the technology in the target areas.
- Changes in traditional practices.
- Impact on culture.
- Marketability of the new product, including impact on trade.
- Acceptance of the new product in the target communities (variety, flavour, taste, ethics, etc.).
- Input costs (affordability) and dependence on suppliers of planting material
- Reduced use of agrochemicals
- Any other concerns raised by these genes in this crop..

Conclusion

The project needs to consider biosafety requirements from the outset. Timely assessments, e.g. early allergenicity reviews, will prevent a waste of money and effort on technology that will not receive regulatory approval in the near future. Planning and anticipation will ensure a smooth flow of technology development, unhampered by regulatory delays.

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General Discussion

Participant: Is IP focused on conventional transformation or on MAS as well?
TF: Activities will include MAS
Participant: Would conventionally bred Cowpea require IP protection on the long run ?
TF: Yes the TF will rephrase the report to reflect this issue
Participant: To what extent will all the materials developed go into the public domain?
TF : The process will involve firstly, protection of the organization that developed the material as the owners of the technology, before considering other potential beneficiaries
Participant: What would be the pattern of funding and what would be the role of AATF ?
AATF: The approved AATF funding pattern will be adopted, in which AATF funds 75% of the project formulation costs and 25% of project implementation costs.
Participant: In IP projects, what are the merits of joint ownership against royalty free arrangements for the technologies generated
TF: Royalty-free option rather than joint ownership is preferred ; however it is important to understand the implications of joint ownership arrangements.

5. Storage and Utilization Task Force

Members of the Task Force

Larry Murdock – *Chair*
Esther Sakyi-Dawson – *Co-Chair*
Francis Padi - *Rapporteur*
Ousmane Boukar
Laurie Kitch

Summary of Recommendations

Storage

- Create storage IPM technologies appropriate for individual project sites
- Disseminate these IPM packages through training e.g Farmer Field Schools(FFS) model, training of trainers programmes with partners
- Use of public communications channels (radio, TV, pamphlets)
- Link to other project components- seed production, Field IPM, Marketing and Trade

Utilization

- Carry out a participatory needs and opportunities assessment at the outset of the project area(s)
- Fostering value-added products through promotion of cowpea traditional foods, e.g. weaning foods, cowpea flour,(village mills); especially targeting urban markets
- Creation of small-scale cowpea processing businesses which may evolve into larger businesses(e.g. company of women who manufacture, package and market cowpea based products locally and to urban markets)
- Facilitate where possible, linkages between producers and large scale business e.g Nestle
- Provision of training for associated packaging technologies(equipment and materials)
- Focus should be on women's groups particularly for utilization
- Assistance for access to larger markets
- Facilitate access to inputs
- Guidance is needed in deciding which cultivars to select for project activities
- Possible use of credit with education programmes for training purposes.

Presentation

Overview of the Problem

- Loss of grain/seed in storage to bruchids resulting in economic and nutritional losses.
- Inadequate availability of value-added cowpea products resulting in less opportunities for income generation and improved nutrition.

Major Constraints

Some key constraints seriously affect effective storage and utilization of cowpea, these include :

- Inadequate dissemination of storage and utilization technologies- inadequately structured systems/fora for technology transfer
- Inadequate resistance genes for cowpea bruchids
- Lack of information about the potential value of cowpea utilization technologies
- Input availability – Capital, Raw materials, Equipment
- Lack of markets for existing products – inadequate information about demand for cowpea products

Challenges and opportunities

These constraints pose interesting challenges and offer opportunities for minimizing them. The major challenges and opportunities are:

Challenges

- Inadequate resources- appropriate cultivars, equipment, capital, physical inputs, training, market information.
- Resistance to change in food habits
- Creating balanced awareness of future biotechnology products

Opportunities

- Existence of several storage IPM technologies
- Availability of food processing technologies- fortification of traditional foods; cowpea flour production technologies suitable for small-scale entrepreneurs.
- Experiences from existing Farmer Field Schools
- Development of cowpea varieties with traits suitable for specific food uses- e.g white eyed cowpea, sweet cowpea, green cowpea.
- Possibility of the development of transgenic cowpeas using the alpha-amylase gene.

Approaches

Project activities will be designed to provide

- training on storage technologies
- access to inputs
- access to appropriate equipment
- market information and markets
- training on value-addition technologies
- identification or development of cultivars with traits suitable for specific food uses
- Potential partners – to be identified to include
  NGOs, FAO, Universities, NARS, Bean-Cowpea CRSP,IITA, AATF, NGICA
- Networking through
  Webpage, Email, Newsletters and personal contacts

Benefits derivable from project implementation

1. High quality seed for farmers will lead to higher yields hence increased income and better nutrition.
2. Better access to markets
3. Access to more capital
4. Supply of better quality grains to traders therefore higher incomes
5. Consumers(rural and urban) will have better quality grains.
6. Increased product base of cowpea products can lead to more utilization and better nutrition.

Milestones

1. Achievement of the socio-economic assessments(needs assessment and participatory input from end users(3-6 months)
2. Assembly of appropriate packages of technologies(1 year)
3. Farmer Field Schools in storage IPM technologies(year 2 and 3)
4. Creation of core value-added business Plan (18 months)
5. Implementation of business Plan (2 to3 years)

Taskforce Report

Cowpea grain is severely afflicted by a stored grain pest, the cowpea weevil or cowpea bruchid

Harvested grain comes into the granaries on the farms in Africa with a very low level of infestation: one, two or a few seeds out of 1000 are infested in the form of an egg on the harvested cowpea pod or a larva in the seed.

But cowpea bruchid larvae develop rapidly and produce adults that immediately mate and produce 20-40 eggs. This rapid cycle of reproduction can cause serious losses within 2 or 3 months. Within a few months the store can be completely lost - - unless measures are taken to prevent the loss.

Plant breeding has had a measure of success in stemming the losses. There is a single known source of resistance - - discovered by IITA scientists about 30 years ago in a landrace of cowpea called TVu2027. Unfortunately this resistance is only moderate and it only slows the development of severe infestation - the resistance is said to "break down" with time.

New and better sources of bruchid resistance are needed. We have identified a gene that will do the job - the □-amylase inhibitor gene from common bean.

About 10 years ago, T.J. Higgins, Maarten Chrispiels, my colleagues, and I showed that if we put □AI gene into garden pea - - the gene transfer essentially renders the garden peas immune to cowpea weevil damage.

But this □-amylase inhibitor gene isn't in cowpea yet because we can't transform cowpea. Moving the □AI gene into cowpea - when we are able to do it - would be equivalent to moving a gene from one edible food legume to another edible food legume.

Our work with models at Purdue has shown that combining the AI gene with that of the TVu 2027 resistance would create a cowpea that one could store for a year easily. This would solve the storage problem. But essentially do we want to do this? What are the pros and cons?

In addition to biotechnology, CRSP projects in Senegal and Cameroon have devised a series of simple, low-cost technologies that stop cowpea weevil infestations.

I'll mention only three of them:

1. Storage of cowpea grain in sealed metal drums hermetic sealing – it works by O_2 exhaustion.

2. Storage of the grain in triple plastic bags.
3. Solar disinfestation - use of the sun's rays to heat the grain to 60° C or higher, which kills all stages of the cowpea weevils. If this grain is then subsequently stored such that it doesn't get re-infested, it can be kept indefinitely without further loss.

These technologies work, and they work extremely well when done properly. They are competitive with insecticides in effectiveness and in costs.

But there are barriers to their adoption.

1. The most important barrier is the availability of inputs. Many areas in sub Sahara Africa have no ready supply of good metal drums in this region, Senegal seems to be an exception. Good plastic bags are often not readily available in the countryside, and the same is true for the plastic materials used in the solar heaters.
2. People don't know about the technologies and so can't try them through some NGO's like WVI and projects like PRONAF/PEDUNE managed by IITA have actively been helping build awareness.

Assuming Cowpea Storage is a Priority Constraint

The Question our working group will be addressing:
Is there a project activity where a storage technology package could be disseminated and promoted to help producers (ex. indirectly consumers) have a supply of quality cowpea grain?

Producing and storing cowpeas is not enough; the grain needs to reach consumers so they can benefit from the high value nutrition.
Over the years CRSP, IITA, and other projects have explored to find ways to improve cowpea processing and utilization.

Village mills was one experiment - - to save the labor of women who have to process the grain.
Processed cowpea flour, if it can be purchased, saves a lot of labor.
Other cowpea-based processed foods – some of which can be produced with simple equipment, things like weaning foods, and pre-cooked cereals and cowpea rice, offer possible ways to bring benefits to cowpea consumers.
A question for discussion: Can we identify a package of cowpea processing that our project would promote to benefit women and consumers?

General Discussion

Participant: There seems to be public perception regarding consuming stored cowpea grain that is contaminated with pesticides; how do we deal with this matter?

TF: It is necessary to assure consumers that there is no negative impact on the use of storage chemicals on animals that consume food made from stored grain.

Participant: Successful grain storage technologies are available; how do we disseminate the information on these technologies for farmers to apply them?

TF: Information dissemination is an on-going process but the TF will promote this activity particularly using the IPM/FFS model. Storage technology information will also be disseminated through the AATF/NGICA project collaborating closely with NGOs and other relevant partners working directly with small holder farmers.

Participant: To increase income, it would be useful to develop a Cowpea storage and Marketing Business Plan, to promote Small Village Businesses starting with 4 villages and expanding to other villages.

TF : Partnerships with NGOs such as TechnoServe would be developed for implementation of these small village businesses.

Participant: Project costing seems to be weak in this report, would the TF regularize this for the project.

TF: More information would be obtained within 1 month to enable the TF prepare a full budget for the project.

Sub-project Concept Notes on Post-harvest Constraints

1. Background

As agreed at the July 10-11, 2003 Constraints to Cowpea Production and Utilization in Sub-Saharan Africa meeting in Nairobi, a partnership between the African Agricultural Technology Foundation (AATF) and Network for the Genetic Improvement of Cowpea for Africa (NGICA) will spearhead the promotion of appropriate technology interventions for the improvement of cowpea production, storage and utilization in sub-Saharan Africa. During the meeting five cowpea production constraints areas were identified namely; seed production, field production problems, storage and utilization, marketing and intellectual property .It is the purpose of the Accra Cowpeas Stakeholders Workshop to develop a technology plan that will bring the benefits of modem technologies to farmers and consumers in Africa. The ultimate objective is to come up with a linkage of modem technologies that are developed, improved and disseminated in a manner that will have long-term benefits to African producers and consumers. This paper outlines the issues pertaining to storage and utilization constraints and identifies technology options for resolving the constraints.

2. Issues pertaining to cowpea storage and utilization constraints

2.1 Introduction

Cowpea *(Vigna unguiculata)* is a very the important indigenous legume crop in African smallholder farming systems (Padulosi and Ng, 1997). The crop has a high level of drought and heat resistance and is an important source of protein in human diets as well as a nitrogen fixer. Cowpea is considered nutritious with a protein content of about 23%, fat content of 1.3%, fiber content of 1.8%, carbohydrate content of 67% and water content of 8-9%. Cowpeas are also valuable sources of vitamins and minerals including

folate, thiamin and riboflavin (Phillips *et al,* 2003). As in most legumes, the amino acid profile complements that of cereals. However cowpea production in most parts of Africa has been hindered by loss of yields to storage pests and various utilization.

a) Storage Constraints

Two storage related constraints were identified as the major hindrances to cowpea utilization in sub-Saharan Africa (SSA) and they are reviewed in this section. Cowpeas are prone to insect infestation; both in the field and in storage and initial infestation occur in the field and is carried to storage. One of the most critical problems that all smallholder farmers face in Africa is the post-harvest handling of cowpeas to keep grain loss to bruchids *(Callosobrushus sps* L. Fabricus.) at minimal levels (Giga, 2000). Stored cowpea grain is often lost with losses of up to 95% even being recorded in as little as 3 months of storage and it is also commonplace to find infested cowpea seeds in commercial stocks and in households (Ojimeluwekwe, 2001). Much of the grain harvested is at risk to attack in storage by the seed-eating bruchids and if conservation and storage techniques are not adequate, high losses occur resulting in most farmers often selling their harvested crop earlier in the marketing season for low prices. The financial and nutritional losses of cowpea to storage pests in SSA are not well documented, but are clearly very high (Murdock *et al,* 1997) and in most markets, when damage exceeds one emergence hole per seed, the price is usually discounted.

Another post-harvest constraint to utilization of cowpea is the prolonged cooking that results from storage conditions of high temperature and relative humidity (Phillips *al,* 2003). This phenomenon is called the hard-to-cook (HTC) defect and is distinguish from "hard seed coat" which is related to impermeability of the seed coat to water. Liu *al* (1992) confirmed that storage of cowpea at high temperature and relative humidity (RH) causes the firmness of cooked grain to increase. Cowpeas stored for 6 months at -18°C or at 30°C and 35% RH produced little change in texture of cooked peas compared to fresh seeds, while storage conditions of 30°C/64% RH, 25°C/75% RH a 37°C /75% RH produced hard to cook seeds about 2.5 times greater.

b) Utilization Constraints

Cowpea has been consumed by humans since the earliest practice of agriculture and been ascribed medicinal and nutritional roles (Phillips and McWatters, 1991). In Africa cowpea is primarily grown for its edible seeds, however young cowpea leaves are al harvested and consumed. Many researchers have examined and reported on t nutritional quality of cowpeas but despite their excellent nutritional quality, co contains a number of anti nutritional factors that lower their potential utilization levels. The limited availability of diversified value added products (VAPs) in most households has also been identified as another constraint to cowpea utilization.

(i) Nutritional quality analyses done on cowpea have shown that the amino acid profile is rich in lysine based amino acids but is limiting in sulfur amino acids (Phillips *et al,* 2003).

(ii) Digestibility of cowpea starch is slower than that of cereals and tubers and it produces less abrupt changes in plasma glucose and insulin upon ingestion.

(iii) Lack of appropriate and practical technology to reduce the levels flatulence-causing oligosaccharides:

The nutritional quality of cowpea is also limited by the presence of both he labile and heat stable antinutritional factors or antinutrients. The mo important of these is the trypsin inhibitor and flatulence causing indigestible oligosaccharides, raffinose, starchyose and verbascose. These sugars are not utilized by humans (being monogastric animals) because of the lack of specific α-galactosidase enzyme needed to digest them. This often leads abdominal discomfort (flatulence) and as a result many African mothers a hesitant to utilize cowpea as a component of weaning food (Uwaegbut 2000). While there are technologies that reputedly reduce the levels
oligosaccharides, they involve extra labor and in many cases are not practical.

(iv) Limited expansion of utilization of VAPs

Currently, the majority of cowpeas in West Africa are sold as grain and/ processed into value added products. A variety of cowpea-based value added products have been developed by food scientists, but there has been limit adoption of VAPs. This has largely been attributed due to lack of an effective extension program.

Very little to no large scale industrial processing is presently occurring processors require technology, equipment, packaging materials, preservatives , skilled labor and an effective demand for their products.

3. Options for resolution of constraints

3.1 Introduction

It is of benefit to both fanners and the consumers, to have a production system that ad value to cowpea from the first stage of production to final processing. Improved storage and utilization methods are part of the package of technologies that will add value to co pea along the production chain. To maximize adoption of technologies, it is important take into account the socio-economic situation of the targeted fanners the practicality feasibility of the technologies.

The following proposed technology interventions are designed to be implemented in short, medium and the long term phases of the program.

3.2 Storage Goals

1. To expand the use of already developed storage techniques in the focus countries *(short term phase)*

Objectives
a) Develop an effective extension program (Fanner Field Schools, Training Trainers, simple and easy to follow extension publications)

Background
To minimize the damage, a range of conservation and storage methods have evolved over the years to suit different farmer situations. Besides the traditional techniques, efficient methods for large-scale storage have also been developed and these include: proper storage facilities, fumigants and residual insecticides (Giga, 2000).

The USAID-funded Bean/Cowpea Collaborative Research Support Program (CRS , started in the 1980s, resulted in storage technologies being developed in Cameroon a Senegal through research efforts at Purdue University (Murdock et al, 2003). storage technologies developed in this program included:

(i) Solar disinfestation technique

(ii) Improved ash storage procedure

(iii) Triple bagging technology

(iv) Combined seed and pod resistant varieties

(v) Drum storage technology

Impact assessments in Cameroon and Senegal show that storage research has benefited large numbers of people and is generating a substantial economic benefit. In Senegal, the CRSP drum technology is used for over 80% of stored Cowpeas. About 1 0"/& of cowpea in northern Cameroon are stored with storage techniques developed by the IRAD/Purdue CRSP team.

There is however need to strengthen the levels of adoption in focus countries through technology transfer program that takes into account the socio and economic status oft target groups.

Indicator of progress in achieving goal will be in the levels of adoption observed through technology impact assessments as well as economic loss research.

2 Research on other storage technologies *(intermediate phase)*

Objectives

a) Research on the improvement/use of diatomaceous earths
b) Research on the effectiveness and improvement of hydrothermal treatment

Background

The use of diatomaceous earths (as ash substitute) and hydrothermal treatment cow peas have been identified other technologies that still require further research. Mvumi et al 2000 showed that two types of DEs were as effective as some commercial insecticides against Callosobruchus sp. There is need to determine the most effective and also it's the rate of application with the highest efficacy, since DEs are likely to cheaper than commercial insecticides.

Sefa-Dedeh et al1998 reported that cow peas steamed for 5 to 10 min, followed by dry before storage, showed no weevil damage after 6 months of storage as the treatment prevents the emergence of adult insects. The process has been termed hydrothermal treatment and had the advantage of not requiring the use of chemical agent sophisticated equipment or trained personnel. However seed viability is reduced completely lost after steaming therefore the treatment cannot be applied to see intended for later crop production.

Indicator of progress; their efficacy will be evaluated and compared to other techniques.

3. To enhance levels of bruchid resistance in moderately resistant cultivars *(long term phase)*

Objectives

Genetic transformation of high yielding and consumer preferred varieties for bruchid resistance.

a) Optimize a regeneration and transformation system of cowpea plantlets from cell cultures.

b) Genetic transformation with the α-amylase inhibitor gene.

Background

Through conventional breeding efforts at IITA, modest levels of resistance to maculatus have been attained (Singh et al, 1997). To enhance these modest levels resistance levels, efforts have also been underway to identify plant genes that affect . maculatus development. A number of genes have been identified as candidate genes bruchid resistance. Transgenic pea and azuki seeds containing the bean IX-amyl inhibitor are

resistant to bruchid. Once a transformation system for cowpea becomes routine this gene for α-amylase inhibitor can be introduced in high yielding a consumer preferred cowpea varieties. Genetic modification offers a novel way transferring the gene for bruchid resistance without other undesirable traits being transferred also.

Indicator of progress; will be the availability of a routine regeneration and transformation system and the production of mature plants carrying the α-amylase gene.

4.Evaluate the Economic and social feasibility of storage technologies *(short to long term)*

Objectives

a) For all the identified technologies need to evaluate the economic feasibility terms of Time, Cost and Labor.
b) Need to establish farmer preference in each country/region.
c) Identify the principal economic advantage for each technology on a per kg a period of storage basis (3 months and 6 months)

3.3 Utilization goals

1. Increase the nutritional value of cowpea *(short to long term phase)* *Objectives*

a) To develop improved Value Added Products.

As a means of adding value to cowpea grain and food products to promote increased utilization and consumption, the following technologies are proposed;

1) Blended cow pea and cereal flour
Flour like products can be processed fairly easily from mature, dry cowpeas. Blending cowpea with cereals improves the protein quality of the blend. Bakery products bread, muffins and doughnuts can be produced from extruded cowpea flour.

2) Fortified traditional foods and snacks

3) Weaning foods
One of the most important food applications for cowpea is in weaning foods for children.
Optimal formulations for (cereal-cowpea) blended weaning food have been developed from
ingredient cost and nutrient profile information (Phillips et al 2003).

4) *Reduction of the levels of flatulence caused by oligosaccharides in cow pea products through:*

Gene silencing; advances in molecular biology have now made it possible, in principle, to block the biosynthetic pathway leading to production of oligosaccharides, making it possible to produce flatulent-free cowpeas.

Controlled germination for reduced flatulence;
Studies focusing on the use of beans as a weaning food have shown that fermenting the beans reduces the oligosaccharide levels, which will reduce problems of flatulence and discomfort for small children. Nnanna and Phillips 1988 also found out that germination at 30°C for 24h reduced flatulence in cowpea consumed as a result of lower oligosaccharides levels. Ibrahim *et al* 2002 reported that long-time soaking (16 h) in bicarbonate solution caused remarkable reduction in the antinutritional factors. Pressure cooking was more effective than ordinary cooking in reducing flatulence. Cooking pregerminated cowpeas was the most effective treatment. Fermentation completely removed trypsin inhibitors and oligosaccharides.

2. Expand the utilization of VAPs in focus areas *(short to long term phase)*

Objectives

a) To determine consumer preference for cowpea products
b) Develop an effective extension program on the use of VAPs Creating new foods from cowpea, especially convenient items like snacks, is a promising way to increase cowpea consumption {Phillips et al, 2003) with the overall goal being to make cowpea-based food products available to consumers. This requires information on consumer preferences and market opportunities for the products, since the most important hurdle for any food product is consumer acceptance.

6. Project Formulation Task Force

Members of the Task Force:

Phelix Majiwa-*Chair*
Louis Jackai - *Co-Chair*
Irv Widders
Ralph von Kaufmann
Tony Youdeowei
Emmanuel Owusu-Bennoah

This Task Force found it necessary to use only some segments of the recommended reporting format.

Summary of recommendations

- Goal of the project should remain the genetic improvement of cowpea through biotechnology: Explicitly producing transgenic cowpea initially by transformation, followed by introgression into the local varieties.
- One entity should manage the whole effort to co-ordinate all the parts with time lines to ensure that activities are contributing to achievement of the project goal.
- Cowpea transformation and the necessary processes should be done in collaboration with SRO (i.e., CORAF) in a country which has the required facilities and enabling environment
- Dialogue should be initiated between AATF and CORAF regarding the hosting of the suggested co-ordinator.
- AATF should lead fundraising effort for the project, but other members must take an active role in these efforts, i.e., by approaching offices of donor agencies in their respective countries.

Title:

Improvement of livelihoods through the application of appropriate technologies to cowpeas in Africa

***Product*:**

The product of the project will be seed of an improved cowpea variety; however, seed is only one component of technologies required by farmer to realise the full potential of the improved cowpea. Furthermore, no single cowpea variety will have all the qualities that are needed.

This emphasizes that while biotechnology applications will be significant in advancing improvement of cowpea, other factors will be required for its success.

The product will need to be demonstrated in farmers' fields and to capture the interest seed companies. It should be aimed initially at African smallholders, processors, traders and consumers. However, all these categories of beneficiaries should be able to move up the economic scale through use of the technology embedded in the new cowpea varieties.

Therefore, the Project will provide innovative technologies, including new varieties, which will contribute to improved productivity and utilisation of cowpea.

This will be realised through activities consistent with the AATF's mission of accessing technologies royalty free and facilitating their transfer to end-users.

Project structure and management

The TF wishes to emphasise the importance of making suitable arrangements for management, to ensure success of the whole project. It is desirable to have a centralised co-ordinated management of the overall project and its component parts. One of the key objectives of the management will be to keep the different actors in communication with each other, to retain coherence and keep the whole project intact and focused.
The project should be structured in modules such that an investor will be free to support the particular modules they find attractive. The Task Forces were asked to discus each of the modules. AATF works though existing networks, in which each member operates responsibly and agrees to share the necessary responsibilities and obligations.
There are remaining questions about who owns the project and its outputs (products). This refers to methods and technologies applied because where the final product is a self-pollinated crop, the product will in effect be in the public domain. This is different from ownership arrangements required for crops such as wheat and maize, or others like cassava, which are utilised in the starch industry.
It is recommended that the breeding of cowpea remains be retained as the focus with the objective of taking advantages of advances in biotechnology. Cowpea is particularly suitable to the application of biotechnology because of the number of fruits that it has and its early maturity. In this regard it is noted that genetic resistance to *Maruca* is low but could be addressed by pyramiding of genes which would be facilitated by collaboration between breeders and molecular biologists working on transformation of this crop.

Opportunities for partnerships and networking arrangements

NGICA was founded to stimulate interest and research in genetic improvement of cowpea varieties. The network is important because the new varieties from different regions will have to be adapted and incorporated into the farming systems.
AATF will support research on the adaptation and deployment of technologies for the benefit of African smallholders, but not the development of wholly new technologies.
The **Bean/Cowpea CRSP** invests in long-term collaborative research and training, and institutional capacity building through partnership with NGOs and NARS. CRSP technologies are adapted and transferred to end-users.
National systems are needed to incorporate the transgenes into locally adapted cowpea lines of appropriate market classes; SROs, NEPAD, FARA, TRANSLEG (supported by EU), etc are needed for issues that cross national boundaries.
International Centers: IITA and ILRI, both of which have global mandates and are collaborating on cowpea research.
Private sector: Monsanto, CSIRO, Growers of Associations, Seed Companies that deal in Cowpea, NGOs, Companies that have moved crops through regulatory systems in different African countries
UN and other Govt Programs: UNEP-GEF, Agricultural Biotechnology Support Program (ABSP) II (University of Michigan and Cornell), Biosafety Support Program (BSP) for both east Africa and west Africa
Bio-safety
Countries that have signed the Cartegena Protocol are obligated to have functional bio-safety systems. However, some may need to be constantly reminded to actually do this.

AATF should work with other agencies to achieve this. Some of the programs, i.e., BSP, ABSP, UNEP-GEF, assist individual countries and SROs to operationalise biosafety systems.
Deployment of project products in individual countries will depend on having operational biosafety systems and functional NARS. AATF will work as a partner of the NARS. Conditions under which a product is released will be negotiated individually with each country. This process will require considerable legal capacity in IP. AATF needs to have some quick success to establish its credibility. This requires a tight focus and limited ambitions. It also requires identification of appropriate technologies that are amendable to AATF brokerage.

Participation of African countries in the project

Individual African countries should be encouraged by AATF to invest in the projects, so they can be co-owners of any intellectual property that may arise. Power over the technologies will come with their ownership. There is also need for consideration of opportunities and technologies, which already exist in Africa.
This approach will make the countries proud and protective of their IP rights. It is the responsibility of individual countries to protect their own IP rights, but it was suggested that AATF should help raise awareness among African countries of danger of loss of intellectual property such as is happening certain teas and appetite depressants.

Working with the private sector in technology development

Although it was possible in the past for scientists to work in the laboratories of the private sector, (i.e., Monsanto) this is no longer possible, for a variety of reasons. Several models for collaborating with the private sector were considered:

- they could develop products entirely on their own and pass this to National programs through AATF;
- they could provide technology for adaptation and training on technology use through contract work undertaken by another laboratory in a developing or a developed country;
- they can donate technology they have and let those interested do the required modifications/adaptations. It is doubtful that the private sector will be interested in investing in physical structures, such as containment facility for generating and handling the transformation crops. This will require collaboration with regional centres of excellence being set up in Africa.

The private sector is more likely to license a technology through an intermediary such as AATF who would then deal with the third party. Whether donated for humanitarian reasons, the company may still impose conditions to protect them from liabilities and to ensure compliance with the terms of the license, a process that is easier done through an agency such as AATF.
It was noted that the private sector are generally reluctant to be involved in the management of projects that are not entirely their own, i.e., collaborative projects. Thus although it would be desirable to work side in partnership with the private sector in product development, exactly how this would be done has yet to be clarified, and may vary with each company. Getting this arrangement right will be the key to getting USAID

funding for this project within the context of a Global Development Alliance, that requires private public partnerships in product development as one of the conditions.

NGICA structure and relationships

There are questions that need to be considered about the future role of NGICA. These include how best it can continue to be linked with AATF; whether it should be hosted wholly in the institutions where its director(s) work; its relations with Bean/Cowpea CRSP;
Is it necessary for NGICA to be able to receive funds or should it be limited to a coordinating and sponsoring function, with individual institutes raising and managing their own funds.
As a network, NGICA needs to move beyond depending on just two people, but should not grow such that it looses its focus. Its membership used to be primarily geneticists but it now appears to embrace cowpea development generally, perhaps out of realisation that genetic improvement cannot succeed on its own.
NGICA has a vital role to play in coordinating cowpea improvement. Mali is the only West African country that is not a member of NGICA and consideration should be given to enrolling it. NGICA is not a legal entity so consideration must be given to the hosting of its management. There are various options that may be considered. Amongst the options are:

1. AATF especially in the early days to catalyse action.
2. CORAF/WECARD with the individual hosted and a CORAF member institution such as Ahmadu Bello University
3. FARA along with ABSP II

There is need for understanding of the overall environment in which the improved cowpea will be deployed, but the focus on biotech must be retained. *Bt* is just the first biotech advance that can be anticipated. There are only a few labs (e.g., Arkansas, Purdue, Davis, CSIRO, IITA, etc) working on the transformation of cowpea, but no consensus has been reached regarding the varieties that should be transformed. To get cowpea up to its potential requires more than a single technology, so AATF may be interested in other aspects of cowpea improvement.

Estimated cost of approaches and potential funding sources

AATF has a resource mobilisation function, and can put in joint grant applications, add its endorsement to ongoing projects, or fund its contribution to aspects of ongoing projects. AATF can join in writing new proposals or may endorse them.
The Global Development Alliance requires a three to one match for grants but they will accept in-kind donations. This source has indicated a nominal figure of $300,000, but they have given a range of grants above and below this.
The Kirkhouse Trust is prepared to finance Post Doc [to be quantified in monetary terms]
Monsanto is prepared to donate one or both of cry genes 1&2genes [to be quantified in monetary terms]; there may be other genes that are useful in enhancing production and utilization of cowpea and other companies may need to be approached to license these to AATF.
It was suggested that other companies that may have technologies relevant to cowpea should be asked to be involved in the initiative. Cowpea is unique and has the advantage

that other crops do not have, in that there is no concern about competition with producers in the OECD countries.

Processing cowpea

There is a range of products being made from cowpea. In Ghana, a company supported by USAID is involved in commercial processing of cowpea. There may be opportunities for technology transfer in processing and packaging.

Conceptual framework for the project formulation_____

In a plenary session, the workshop discussed the purpose and mechanism for the project formulation and approval process. The purpose of the discussion was to

- Agree on the thrust of the project
- Formulate an appropriate text for the Title
- Prioritise project activities linked to clearly defined deliverables
- Agree on a time horizons for achieving impacts
- Design a management structure for project implementation and
- Agree on a funding strategy based on the approved AATF model

The procedure for formulating the Cowpea project concept note will adopt the AATF approved project formulation and approved process which consists of the following steps.

1 AATF leads the development of the project concept
2 The project concept note is developed in close consultation with key stakeholders; Project concept notes cover technical, commercial, financial and associated legal/regulatory issues.
3 The draft concept note is subjected to a peer review process and finalized
4 The revised Concept note is submitted to the AATF Board for approval
5 Following approval, the Business Plan for the project is developed.

Summing Up – The Project "Road Map"

After extensive discussion of the "Road Map" for the project, the workshop adopted the following framework for the development of the Cowpeas Project Concept Note.

Title :

A total of 34 texts were recommended for the project title. Participants votes on the top 3 titles, resulted in the following

- Top choice**:** (19 votes) *Enhancing livelihoods through improved cowpea productivity and utilization in Africa.*
  Suggested changes to this title were given as
  (i)*Enhancing livelihoods with integrated use of emerging cowpea technologies in Africa*
  (ii) Enhancing livelihoods in Africa with emerging cowpea technologies.
- Second choice:(8 votes) *Improvement of livelihoods through the creation of high value cowpea.*
- Third choice(7 votes) *Enhancing access to advanced technologies for cowpea improvement in Africa.*
  Suggested change : *Advanced technologies for improvement of cowpea in Africa.*

The workshop gave AATF management the discretion *to polish* this title to appropriately reflect the key ideas discussed. Special effort should be made to ensure that the title captures the key words/concepts that reflect current rural development issues such as food security, improved nutrition , rural livelihoods, poverty alleviation, income generation and improved standards of life.

Project focus : The primary focus for the project product would be cowpea varieties that are

- Socially acceptable
- Meet the needs of the variety of end users
- Highly productive
- Resistant to biotic and abiotic stresses
- Addresses food security issues
- Improve nutrition
- Generate income for resource poor farmers in sub-Saharan Africa.

An alternative product focus would be Seeds of high yielding and pest resistant cowpeas for enhanced food security and better livelihoods in sub-Saharan Africa.

Project activities:

Activities selected should include cowpea processing technologies, involve strong collaboration with institutions, groups, organizations and agencies already engaged in research and development of cowpea production and utilization. Activities should be linked to Deliverables. The broad areas of project activities required were identified as follows:

i. Strengthening cowpea seed production and marketing systems in sub-Saharan Africa
ii. Setting up a project management system
iii. Developing and applying a genetic transformation system for cowpea
iv. Developing and applying a marker assisted selection approach for the improvement of cowpea.
v. Developing dual-purpose cowpea varieties to extend the utilization of cowpea
vi. Better understanding of consumer preferences concerning GM cowpea
vii. Extending non-chemical cowpea storage technologies that respond to consumer demands
viii. Establishing FTO(Free To Operate) for cowpea biotechnologies.
ix. Setting up a risk management plan for transgenic cowpea in sub-Saharan Africa.

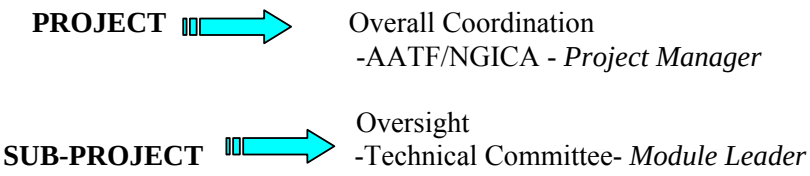
The activities will be implemented in such a manner that will yield the following deliverables.

i. Bt gene in market acceptable cowpea varieties widely available to small holder farmers in Africa.
ii. Efficient local systems for delivery of high quality cowpea seeds
iii. Increased capacities in cowpea systems including research, seed distribution and cowpea processing
iv. Genetic markers for specific biotic and biotic stresses including *Striga*
v. More rapid development of elite cowpea varieties for resistance to *Striga* and other biotic and abiotic stresses using marker selection systems.

Project management structure:

The project structure will be constituted on a Modular form, each sub-project making up the component Modules. Each of the modules will be coordinated by individual module leaders or task force leaders or task coordinators. The AATF and NGICA partnership will be the assigned overall coordination entity for the project and this entity will hire a

project manager to undertake the task of coordinating the work of the module leaders; this structure is simply illustrated as follows



The mechanism for overall project implementation will consist of technical sub-committees to provide oversight for each component sub-project Module.
Strong partnerships with relevant national, regional and international institutions and agencies will be established for effective project implementation.
Periodic monitoring and evaluation will form an essential and integral part of the project implementation process.

Funding strategy

The entire project could be funded by a single donor, but it is more likely that different donors will fund components Module sub-projects that are of particular interest to them. The approved AATF funding formula will be adopted as follows:
Project formulation – AATF funds 75% while 25% will be sought as matching funds
Project implementation- AATF to fund 25% while 75% will be sought from donors.

The Global Development Alliance Secretariat of the United States Agency for Development USAID, has expressed interest in the AATF/NGICA Partnership Cowpea project therefore efforts will be made to complete the preparation of the Project Concept Note to conform with the GDA guidelines for submission to GDA/USAID.

Outline of the cowpea project concept note

Fundamental principles underlying project formulation

1 The project objectives should stress critical issues of Enhancing Rural Livelihoods, Food security, Improved Nutrition for farming families, Increased Household Incomes, use of Emerging Technologies such as biotechnology, information technologies and chemical technologies, Sustainability, Presidential initiatives, Effects of HIV/AIDS, Geographical focus and Impacts on livelihoods of small holder farmers in sub-Saharan Africa.
2 Focus will be on generic technologies, giving examples of technologies/ tools that will be used to achieve the project objectives.
3 Interventions will be made so that their impact on cowpea production and utilization can be realized within a set of time horizons, namely immediate(short term), medium term and long term.
4 Activities will involve integrating approaches from different collaborating institutions/time frame/technologies and geographic focus. The work of institutions will be integrated in such a manner that relevant technologies are captured in various areas.
5 The project should build the foundation for the use of modern and sophisticated technologies to achieve early impact.

6 Intellectual Property Rights issues will be integrated within the framework of the Improved Varieties sub-project; the institution and mechanism for managing IPR issues during project implementation has been identified.
7 It is recognised that different project Deliverables will go to Farmers, Consumers, Traders, Researchers, and technology developers.
8 The project concept note will be prepared to conform with the guidelines for the Global Development Alliance – USAID; the document should be limited to 10-12 pages according to the GDA guidelines.
9 To facilitate the preparation of the project concept note, information will be sought from Chairs of Task Forces if necessary. The sources of information identified are indicated in brackets in relevant parts of the project concept outline.
10 Names of specialists may be suggested for the Peer Review Panel as required by the AATF procedure for project development and approval.

Outline for Cowpea Project Concept Note developed.

1. Accepted Title

Enhancing Livelihoods in Sub-Saharan Africa through Integrated Use of Emerging Cowpea Technologies

2. Introduction

Economic importance of cowpea ; outline mode of
-Production
-Utilisation and income generation
Current productivity constraints and gaps
Partnerships (past, on-going), AATF/NGICA/IITA Bean CRSP etc, that continue working to address constraints
Expected benefits from project implementation
Impact of the project activities on a time frame

3. Objectives/Goals

-To enhance livelihood in Sub-Saharan Africa through emerging cowpea technologies.
. define meaning of enhanced livelihoods, improved nutrition, income generation,
. emerging cowpea technologies, including Biotechnology, Information technology, Chemical technology
. capture range/breath of technologies
. time, technologies, integrating institutions, systems, mobilizing and linking
. time horizons, linking over the life time of the project

4. Deliverables : these will constitute the focus of the project

- **Improved varieties** (seed, grain and fodder)
- **High quality seed**- for seed storage

. Seed quality control - seed laws and bio-safety issues

- **High quality grain** for processing, utilization/storage and consumption.
- **Improved Cropping/Production systems** and practices-adopting the Farmer Field School participatory model to address all constraints; soil/water management, pests/diseases, storage, processing and utilization, market information etc
- **Improved cowpea processing**
- **Market plans** for cowpea in various grain sheds in SSA

- information for business plan & opportunities
- model for cowpea business plan
- investment options
- - **Capacity Building** for compliance with seed laws

Enhanced livelihoods : the following deliverables will contribute to enhancing livelihoods

-efficient seed delivery system
- seed companies
- ease to attract markets, manage risks and reach new markets
- efficient storage to address pest infestation
- production of quality grain and fodder

4. Activities – to be elaborated by Task Forces according to uniform format

The format will consist of the following

- Overview of the problem/constraint
- Objective of the sub-project
- Activities to be undertaken
- Geographic Focus – starting with the Nigerian GrainShed.
- Partners to be involved
- Methodology
- Deliverables
- Milestones based on AATF time horizons, immediate, medium term and long-term
- Budget

HS (High quality Seed) *(**Source information from Seed Task Force)*

- Non-chemical cowpea storage technologies
- Certified cowpea seed distribution
- Production of high quality seed
- Seed quality control; best available cowpea seed storage technologies; certified cowpea seed distribution system, production of high quality seeds, production of nuclear seeds.

Capacity building (produce and store quality seed) for compliance with seed laws; farmers capacity to produce and store high quality seeds, capacity to enforce seed quality control measures - seed handlers, extension agents.

Improved Varieties (IV) *(** Source information from Field Constraints Task Force)*

- Introgression of genes for resistance (MAS)
- Develop genome-wide DNA marker set
- Introgression of genes using MAS
- Genetic transformation of Bt into cowpea
- Capacity building for application of MAS-(*target Kirkhouse Trust program for funds)*
    - Use MAS in breeding (regional/national levels by breeders)
    - Use transformation techniques.

Intellectual Property: all related issues to be handled here*(** Source information from IPR Task Force)*

HQG (High Quality Grain)

- Extension of storage and packaging technologies to be closely linked with activities on resistance against storage weevils.
- Characterization of cowpea grain
- Capacity building
  . Farmers to deliver high quality grain
  . Traders to deliver high quality grain to processors
  . Entrepreneurs to recognize business opportunities arising from income generation e.g. deliver solar heaters, deliver inputs etc.

Improved cowpea production systems (IPSC)

- Cowpea crops/livestock production system
- Integrated production and pest management, IPPM.
  - Cultural crop management
  - Cultural pest management

- Cowpea crop management systems
  - Inter-cropping
  - Monoculture
  - Use of Fertilizers

Capacity Building of farmers to adapt and adopt improved production systems

- Farmers to adopt IPPM technologies for cowpea production
- Change agents to introduce, validate and adapt production technologies

Marketing and Trade Plan *(**Source information from Marketing and Trade Task Force)*

1. Seed sub-sector Analysis
2. Consumer preferences studies relating to grain seeds and processed products.
3. Farming system changes and Impact analysis
   - Changes in farming/ production systems
   - Impact analysis: ex-ante and ex-post analysis to be conducted at each of the following levels)
     - farm level
     - community
     - country and
     - sub-regional
4. Trade analysis
   - Supply and Demand for grain and processed cowpea and trade analysis (food safety issues)

5. Dissemination of the information from these studies to stakeholders of the project and to impact on priority setting for the other project components.

Capacity Building for
- farmers, traders and processors on cost/benefit analysis;
-development agents/change agents and NGOs, social scientists, biological scientists to do impact assessment and market studies

Improved cowpea processing(***Source information from Storage/Utilization Task Force)*

1. Needs and Opportunity assessment of needs using participatory approaches
    - Technology needs
    - Barriers to technology acceptance by end-users
    - Barriers to consumer acceptance of products
2. Extension/adoption of value-added cowpea products
3. Food Safety studies in Bt Cowpea and processing

Capacity building on
- Training in the creation and management of small to medium scale cowpea processing enterprises
- Public awareness in food safety issues

Summary

Specific IP issues will be handled under improved varieties. Only capacity building and public awareness to be handled as a stand alone activity.

FORMAT TO BE USED for preparing text for each sub-project.
Objectives of the sub-project
Activities to be undertaken
Geographical focus
Partners to be involved
Methodologies to be applied
What will the activities deliver
Milestones

Horizon 1	1 – 3 years
Horizon 2	3 – 6 years
Horizon 3	beyond 7 years

Budget
Nigerian Grain shed. More focus
Deadline 15 March, 2004
Action plan : A uniform set of notes from presentations made by Task force leaders and Rapporteurs.

20th	February	Tony to Phelix
25th	February	Phelix to PFTF
29th		PFTSs to Phelix

ANNEXES

Annex IA. List of Participants

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B.B. Singh IITA Kano Station C/O L.W. Lambourn & Co. Carolyn House 26 Dingwall Road Croydon CR9 3EE, England Phone: 234-64-645-350/51/53 Fax: 234-64-645-352 Cell : 233-71-24015 Email: bsingh@iita.exch.cgiar.org b.b.singh@cgiar.org	Idah Sithole-Niang University of Zimbabwe Dept. of Biochemistry P.O. MP 167, Mt. Pleasant Harare, Zimbabwe Phone: 263-4-303-211/308-047 (direct) Ext. 1283/1421 Cell: 263-23-412-801 Fax: 263-4-333-678/333-407/308-046 Email: isn@mweb.co.zw isniangzw@yahoo.com
Ed Southern Kirkhouse Trust 12 School Road Kidlington, Oxfordshire OX 5 2HB U.K. Phone: 44-1865-379310 Fax: 44-1865-849023 Email: ed.southern@bioch.ox.ac.uk	Eugene Terry AATF c/o ILRI P.O. Box 30709 Nairobi, 00100, Kenya Phone: 254-020-630-743 (ext 3720/3139) Fax: 254-2-631-499 Email: e.terry@cgiar.org

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Irvin Widders Michigan State University Bean/Cowpea CRSP Management 321 Ag Hall East Lansing, MI 48824-1039 Phone: 517-355-4693 Fax: 517-432-1073 Email: widders@msu.edu	Anthony Youdeowei Consultant,IPPM, Agricultural Education,Training and Communication Villa 126 Riviera Palmeraie 07 BP 950 Abidjan 07, Côte d'Ivoire Home Phone: 225-22-47-91-76 Accra Cell: 233-027-606-418 233-024-844-196 Email: ayoudeowei@yahoo.co.uk

Annex IB. Background Information on Participants

Participant	Background
1	
2 . Eugenia Barros	Molecular biologist and research fellow at CSIR - Bio/Chemtek in South Africa. She has over 10 years experience in molecular marker development for marker assisted selection (MAS) in agricultural crops and forest trees. Eugenia has worked briefly on the development of drought tolerant markers for cowpea. She is currently a steering committee member of NGICA, the Network for the Genetic Improvement of Cowpea in Africa.
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6 George Bruening	Dr. George Bruening is appointed in the Department of Plant Pathology, University of California at Davis. He has worked with cowpea for more than 30 years and currently is pursuing cowpea transformation and the production of cowpea co-dominant polymerase chain reaction markers in collaboration with Dr. Ivan Ingelbrecht of IITA Ibadan and Dr. Douglas R. Cook of UC Davis.
7	
8 . Ousmane Coulibaly	Ousmane Coulibaly is an Agricultural economist with the International Institute of Tropical Agriculture, he works on the economics of integrated pest management at the Biological Control Center for Africa in Cotonou, Benin. Ousmane does capacity building of national agricultural research and extension systems, rural development projects funded by state and various donors like IFAD, AfDB, World Bank etc..The courses are focused on the impact assessment of agricultural technologies and institutional arrangements on food security, poverty reduction and environment protection. Ousmane has collaborative activities with universities in Africa, US, Europe and Australia. He is the regional coordinator of the cowpea project for Africa (PRONAF).
9	
10. Jeff Ehlers	Jeff Ehlers, Dept. of Botany and Plant Sciences, University of California, Riverside. He conducts a breeding program to develop improved cowpea varieties and undertakes genetic studies of important traits. Dr. Ehlers has been working on cowpea at the University of California for the past 13 years as part of a USAID funded Bean/Cowpea CRSP project and interacts regularly with West African cowpea breeders. Prior to

	this he worked for IITA for 3 years while based with ICIPE in Kenya.
11. Salvador Fernandez-Rivera	Ruminant Nutritionist working at the International Livestock Research Institute. His professional interest is aimed at increasing the productivity of mixed crop-livestock farms in developing countries through improved production and use of food-feed crops and other feed resources, better livestock nutrition and efficient use of natural resources. He is the Coordinator of the CGIAR System-wide Livestock Programme and is based in Addis Ababa, Ethiopia.
12	
13 T.J. Higgins	TJ Higgins main research focus is the application of gene technology for plant improvement. He is particularly interested in improving the nutritive value of plants for feed and food uses. Born in Ireland, TJ's first degrees were from the National University of Ireland. He gained his PhD from the University of California at Davis. TJ is the Deputy Chief of CSIRO Plant Industry, Canberra, and is a Fellow of the Academy of Technological Sciences and Engineering.
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17. Mohammad Faguji Ishiyaku	Mohammad Ishiyaku is a Cowpea Breeder, based at the Institute for Agricultural Research of the Ahmadu Bello University, Zaria, Nigeria. Specialised in the development of cowpea varieties with resistance to pests, disease and drought tolerant using conventional and modern biotechnology tools. Interseted in disseminating improved varieties to African farmers as well as public awareness on the benefits of biotechnology. Engaged in cowpea breeding and working with farmers since 1989 and currently member of two regional cowpea projects. Chair Seed TF of the AATF/NGICA Increased Cowpea Productivity Project.
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20. Jess Lowenberg-DeBoer	Jess Lowenberg-DeBoer is Professor of Agricultural Economics at Purdue University and West Africa Regional Facilitator for the Bean/Cowpea Collaborative Research Support Program (CRSP). He has 16 years research experience in economic assessment of agricultural technology in Africa, including long term experience in Niger and Burkina Faso. He works with engineers and biological scientists in developing technology, with extension personnel in disseminating technology and in

	impact assessment. Because of his experience as a farmer (1972-1976) and journalist (1977 to 1980), he brings a private sector perspective to his work.
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23. Larry Murdock	Larry Murdock is an Entomologist with the Department of Entomology, Purdue University, W. Lafayette, IN, USA; long-term interests in: (1) cowpea insect pests and post-harvest storage of cowpeas; (2) mobilization of technology for cowpea production, storage, and utilization in sub-Saharan Africa; (3) physiological and biochemical systems in insects as targets for novel approaches to insect control (4) genes for insect resistance in plants. Seventeen years of experience collaborating with African colleagues on research related to cowpea production and storage, primarily with the Bean/Cowpea CRSP. Organizer or co-organizer of four cowpea-related symposia or workshops in West Lafayette, (1993), Dakar (2001), Capri (2002), and Accra (2004). Currently Co-Chair of NGICA with Idah Sithole-Niang.
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26 . Francis Padi	Francis Padi is a Plant breeder and Molecular Geneticist at the Savanna Agricultural Research Institute (SARI) in Ghana. His research focus is to improve cowpea-based cropping systems for the savannah ecologies. Currently leads the Cowpea Improvement Programme in SARI.
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32. Ida Sithole-Niang	Ida Sithole-Niang is a Molecular biologist, based at the University of Zimbabwe in Harare. She is specially interested in biosafety issues, intellectual property rights, and public awareness of biotechnology. Ida has over 12 years experience working in the field of Cowpea biotechnology. She is currently the Co-chair of NGICA, the Network for the Genetic Improvement of Cowpea in Africa.
33. Sir Ed Southern	Ed Southern, Molecular Biologist and Founder/Charirman of the Kirkhouse Trust. He has a long-standing interest in Genomics, in particular the development of techniques for the analysis of genome structure and for genetic analysis.
34. Eugene R. Terry	Eugene Terry is a plant pathologist and an agricultural research and development specialist with thirty-six years of professional experience in research, research management, technology generation and dissemination. He has held leadership positions

	in capacity building and institutional management in universities, international agricultural research institutes and international development agencies. He holds a BSc in agriculture and an MSc in plant pathology from McGill University, Montreal, Canada, and a PhD in plant pathology from the University of Illinois, Urban-Champaign, Illinois, USA. He has been associated with the University of Sierra Leone, and has held the position of Plant Pathologist and Director of International Cooperation and Training at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria. Dr Terry was the first Director General of the West Africa Rice Development Association (WARDA), Bouake, Cote d'Ivoire, a position he held for nine (9) years, before joining the World Bank in Washington DC, first as an Advisor (Agricultural Research and Extension Group-ESDAR), and then later as Crops Advisor, in the Rural Development Department. Eugene is currently the implementing Director of the African Agricultural Technology Foundation (AATF) – a public/private sector partnership organisation that promotes access and delivery of advanced agricultural technology for resource poor African farmers. He is also the Chairman of the Board of Trustees of the World Agroforestry Centre in Nairobi, Kenya. He has served (until November 2002) as a Trustee of the International Water Resources Management Institute in Colombo, Sri Lanka. Eugene is married to Lorna Leola and they have three children.
35. Michael P. Timko	Michael P. Timko, Professor of Biology at the University of Virginia. Major interests are in plant molecular genetics, genomics, and genetic engineering. Has been involved in *Striga* research for over 15 years. Currently pursuing studies aimed at further developing functional genomic techniques for cowpea and characterization of pest and disease resistance genes. Plant breeder, based at the Bambey research center in Senegal. Interested in Breeding for adaptation in semi-arid zones and resistance to biotic contraints. I have been a cowpea breeder for the last twenty years and bean cowpea CRSP PI.
36 Ralph von Kaufmann	Ralph Kaufmann is Agricultural economist with varied experience in the University of Nairobi Institute for Development Studies, the Kenyan Agricultural Finance Corporation, the World Bank, the Botswana National Development Bank, and with ILCA, now ILRI, in Botswana, Nigeria, Ethiopia and Kenya. From 1978 to 1991, he led the ILCA Subhumid Zone Programme based in Nigeria which conducted participatory research on forage legumes in semi-

	pastoral and smallholder systems. More recently he has been involved in resource mobilisation and programme development. He is currently Senior Resource Person at FARA which has its headquarters in Ghana.
37	
38. Anthony Youdeowei	Anthony Youdeowei was Professor of Agricultural Entomology at the Faculty of Agriculture and Forestry, University of Ibadan, Nigeria from 1973 to 1990. Later, from 1990 to 1997, he was appointed and served as Director of Training and Communications at the West Africa Rice Development Association (WARDA/ADRAO,) an international agricultural research center of the CGIAR based in Cote d'Ivoire. Anthony is a specialist in Integrated Pest Management, and has also developed interest and competence in agricultural education, training and scientific communication. Currently, Anthony is an international Consultant IPM Specialist and advises African Governments, the Food and Agriculture Organization of the United Nations, FAO, the World Bank Africa Region, GTZ and other development agencies on integrated pest management polices, planning and field implementation of IPM programmes. He is also consultant to CTA in The Netherlands on training and agricultural communication issues. Anthony Youdeowei has vast experience of agricultural development in African and other third world countries. He is a Founding Fellow of the African Academy of Sciences and a Fellow of the Third World Academy of Sciences.

Annex II Workshop Programme

Tuesday, February 10

8:30 am	Welcome and Introduction Chair : Emmanuel Owusu-Bennoah, *Chief Scientific Officer and Acting Director General, Council for Scientific & Industrial Research*

Plenary Presentations : Chair - Ennamuel Owusu-Bennoah

9:00 am	Comprehensive Update on the AATF *Eugene Terry, Implementing Director, AATF*
9:30 am	Update on NGICA *Idah Sithole-Niang, University of Zimbabwe*
9:50 am.	General Aims and Procedures of this Workshop *Larry Murdock, Purdue University*
10:20 am	Group Photograph & Coffee Break
10:45 am	Cowpea Marketing and Trade: An Update *Ousmane Coulibaly, IITA/Benin*
11:10 am	Potential Economic and Trade Impacts of Bt Cowpea *Jess Lowenberg-DeBoer, Purdue University*
11:35 am	Genetic Transformation of Cowpea – State of the Art *T. J. Higgins, CSIRO/Australia*
12:00 Noon	Lunch
1:30 pm	**Plenary Session with Task Force Leaders:** **Chair - Tony Youdeowei** *Ousmane Coulibaly, Mohamad Ishiyaku, Laurie Kitch, Phelix Majiwa, Larry Murdock and Idah Sithole-Niang*
2:30 pm.	Specific Guidance for Task Forces *Tony Youdeowei, Rapporteur; and Phelix Majiwa, AATF*
2:45 pm.	Task Force Breakout Group meetings
4:15 pm.	Coffee Break
4.30 pm	Kirkhouse Trust programmes- *Ed Southern*

Plenary Presentations

4:40 pm.	Dual Purpose Cowpea and Fodder Cowpea: Collaborative research within the CGIAR Systemwide Livestock Programme. *Salvador Fernandez-Rivera, ILRI/Ethiopia*
5:00 pm	Potential and Constraints of Improved Cowpeas in Increasing the Productivity of Cowpea-Cereals systems in the Dry Savannahs of West Africa *B.B. Singh, IITA/Nigeria*
5:25 pm. – 6.30 pm	Task Forces resume deliberations
7:00 pm	Cocktails at the M-Plaza Hotel

Wednesday, February 11, 2004

Chair - Ida Sithole-Niang

Plenary presentations

8:30 am	Plenary Session: Cross-Cutting Issues *Phelix Majiwa, AATF/Kenya*
9:30 am	Getting Technology into Farmers' Hands : Increasing farmers' income through improved quantity and quality grain production *Ouendeba Botorou, INRAN/Niger*
10.00 am.	Task Forces to Continue Deliberations
12:00 Noon	Lunch
1:30 pm	Task Forces to Continue Deliberations
6:30 pm.	Collective Dinner at Maquis Tante Marie Labonne

Thursday, February 12, 2004

Plenary sessions- Reports from Task Forces

Chair- Jess Lowenberg-DeBoer

8:30 am.	Marketing and Trade Task Force - *Ousmane Coulibaly*
9:00 am.	Seed Constraints Task Force - *Mohamad Ishiyaku*
9:30 am.	Coffee Break
10:00 am	Field Constraints Task Force- *Eugenia Barros*
10.30 am	Intellectual Property Task Force- *Ida Sithole-Niang*
11:00 Noon	Storage Task Force – *Larry Murdock*
11:30 pm	Project Formulation - *Phelix Majiwa*
12. noon	Task Forces break up sessions to finalize reports
1.00 pm	Lunch
2:30 pm	Plenary Discussion **Chair- Phelix Majiwa**
4.00 pm	Summing Up *Eugene Terry*

Closing : Chair Emmanuel Owusu-Bennoah

5:00 pm	Closing Remarks *Emmanuel Owusu-Bennoah*

Friday, February 13, 2004

Chair : Eugene Terry, Implementing Director AATF

8.30 am – 4.00pm	Discussion on conceptual framework for the Cowpea Project Concept Note *Working Group on Project Formulation*

Annex III Composition of Task Forces

Seeds

Mohammed Ishiyaku, *Chair*
Vincent Gwarazimba
Ndiaga Cisse
Issa Drabo
B.B. Singh
Jeff Ehlers

Storage

Larry Murdock, *Chair*
Ousmane Boukar
Esther Sakyi-Dawson
Francis Padi
Eugene Terry

Intellectual Property

Idah Sithole-Niang, *Chair*
Joe Huesing
Walter Alhassan
Sika Gegbelegbe
Ed Southern
Patricia Kameri-Mbote

Field Constraints

Eugenia Barros, *Chair*
T.J. Higgins
Larry Beach
Phil Roberts
George Bruening
Ivan Ingelbrecht
Jeremy Ouedrago
Mike Timko

Marketing and Trade

Ousmane Coulibaly, *Chair*
Sam Sefa-Dedeh
Ouendeba Botorou
Salvador Fernandez-Rivera
Jess Lowenberg-DeBoer
Nancy Muchiri

Project Formulation

Phelix Majiwa, *Chair*
Louis Jackai
Irv Widders
Rolf von Kaufman
Tony Youdeowei
Emmanuel Owusu-Bennoah

Annex IV Opening and Closing Addresses

OPENING ADDRESS
by
PROF. E. OWUSU-BENNOAH,
AG. DIRECTOR-GENERAL, CSIR, Ghana

Distinguished Ladies and Gentlemen

It is with great pleasure that I extend a hearty welcome to you at this all-important International Cowpea Stakeholders' Workshop. We are happy to note that Sir Edwin Southern, Founder and Chair of both Kirkhouse Trust and Oxford Gene Technology Limited is here with us as a guest. On behalf of the government and the people of Ghana I want to say a big AKWAABA to Sir Southern and all our distinguished participants. We in Ghana are particularly happy and grateful to the African Agricultural Technology Foundation (AATF) for choosing Accra to host this workshop.

If I really accepted to preside over the opening ceremony of this workshop, it is because I believe in the community effort aimed at helping to shape plans for mobilizing new or better technologies to increase cowpea productivity and utilization in Africa. Cowpea is estimated to be one of the most important food grain legume crops in Ghana. It is cultivated extensively in the northern savanna zone of the country. The role cowpea plays in ensuring food security and in the improvement of the livelihood of both rural and urban poor in this country cannot be underestimated. This is especially true, given the potential of the crop, in firstly meeting the protein requirements of humans; secondly, providing feed, forage, hay and silage for livestock; and thirdly, improving or maintaining the fertility or productivity of soils.
It is in the light of the importance of cowpea that this Workshop must be seen as a step in the right direction. Indeed, this Workshop is the result of a number of initiatives, one of which is the meeting of the African Agricultural Technology Foundation (AATF) and the Network for the Genetic Improvement of Cowpea for Africa (NGICA) in Nairobi, Kenya in July 2003. A previous meeting under the theme "Genetic Improvement of Cowpea" had been held in Dakar in January 2001. The Nairobi meeting resulted in the formation of a Technical Steering Committee, which was tasked to guide the development of a project aimed at increasing cowpea productivity and utilization in Sub-Saharan Africa. It is on the basis of work undertaken by this Technical Steering Committee that we are today witnessing this Workshop.

I must pay special tribute to the collective efforts of scientists and specialists, who out of the desire to improve the productivity of the crop, have worked hard and tirelessly to ensure the holding of this all-important Workshop.
This Workshop, in my opinion, is one of the most appropriate and timely initiatives, coming at a period when all efforts are being made to address the issue of meeting the food requirements of people in the African continent.

I am especially delighted that the Council for Scientific and Industrial Research of Ghana (CSIR) and the University of Ghana have played active roles in this noble initiative. Indeed, the main objective of this Workshop is also at the heart of efforts currently being made by agricultural research institutes of the CSIR to fulfill their mandate of developing improved crop varieties and agronomic practices to ensure increased productivity and thus enhance food security in Ghana. Research in breeding and integrated crop management has resulted in the following achievements:

1. release of twelve cowpea varieties by Crop Research Institute and Savanna Agricultural Research Institute
2. appropriate Integrated Crop Management (Agronomic and IPM) practices have also been developed for cowpea as sole crop or in association with cereals and roots and tuber crops.

Also the CSIR Food Research Institute has developed appropriate technologies to remove the tannin content from the seeds of some cowpea varieties so as to increase digestibility. This is essential in the preparation of weaning blends and other formulations for vulnerable groups like lactating mothers and children.

Ladies and Gentlemen, the main objective of this Workshop, I am informed, is to develop a process and device a plan for bringing the benefits of modern cowpea plant improvement technologies in the form of superior-performing cowpea cultivars with novel traits.

Many would agree with me that the generation of technologies alone might not be enough. They must be linked to plans and mechanisms that would engender development in a sustained manner. Indeed, technologies must be disseminated in a way that would provide long-term benefits to end-users.

It is in the light of this fact that I would urge you to consider ways and strategies that would ensure that high quality genetically improved cowpea seeds reach farmers so that the benefits of genetically improved cowpea cultivars could be realized.

Ladies and gentlemen, one of the difficulties in our attempts at ensuring increased productivity of the cowpea crop has been the problem of seed production systems. As you have gathered here, I would entreat you to give much consideration towards the issue of creating viable and effective seed production mechanisms and facilities. There is undoubtedly, the need to address the issue of producing and disseminating seeds to growers, in the light of the failure of seed-production schemes in most African countries. There has been a few, mostly small-scale but promising cowpea seed production operations in this country, which may serve as a model for you in the creation of viable and effective seed production schemes for countries of the continent.

In addition to making recommendations about agronomic and consumer-preference characteristics of genetically improved cowpea resulting from this Project, I will also ask that you consider the development of tentative business models for possible implementation of cowpea production technology.

The problems associated with storage, insect pests, parasitic weeds, viral, bacterial, and fungal diseases of cowpea should also engage your attention. It is my hope that you would take the opportunity to review each of these field limitations, identify those for which new technology or new approaches are available and review the feasibility and potential benefits of technology interventions.

I hope participants would be able to agree on a common strategy towards developing improved technologies to increase cowpea productivity and utilization for the benefit of African cowpea producers and consumers.
We in the Council for Scientific and Industrial Research and indeed Ghana National Agricultural Research System (NARS) look forward to increased collaboration with International Networks such as NGICA and Continental organizations such as the AATF and FARA in public education programmes with objective and balanced presentations concerning positive and negative effects associated with the adoption of these new technologies.

I wish all participants and guests a resounding success in your deliberations and a pleasant stay in Ghana.

Distinguished Ladies and Gentlemen, it is with great honour and pleasure that I declare this Workshop officially open.

THANK YOU.

CLOSING ADDRESS
by
PROF. E. OWUSU-BENNOAH,
AG. DIRECTOR-GENERAL OF CSIR, Ghana.

Distinguished Ladies and Gentlemen

It is my pleasant duty to address the Closing Session of the 3-day International cowpea Stakeholders' Workshop, which had as its theme "Creating a Technology Plan for African Cowpea Farmers and Consumers". The Workshop which was jointly organized by the African Agriculture Technology Foundation (AATF) and the Network for the Genetic Improvement of Cowpea for Africa (NGICA) primarily sought to bring together technical specialists who are interested in increasing cowpea productivity and utilization in Africa. This workshop could not have been held at a more opportune time than now since most African governments south of the Sahara are busy working towards the attainment of the Millennium Development Goals of reducing poverty, hunger, and ensuring food security.

In my Opening Address, I charged participants to consider ways and strategies that would ensure that high quality genetically improved cowpea seeds reach farmers so that the benefits of genetically improved cowpea cultivars could be realized. I am happy to note that participants have worked hard during these three days to develop an attractive project to increase cowpea productivity and utilization for Sub-Saharan Africa.

This workshop has also given the opportunity to some of us to understand clearly the set objectives and ideals of the African Agriculture Technology Foundation (AATF). In my opinion, this is an excellent Foundation, which should be supported by all African governments, and I wish to take the opportunity to commend the founding fathers of this noble foundation. I shall plead with the AATF board that the activities of the Foundation should be popularised for the benefit of poor African farmers. We have also had the privilege to hear more about the Network for the Genetic Improvement of Cowpea in Africa (NGICA). I am excited that this successful stakeholders' meeting in Accra has laid a solid foundation for a cowpea project that would be jointly implemented by the AATF and NGICA. I wish to commend all the Working Groups and their respective Chairmen for the great efforts put in coming out with their recommendations.

Given the complexity of this undertaking, a number of organizations and people have provided their facilities and time to ensure that this workshop succeeded. To all these people and organizations, I say a big thank you on behalf of the organizers.

Sir Southern, who found time to be with us I say thank you. To you the participants, your contributions have been very much appreciated.

I hope participants enjoyed their brief stay in Ghana.

Finally, on behalf of the Government and people of Ghana, I wish you all *Bon Voyage*. Ladies and Gentlemen, it is with great honour and pleasure that I declare the Workshop officially closed.

Thank you, and God bless.

Annex V. PowerPoint presentations

1. Technological Advances IPR, Food Security and Poverty in Africa – Eugene Terry
2. AATF Draft Communications & Development Strategy- Nancy Muchiri
3. Update on NGIOCA Network for the Genetic Improvement of Cowpea in Africa --Ida Sithole-Niang
4. Biosafety Audit – Muffy Koch
5. Socio-economics of Cowpea in sub-Saharan Africa: Production, Marketing and Trade-Ousmane Coulibaly
6. Potential Economic and Trade Impacts of Bt Cowpea- Jess Lowenberg-DeBoer
7. Establishment of a Gene Transfer Protocol for Cowpeas(*Vigna unguiculata*) -T J Higgins
8. Dual Purpose and Fodder Cowpea: Collaborative Research within the CGIAR Systemwide Livestock Programme- Salvador Fernandez-Rivera
9. Potential and Constraints of improved Cowpea varieties in increasing the productivity of Cowpea-Cereals systems in the dry savannas of West Africa - B B Singh
10. Getting technology into Farmers Hands: Increasing farmers income through improved quantity and quality grain production- Ouendeba Botorou
11. AATF/NGICA Workshop on Cowpea productivity and utilization- Cross Cutting Issues – Phelix Majiwa
12. Project Formulation – Phelix Majiwa