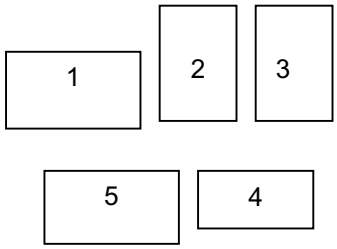
Incentive Measures for Sustainable Use and Conservation of Agrobiodiversity

Experiences and Lessons from Southern Africa

Proceedings of a Workshop

Lusaka · Zambia · 11-14 September 2001



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(1) Nguni bull, K. Ramsey, (2) Seed exhibition Zimbabwe, O. Neuendorf, (3) Mr. Samson Munkombwe from Mudobo Village, Zambia, (4) Discussion Table in Workshop, J. Hagmann,
(5) Local sorghum, Siavonga, Zambia (I. Boto).

Back cover: Workshop participants

FOREWORD

These proceedings share the results of a Workshop that was the first of its kind in the SADC region dealing with identification of incentive measures to enhance the sustainable use and conservation of agrobiodiversity.

The subject 'incentive measures' was chosen because of its high political importance. Article 11 of the Convention of Biological Diversity stipulates that *"Each contracting party shall as far as possible and as appropriate, adopt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity".* This implies that contracting parties need to implement incentive measures. Other articles of the CBD are of importance, e.g. art.13 (provision of information), art.15 (benefit sharing), and art. 16 (technology transfer).

Despite a growing global awareness of the importance of agrobiodiversity little attention has been paid to the need for incentive measures to manage agricultural genetic resources such that they can play a role in poverty alleviation and sustainable development. Next to incentives for farmers, this workshop wanted to specifically include the need for incentives that indirectly support farmers' use of agrobiodiversity, such as in marketing, policy, education and public awareness.

The introductory part of the proceedings contains an introduction to the workshop by the organizing group, the workshop statement by the participants, and the opening addresses. The following part of the proceedings contains the papers underlying keynote and case presentations in the workshop. These presentations formed the basis for identification of incentives and constraints. These were taken up by the workshop participants to further discuss challenges and opportunities, culminating in action plans for the participant country groups. These outputs are reported in the third part of this proceedings and based on the participant-workshop report (www.gtz.de/agrobiodiv).

The workshop and these proceedings would not have been possible without the kind support of a range of organizations. The workshop was hosted in Lusaka by SPGRC. The preparations were carried out by a committee involving the hosting partner, the Ministry of Agriculture of Zambia, Plant and Animal Genetic Resources, CTDT (Community Technology Development Trust), GTZ, IPGRI and CTA. The workshop and proceedings were funded by Sida, IDRC, GTZ, CTA, IPGRI, Hivos and DSE.

The Workshop organizing committee

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CONTENTS

ACRONYMS

ABD	agrobiodiversity
ABS	access and benefit sharing
AnGR	animal genetic resources
CBD	Convention on Biological Diversity
CBO	community based organizations
CGIAR	Consultative Group on International Agricultural Research
COP	Conference of the Parties
DUS	distinct, uniform and stable
FANR	food, agriculture and natural resources
FAO	Food and Agriculture Organization of the United Nations
FFS	Farmer Field School
GEF	UN Global Environment Facility
GPA	Global Plan of Action of the FAO
GR	genetic resources
GURT	genetic use restriction technologies
IK	indigenous knowledge
IKS	indigenous knowledge systems
IPR	intellectual property rights
IU	International Undertaking for the conservation and sustainable use of plant genetic resources
LDC	least developed country
MoA	ministry of agriculture
NEMC	National Environmental Management Council (Tanzania)
NGO	non-governmental organization
PGR	plant genetic resources
PGRFA	plant genetic resources for food and agriculture
PTD	participatory technology development
QDS	quality declared seed
SACCAR	Southern African Centre for Co-operation in Agricultural Research and Training
SADC	Southern African Development Community
SPGRC	SADC Plant Genetic Resources Centre
SSA	sub-Saharan Africa
SSSN	SADC Seed Security Network
TRIPS	trade related aspects of intellectual property rights
VCU	value for cultivation and use
WG	working group
VRC	Variety Release Committee
WS	workshop
ZK	Zambian Kwachas

SUMMARY

The Workshop on Incentive Measures to enhance Sustainable Use and Conservation of Agrobiodiversity had as a principle goal the identification of incentives and disincentives for use and conservation of agrobiodiversity by farmers in Sub Sahara Africa, and opportunities for participants themselves to contribute to implementation of the incentives. The envisioned outputs of the workshop were formulated by a preparatory group. The workshop participants ratified these objectives at the start of the four-day workshop in Lusaka. These were: (1) a common understanding of incentives for agrobiodiversity; (2) state of the art of using incentives for agrobiodiversity; (3) analysis of approaches and incentives in terms of opportunities and constraints in agrobiodiversity enhancement; (4) identification of future thrusts, options to try and workable mechanisms; and (5) elaboration of a follow-up plan of action.

For the workshop, agrobiodiversity was defined as the genetic diversity of crops (including local vegetables and fruit trees) and farm animals that is managed and used by farmer-households. The importance of the system environment in which the farmer-household manages the agrobiodiversity was emphasized.

The preparatory group started from the premise that implementation of incentive measures as foreseen by the signatories of the Convention of Biological Diversity is still weak and that disincentives for sustainable farmers' use of agrobiodiversity seem to prevail. There are, for example, economic incentives (input and produce prices; market possibilities) favouring mono cropping or concentration on a small number of crops. This situation means a disincentive for farmers to grow diversity. Poverty is a serious threat to use and conservation of agrobiodiversity, for example when it concerns indigenous semi-wild growing plants and trees: overexploitation of these resources threatens many of them. Incentive measures can positively affect the sustainable use – and thereby conservation – of agrobiodiversity by increasing the value and appreciation of agrobiodiversity, and thus the possibilities for farmers to benefit from it. It is also important to recognize that incentives can be of economic as well as non-economic character, for example when relating to cultural aspects or when incentives contribute to food security. In addition, incentive measures in areas that are outside the core-agricultural arena are seriously under-addressed, although of paramount importance to sustainable agricultural development.

For the workshop five fields of incentives and incentive measures were identified through which the value and use of agrobiodiversity can be enhanced: farmer-level, market, policy, public awareness and education/training. For each area there were a keynote and two case presentations to serve as an input for the discussions. The full papers of these presentations are compiled in the second part of this proceedings.

The workshop brought together a broad range of expertise by inviting participants from all different stakeholder groups and resource persons. Approximately 80 people participated—mainly from the SADC region; from governmental and non-governmental organizations, national and international research organizations and from development

organizations. Resource persons and experiences were from both within and outside the region.
The effort put into the Workshop by the participants over the four days in Lusaka was considerable. The work has resulted in a rather comprehensive overview of the type of incentives that are applicable and can be implemented to support of use and conservation of agrobiodiversity. However, Genetic Resource policy and regulatory framework continue to be a major obstacle instead of facilitating use of diversity by farmers. In particular, harmonization of the regulation and legislation was identified as an important need for the region. Importantly, it was recognized that incentives are not only needed for farmers, but also for those actors that have to bring about changes and create an enabling environment for farmers and make the use of agrobiodiversity more attractive. The need for 'getting rid of the Cadillac syndrome' and 'thinking outside the box' illustrate key-observations that are particularly relevant for the area of marketing, education and training.

The outcome of the workshop also shows that the activities and incentives in the different fields are not independent and need integrated approaches with collaboration of stakeholders from various fields. In this respect, the ideas and plans that are the final outcome of the workshop are encouraging. They correspond with the expectations of the participants formulated at the beginning of the workshop and make us believe that a basis for joint work in the future is laid. Although promising, an effort is needed to ensure that these plans are put to work and incentives are indeed provided.

What became clear from our Workshop is the fact that there are more activities in Africa that enhance and support farmers' use of agrobiodiversity than most of us expected. An occasion such as this Workshop is excellent for bringing out and discussing the experiences and value of what is actually being done. The fact that this workshop included a diverse range of participants, from governmental and non-governmental institutions, from research, extension and education and from the private sector including farmers has certainly contributed to the value of the exchange of experiences and ideas. It also has stressed once more the need for information exchange on a topic such as Agrobiodiversity Use and Conservation, not only among our close colleagues, but also with others, working in different fields and disciplines.

INCENTIVE MEASURES FOR SUSTAINABLE USE AND CONSERVATION OF AGROBIODIVERSITY

WORKSHOP STATEMENT

The workshop – the first of its kind in the SADC region on incentive measures in agrobiodiversity – was collectively organized by SPGRC, GTZ, CTA, IDRC and Sida to identify incentive measures to enhance the sustainable use and conservation of agrobiodiversity. Workshop participants representing 12 SADC countries, as well as other countries outside the region, came from diverse backgrounds including governments, NGOs, farmers' representatives, private sector, researchers, regional and international organizations.

In the SADC region, more than 80% of the communities depend on agrobiodiversity for their well-being, livelihood and food security. Economic, socio-cultural and policy incentive measures are needed to maintain, manage and use this diversity in a sustainable manner. Specific areas for incentives identified in the workshop are marketing, policies, public awareness, education and training. The incentive measures will increase the range of diversity available to farmers and the options for them to choose. Such incentive measures are critical and important for stimulating initiatives related to conservation and sustainable use of agrobiodiversity. The workshop recognized a need for developing a holistic approach towards mainstreaming agrobiodiversity and integrating the sustainable use of plant and animal genetic resources in the different sectors.

Despite a growing global awareness of the importance of agrobiodiversity, little attention has been paid to the role of incentive measures in managing genetic resources critical to playing a role in poverty alleviation and economic development.

WORKSHOP RECOMMENDATIONS

Participants recommended that in the SADC region there is need to develop new initiatives and promote the formulation of action plans at the following levels:

Community level

- Support community based activities in conservation and use of plant and animal genetic resources such as seed fairs, animal shows, community seed banking and community based management of animal genetic resources, seed exchange activities that contribute to broaden the diversity available at community level and recognize gender dynamics in maintaining diversity.

Policy and legal framework:

- Recognize and protect the rights of smallholder farmers and their knowledge as custodians of agrobiodiversity through policies and legislative framework.
- Develop legislation for access and benefit sharing at national level and the harmonization of such frameworks at regional level based on the African customary law in line with the OAU model legislation.
- Develop a *sui generis* legislation for the protection of new plant varieties.

- Review seed policies and regulations at national level to allow the use, exchange and local marketing of farmers' varieties, and to harmonize them at regional level. There is a need to develop a relaxed seed system, which should accommodate farmers' seed systems.
- Decentralization of seed services is critical and pivotal.
- Strengthen capacities in the context of legislative framework development and implementation at national and regional levels.

Education, training and public awareness

The participants recognized the need for a paradigm shift in the training and education system to participatory inclusive approaches focusing on the reality at farmers' level. This also includes the need for an attitude change by researchers, policy-makers and extension workers and more openness to draw lessons from experience available in other areas.

- Integration of farmers' knowledge, innovation and practices in research and extension.
- Curriculum development and mainstreaming at all levels (primary, secondary, tertiary levels, community schools) to incorporate agrobiodiversity.
- Develop public awareness creation initiatives targeting all relevant stakeholders about the role of agrobiodiversity.

Marketing and adding value

- Add value to genetic resources to increase the sustainable utilization of those resources (through characterization, domestication, participatory breeding, quality enhancement, product development, labelling, etc.) and increase income for farmers.
- Identify and link communities to niche markets (organic production, etc.).
- Create awareness within communities on the value added products.
- Support farmers in engaging in small-scale entrepreneurial activities including offering credit facilities.

Institutional arrangements have to be reviewed with a need for more communication and collaboration between the different sectors and stakeholders at all the different levels. Collaboration between the private sector and the other stakeholders has to be enhanced. Farmers as the custodians of the genetic resources have to play an important role in the development of policies, legislative frameworks, curricula and market opportunities.

Lusaka, September 14, 2001

WELCOME SPEECHES

1. WELCOME BY DR MKAMANGA, HEAD OF SADC PLANT GENETIC RESOURCE CENTRE, ZAMBIA

Mr Chairperson, Dr Muliokela; The Minister of Agriculture, Food and Fisheries; Ms Beate Weiskopf, GTZ; Ms Christine McNab, Sida; Ms Gesa Weseler, CTA; Ms Sheri Anortt, IDRC; Mr Reg Mugwara, Director, FANR

It is my privilege to welcome you to the Workshop on Incentive Measures for Sustainable Use and Conservation of Agrobiodiversity. This workshop is the first of its kind to be held here in Lusaka. Its main purpose is to bring together scientists, non-governmental organizations, administrators and policy-makers from the various SADC Countries, who are involved in the collection, conservation, characterization, multiplication and evaluation of plant and animal genetic resources. Despite the many meetings and workshops held, so far, on the conservation and sustainable use of genetic resources, there seems to be little done to slow down genetic erosion. It is therefore an honour that Sida, IDRC, CTA, GTZ, and DSE considered it appropriate to hold a workshop with all these distinguished delegates present here in Lusaka, Zambia.

Many factors complicate discussions on genetic resources even after the ratification of the Convention on Biological Diversity and adoption of the text of the revised FAO International Undertaking on Genetic Resources for Food and Agriculture, which is likely to become a legally binding document: the FAO International Convention on Genetic Resources for Food and Agriculture. Complications come about because of the vested interests of the public and private sectors, North and South parties and Trade Related Intellectual Properties (TRIPS) of the World Trade Organization. Another field that has exacerbated the debate on conservation and sustainable use of genetic resources is genetic engineering (modern biotechnology). Introduction of genetically modified crops such as maize, cotton and tobacco in countries with limited ability in modern biotechnology and without proper scientific explanation have cast some doubt on the claims of the usefulness of genetically modified crops in both developed and developing countries. I quote Klaus Ammann "Given the complexity of socio-economic, political and ecological problems behind deficits in food security, agricultural biotechnology cannot be a silver bullet or miracle cure for all problems in all countries. A successful battle for food security in the developing world requires battles on many fronts: economy, social policy, gender policy, ecology, water and soil management, agronomy and breeding programmes, agricultural extension, farm management, pest management etc.". New technologies such as agricultural biotechnologies are part and parcel of a successful package.

At this moment, I would like to wish you to have frank discussions and identify realistic incentive measures that would help in operationalizing Articles of the Convention on Biological Diversity. Lastly, I wish all delegates a happy stay in Lusaka. Do not let the tight workshop programme spoil your pleasure and enjoyment.

Thank you very much.

2. WELCOME BY MRS BEATE WEISKOPF, GTZ PROJECT 'MANAGING AGROBIODIVERSITY IN RURAL AREAS', GERMANY, ON BEHALF OF THE PREPARATORY COMMITTEE

Honourable Minister of Agriculture, Food and Fisheries; Dear Chairman; Distinguished Guests; Dear Ladies and Gentlemen,

On behalf of the preparatory committee and also on behalf of GTZ I would like to welcome all of you to this "Workshop on Incentives to Enhance Sustainable Use and Conservation of Agrobiodiversity".

First of all I would like to introduce to you the members of the preparatory committee, on whose behalf I am speaking here:

Mr Charles Nkhoma, SPGRC,
Mr Andrew Mushita, CTDT, Zimbabwe,
Mr Geoffrey Mwila, Mt. Makulu Research Center, Zambia,
Mr Francis Zulu, Ministry of Agriculture, Food and Fisheries in Zambia,
Mrs Conny Almekinders, from the University of Wageningen, Netherlands
Mrs Gesa Horstkotte-Wesseler, CTA
Mr Dierk Hesselbach, GTZ
Mr Ortwin Neuendorf, GTZ
Mr Ehsan Dulloo, IPGRI, Regional Center, Nairobi
and myself.

On behalf of the group I would like to convey my thanks especially to Charles Nkhoma and to Conny Almekinders for the effort they made in the organization of this event. Thanks to SPGRC for hosting this workshop. And many thanks of course to the co-sponsors and co-organizers CTA, Sida, IDRC, who made this important and timely workshop possible and also IPGRI and HIVOS, who will contribute to the proceedings of this event.

Why this workshop on incentives for agrobiodiversity?
First: Based on Article 11 of the Convention on Biological Diversity, which stipulates: "Each contracting party shall as far as possible and as appropriate, adopt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity", the subject incentive measures will be an important issue on the agenda of the meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSSTA) of the CBD this year in November in Montreal.

Second: Quite a lot of information on possible incentive measures is available in the area of environmental protection. IUCN, the World Conservation Union, OECD, UNEP and several others are working on it. But up to now, incentives for agrobiodiversity have not been given high importance in the international discussion.

Next week the CBD Secretariat is organizing a technical workshop in Montreal on incentive measures for the conservation and sustainable use of biological diversity. This workshop will elaborate a proposal to SBSSTA for a future action plan. The organizers are interested in the results of this workshop here in Zambia and we should try to make it possible that they will be

available to them and that they will contribute to a more prominent role of agrobiodiversity in those discussions.

What is an incentive measure?
The following definition is given by the CBD Secretariat: incentive measures are specific inducements designed and implemented to influence the different stakeholders to conserve biological diversity or to use its components in a sustainable manner.

The conservation and sustainable use of agrobiodiversity, however – and especially of the genetic diversity of crops and farm animals: the part of agrobiodiversity we are talking about in this workshop – takes place mainly in farmers' fields. Although a lot of different actors might be involved, these farmers are the people who definitely need incentives to maintain their diversity keeping in mind the current rate of genetic erosion.

Talking about incentives, however, we should also be aware that the removal of negative incentives such as some kinds of subsidies in the agricultural sector could sometimes be more efficient than introducing a whole set of positive incentives.

With this workshop we would like to contribute on one side to have a clearer picture on the role of, conditions for and possible forms of incentive measures for agrobiodiversity and on the other side to operationalize some incentives for agrobiodiversity in the SADC region. The elaboration of an action plan for the SADC region involving the different stakeholders, especially those who are participating in this workshop, is envisaged as an important output.

In closing let me say a few words on behalf of GTZ, especially with regard to the expectations we have of this workshop.

We think that this event is very timely and we expect that the results support decision-makers and their advisors in setting priorities and design and implement incentives for agrobiodiversity either at national and regional level in the SADC region but also at international level by bringing in the results of this workshop into the CBD process. We expect to get funding organizations interested to do more in this area. We hope to see follow-up activities and we as GTZ will be ready to support one or the other measure with our own means.

Thank you for your attention.

3. WELCOME BY DR GESA WESSELER, CTA, THE NETHERLANDS

Honourable Minster of Agriculture, Food and Fisheries, Dr Mkamanga, Director of the SADC Plant Genetic Resources Center and host of this workshop, Dr Muliokela, Chairman of this opening ceremony, Participants, organizers and guests, Ladies and Gentlemen,

Good morning!

On behalf of the Director of CTA, Mr Carl Greenidge, I would like to extend a warm welcome to you all to this workshop on "Incentive measures for the sustainable use and conservation of agrobiodiversity". I thank the organizers for giving me the opportunity to say a few words on behalf of CTA before we move into the main programme of the workshop.

CTA, the Technical Centre for Agriculture and Rural Cooperation, was established in 1983 under the Lomé Convention between the African, Caribbean and Pacific (ACP) Group of States and the European Union (EU) Member States. Since the year 2000 it has operated within the framework of what is know as the ACP-EU Cotonou Agreement, the successor agreement to the Lomé Convention.

CTA's tasks are to develop and provide services that improve access to information for agricultural and rural development, and to strengthen the capacity of ACP countries to produce, acquire, exchange and utilize information in this area. CTA's programmes are organized around the following four principal themes:

Theme 1 deals with developing information management and partnership strategies needed for agricultural policy formulation and implementation, and to evaluate the impact of these strategies on the ACP agricultural organizations we are working with.

Activities under this theme include, amongst others,

- *support to regional policy networks*
- *pilot partnership programmes with NGOs, and*
- *studies, consultations and workshops on topics such as development of market information systems, global agricultural trade negotiations, agricultural extension systems and impact assessment methodologies*

Theme 2 aims at promoting contact and exchange of experience among ACP experts on topics related to agricultural and rural development.

The main activities under this theme are:

- *seminars and workshops, either organized by CTA alone or jointly with other partners;*
- *study visits, and*
- *participant stipends for regional and international conferences*

Three broad thematic clusters guide these activities, namely:

- *market-oriented development*
- *sustainable increase of agricultural productivity, and*
- *environmental protection and natural resources management.*

Through Theme 3, CTA is providing its ACP partners with information on demand. Our main activities here are:

- *CTA publications (including the bi-monthly magazine Spore, which many of you may have seen)*
- *Co-publications together with other publishers; and*
- *A publications distribution service through which CTA is disseminating books and other information products to ACP subscribers*

Finally, Theme 4 aims at strengthening the information and communication management capacities of ACP agricultural organizations by means of

- *training courses,*
- *information and documentation support, and*
- *initiatives to promote the use of modern Information and Communication Technologies.*

Our involvement in this meeting has to be seen in the context of Theme 2 (promoting contact and exchange of information), and in fact, we have become one of the organizing partners in this event, the topic of which is of fundamental importance to food security and livelihoods in all developing countries.

Agricultural biodiversity is a field in which CTA has been active for quite some time. Amongst others, we have helped to publish a number of books on the topic and related areas, such as

- *African indigenous vegetables: an overview of the cultivated species (2000)*
- *The role of smallholder farmers in seed production systems*
- *Seed supply systems in developing countries*
- *Goat breeds of the world*

to name just a few. You can see these publications in the display along the window.

In addition to these publications, CTA has supported participants in a number of conferences which are related to the topic of this workshop, for example

- *Séminaire ouest-africain sur la biodiversité et les ressources phytogénetiques, Ouagadougou, BF (1996)*
- *CABI International Workshop on Biodiversity, London (1996)*
- *Rencontre internationale sur les resources génétiques des plantes en Afrique, Bamako, Mali (1997)*
- *International workshop on genetic diversity: towards a synthesis between crop conservation and development, Baarlo, The Netherlands (1997)*
- *The First Meeting of the Caribbean Plant Genetic Resources Network, Georgetown, Barbados (1998)*
- *IPGRI training workshop on conservation, sustainable management and use of forest genetic resources in sub-Saharan Africa, Ouagadougou, BF (1998); Nairobi, Kenya (1999)*
- *CABI Bioscience Workshop on land-use change and crop-associated biodiversity, Nairobi, Kenya, 2000*
- *Workshop on community-based management of animal genetic resources, Swaziland, 2001*

Furthermore, CTA is co-publishing the English and French versions of the journal "Agriculture and Rural Development", which has addressed the issue of agricultural biodiversity on several occasions.

The December 2000 issue of Spore*, CTA's own bi-monthly magazine, features an article on agricultural biodiversity titled "Ideal partners: the farmer, the planner and the banker". In this article, agricultural biodiversity is defined as "the variety and variability of animals, plants and micro-organisms which are necessary to sustain key functions of the agroecosystem and its structures and processes for, and in support of, food production and food security". As such, agriculture needs the planet's biodiversity and the agricultural community should welcome the world's measures to protect it. However, the story goes on to show that agricultural expansion is often perceived as a major contributor to the loss of biodiversity,*

- *through the conversion of natural habitats to agricultural land,*
- *by replacing naturally occurring plant species by a small number of introduced species,*
- *through the displacement of wildlife, and*
- *the decimation of insects and micro-organisms by pesticides*

This environmental impact ultimately damages the productive potential of agriculture, and mainstream thinking in agricultural policy these days is focused on getting the benefits of biodiversity to apply to agriculture itself.

At the end of the day, and at its beginning, it is food that we need, and for a long time to come it is farmers who will feed us. How can they, in daily, practical terms play a positive role in agricultural biodiversity, so that they too can benefit? How can functioning markets be established, so that the benefits of agrobiodiversity accrue to those deciding whether to conserve it? The article in Spore *argues that "money talks". That is why, in cash terms, some farmers cannot show the regard they would wish for agricultural biodiversity. In the field of agricultural innovation, the story submits that there is in general too little dialogue between the farmer, the planner and the banker, to explore opportunities for the use of credit, savings and finance instruments as incentives to the conservation of agrobiodiversity, all the way along to the village level.*

This is not to say that money is the only incentive for the conservation and sustainable use of agrobiodiversity. It is one, although a crucial one, among many others which I hope we will be able to identify in the course of this workshop, which will provide lots of opportunities for exchange and dialogue. On this note, I would like to close and wish us all a very productive meeting and fruitful discussions, the results of which will be of great interest to CTA.

Thank you!

4. WELCOME BY SHERI ARNOTT, IDRC, CANADA

Dear Esteemed Guests and Participants,

It is with great pleasure that I join all of you at this very important and historic Workshop on Incentive Measures for Sustainable Use and Conservation of Agrobiodiversity.

I work with the Sustainable Use of Biodiversity Programme (SUB) at IDRC. Our Programme focuses on the inextricable link between farmers` knowledge and innovations and the maintenance and enhancement of agrobiodiversity; and seeks to link this research to efforts to create an enabling policy environment for agrobiodiversity conservation. The goal of our programme is to promote the conservation and sustainable use of biodiversity and the development of appropriate technologies, local institutions and policy frameworks through the application of interdisciplinary and participatory research that incorporates gender considerations and local and indigenous knowledge.

To achieve this goal, we support research which:

- *promotes the use, maintenance and enhancement of the knowledge, innovations and practices of indigenous and local communities that conserve and sustainably use biodiversity;*
- *supports the creation of models for policy and legislation that recognize the rights of indigenous and local communities to genetic resources and to the equitable sharing of the benefits of the use of these resources in the context of intellectual property regimes; and*
- *develops gender sensitive incentives, methods, livelihood options and policies that facilitate community-based participation in in situ biodiversity conservation and management strategies.*

Incentives are not a theoretical concept for SUB; they negatively or positively effect the day-to-day decisions that women and men farmers make. We all understand that globally, agricultural policies, amongst others, have had a severe negative impact on the choices available to small-scale farmers, and consequently, on the maintenance of agrobiodiversity. The challenge therefore lies before all of us to explore the many incentives, at the level of farmer (both market and non-market) or at the national and international level (policy) that may serve to enhance the range of decision-making choices available to smallholder farmers around the world.

Thank you!

5. WELCOME NOTE ON BEHALF OF THE SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY, SIDA, BY CHRISTINE MCNAB, SIDA, SWEDEN

Why does the Swedish International Development Cooperation Agency, Sida think this workshop is so important that we are participating as one of the Co-sponsors? I would like to make a few remarks and hope that you will understand their sincerity despite me being an 'outsider', an education specialist in a meeting full of biologists and agriculture experts. Perhaps being an education specialist is not a bad thing in this context, as I can remind you that education is your ally. It can help you reach out with your proposals about what needs to be done.

Biological diversity is the foundation for human life and welfare

Sweden has signed the 1993 Convention on Biological Diversity and all international agreements that have followed in the field of biodiversity. Sweden has thereby undertaken to support the work

done by developing countries for the conservation and sustainable use of biological diversity. Sweden actively participates in the international policy dialogues and work on the integration of the Convention's objectives into Sida's operations is a continuous and prioritized area of strategy development.

When we focus on agriculture we can see that not only is the intrinsic value of biodiversity threatened when crop varieties and agroecosystems are lost, eroded or marginalized, but also that knowledge, earned through centuries, about caring for sustainable farming systems is at risk. In the South, it is particularly women who have played a traditionally important role as custodians of such knowledge. We cannot afford to lose their knowledge.

The promotion of biodiversity in agriculture is one way to improve food security. This can be seen locally, where the present situation of heavy reliance on one staple, maize, contributes to food insecurity and recurrent severe food shortages. Agrobiodiversity can give extra security in conditions of drought and climate change. And it can do more than this. It can be a way of improving income generation as there is a potential for exports. It can also contribute to the resource base for economic development.

Macro economic policy decisions indirectly affect biodiversity. A well functioning liberalized agriculture market and a private agriculture sector could play an important role in sustaining biodiversity and could serve as an incentive to enhance agrobiodiversity. This is why Sida supports policy and strategy formulation processes in this area in a number of countries including Zambia. With appropriate policies in place, biodiversity will enable farmers to optimize the use of natural resources, and this can be reinforced, for example by using appropriate technology and by improving the status of women in agriculture

It is clearly a challenge to find incentives for the enhancement of agrobiodiversity. The points mentioned above involve the direct participation of the farming/rural community. Most of the Sida agriculture sector support takes place at this community level. The projects are also trying to promote incentives to protect and make use of the biodiversity:
Speaking on a more personal note, as a mother and future grandmother, I can see the outcomes of this workshop being a contribution to ensuring that future generations can enjoy the same biological diversity that our generation took for granted. The proposals from this workshop can make a difference, not only in ensuring that the beauty of biodiversity is not lost, but also in ensuring food security for all.

This Workshop will be a challenging one for all the participants. Expected outcomes include recommendations on how agricultural development, through the introduction of improved crop varieties, can be harmonized with the need to sustain agriculture biodiversity. Are there ways for conservationists and development agents to strengthen each other's work towards the goal of food security and poverty alleviation? We believe so, and wish all the participants well in their endeavours to come up with some of the answers.

Christine McNab
Chargé d'Affaires

Torsten Andersson
Senior ProgrammeOfficer
Natural Resources

6. WELCOME BY HON. MISHECK CHINDA, M.P., MINISTER OF AGRICULTURE, ZAMBIA

Chairperson,
It is my honour and pleasure to have this opportunity to officiate at this very important workshop which has drawn participants from the SADC region and with resource persons coming from within Africa and abroad.

Chairperson,
I wish, on behalf of the government of the republic of Zambia and indeed on my own behalf, to welcome you to Zambia and Lusaka in particular. As a country we feel honoured to host the workshop and hope that you will take full advantage and derive the most benefit out of your short visit. It is also my hope that the workshop programme includes some social events that will allow you to interact with the local people and allow you to sample our "Zambian hospitality".

The theme of the workshop "incentive measures for the conservation and sustainable use of agrobiodiversity" is of great importance for the African situation in general and the SADC region in particular. It is well known that the majority of our population directly depend on agrobiodiversity for their livelihood and hence survival. It is also true that there has been widespread concern about the loss of these resources, especially the diversity our local varieties and its possible impact on food security. We also know that most of our rural farmers depend on farm-saved seed as their primary seed source.

Chairperson,
We in the SADC region in general and Zambia in particular are fully aware of the debates and the issues being raised at various fora, with regard to ownership and control of various components of biodiversity, particularly relating to access to genetic resources and equitable sharing of benefits derived from its uses.

It is generally appreciated that our countries in this region, like other developing countries, have a rich reservoir of genetic resources, which have been drawn upon over the years to advance agricultural production and create wealth for most developed countries. The appreciation of the value of these resources by our local communities is limited as the resources are mainly used for local consumption. Appreciation for the value of agrobiodiversity beyond local perceptions needs to be initiated through some deliberate action.

Chairperson,
There is no doubt in my mind that the issue of incentives for the local communities is critical for effective conservation and sustainable use of the agricultural biodiversity available in these communities. We expect that such incentives will have the same effect and impact as the incentives created and provided to plant breeders, the developers of improved varieties and other products arising from the use of genetic resources.

Chairperson,
Zambia and indeed most SADC countries are party to a number of international agreements which are designed to promote the conservation and sustainable use of different components

of biodiversity. A number of these international agreements have addressed concerns of developing countries on the need to recognize the important role that local traditional communities have played and have continued to play in the evolution and conservation of genetic resources. The convention on biological diversity (CBD) to which Zambia is a party contains important provisions for releasing this both at international and national levels. We are also aware of efforts being made in the negotiations for the revision of the international undertaking on plant genetic resources within the FAO commission on genetic resources, in trying to strengthen provisions on benefit sharing.

Chairperson,
You will agree with me that time is fast running out for us to stop or minimize the loss of valuable genetic resources still found in the local communities and realize increased benefit from the use of these resources. This workshop is therefore coming at an opportune time and should provide a platform from which concrete steps and sustained interventions to address thess problems could be made. We have had adequate discussions and now it is time to be serious towards the implementation of these important principles.

Chairperson,
Zambia, through the SADC network, is actively involved in the promotion of agrobiodiversity conservation. The interdependence of nations in terms of exchange of genetic resources particularly relating to agricultural biodiversity underscores the need for international cooperation.

One of the major challenges facing us today, as governments, is whether to meet our obligations to international trade agreements while fulfilling our responsibility to recognize, protect and promote the knowledge and resources of farmers and traditional local communities.

Chairperson,
Let me, at this juncture, commend the organizations that have contributed towards the organization and funding of the workshop who include the German Technical Aid Programme, the German Foundation for International Development, the Technical Centre for Agricultural And Rural Cooperation, the International Development Research Centre, the Swedish International Development Cooperation Agency, the International Plant Genetic Resources Institute, the Community Technology Development Trust, the SADC Plant Genetic Resources Centre and the staff of my ministry.

With the rich diversity of backgrounds of both participants and resources persons, I am confident that the deliberations will be fruitful and experiences derived rewarding.

With these few words, it is now my honour and pleasure to declare this workshop officially open.

God bless you.

SECTION 1
KEYNOTES AND CASE STUDIES

SECTION 2
WORKSHOP RESULTS

INCENTIVE MEASURES TO ENHANCE THE SUSTAINABLE USE OF AGROBIODIVERSITY

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1. INTRODUCTION

The relevance of the topic 'Incentives to Enhancing the Sustainable Use of Agrobiodiversity' becomes obvious once it is recognized that Food Insecurity is a reality that is lived and shared by many in the SADC region. This fact was also recognized by the founding fathers of SADCC (the Conference) 21 years ago here in Lusaka, who identified food security as one area of regional cooperation. This was because the founding fathers of SADC had identified four major concerns namely:

- the imbalance between food production and population growth;
- the lack of trade in agricultural commodities;
- the region is endemic to periodic droughts and yet no budgetary provisions were in place;
- as population growth rose, more and more people moved into marginal land causing environmental degradation, hence undermining and degrading the natural resources base and its biodiversity.

It was around these concerns that the Food, Agriculture and Natural Resources cluster of sectors was formed.

The FANR is a cluster of technical sectors with activities spanning food security policies and strategies, environment and natural resources, agricultural research and development, agricultural trade and related capacity building. The system of coordinating responsibility for the FANR sectors spans five member states (Malawi, Botswana, Namibia, Lesotho, Zimbabwe). It also consists of two SADC institutions, the SADC Plant Genetic Resources Centre (which is co-hosting of this Workshop), and the other being the Regional Early Warning System.

In the rest of this paper we will explore the relevance of addressing Agrobiodiversity and incentive measures to support its use and conservation, focusing in particular on the SADC region.

2. AGRICULTURE AND AGROBIODIVERSITY

Agriculture is historically the first example of globalization, since the cultivation and domestication of the world's major crops and livestock spread from eight to ten centres of origin to all the continents of the world. Of late, there have been some profound changes with regards to public research and development, which has been for the most part a public good. Public research has been the main vehicle of transmission of agricultural development

throughout the world. The battle now is between the provision of public good research versus the profit motive. The latter is characterized by motivation of developing a single product with the widest application and ideally limiting the sources of that product to a single product so as to satisfy the profit motive of such companies. The process of homogenization of products clearly undermines DIVERSITY.

In recognition of these developments the FAO Commission on Plant Genetic Resources is a non-binding international undertaking on Plants Genetic Resources to be formed. This status has just very recently been changed to a binding one. The agreement is to ensure collection, conversation, sustainable use and continued free flow of germplasm for crops and ensure food security for all. The rationale was that diversity of germplasm provides insurance for crops against changes in climate, the impact of pests and the incidence of disease.

Yet the dramatic concentration of agro industries, the rise of agro biotechnology, and the coming into force of the Convention on Biological diversity WTO Agreement on Trade Related Aspect of Intellectual Property Rights have erected fundamental changes in the dynamics of the use of and, above all, OWNERSHIP and TRANSFER of biological material.

This workshop will focus on genetic diversity of crops and farm animals. It is a wide and complex area to discuss in one workshop but is also necessary to realize that crop and animal diversity are only a relative small part of the total biological diversity or agrobiodiversity that we need to be concerned with. Thus crop and animal genetic diversity function in a wider context of agrobiodiversity.

3. AGRICULTURE AND NICHE SIMPLIFICATION

In the context of this Workshop, our interest is the optimization of biomass production in the crops and/or domestic animals that we use for food or for other purposes, which is what constitutes agriculture. In nature, species that grow together often exploit different niches of the same ecosystem. This is clearly seen in a forest in the adaptation to differing light intensities by plants of differing height, as well as differing sizes, shapes and angles of leaves. Similar niche specializations occur, involving adaptations to various other environmental factors as well, e.g. soil depth. In a monoculture, only one niche is used, and all the individuals of the crop or animal species that could use them are not present.

The species of crops and domestic animals form the biomass, which we want to maximize. These species are usually fewer in number than those that naturally grow in that ecosystem. Even when based on a polyculture, therefore, agriculture reduces niche utilization in the agroecosystem. Hence, it also correspondingly reduces the positive responses made by the components of the agroecosystem in reaction to the negative signals of the natural homeostatic processes. Therefore, the agroecosystem fails to adjust as effectively as the ecosystem it has replaced, and deterioration sets in. That is why losses of structure and fertility of the soil occur. The hydrological cycle then gets disrupted, often resulting in soil erosion and sedimentation.

Many civilizations have been eclipsed by such agriculture-induced devastations, e.g. owing to salinization in the Tigris and Euphrates Valleys, and owing to soil erosion and sedimentation in Ephesus.

4. TECHNIQUES USED BY FARMING COMMUNITIES TO COMPENSATE FOR THE LOSS OF ECOSYSTEM COMPONENTS

Over the thousands of years of the history of agriculture, farming communities have learnt various biological and physical methods of coping with the problems of loss of components of agroecosystems, e.g. terracing and fallowing. But perhaps the most significant and of most relevance to us in the context of agrobiodiversity are those that make the conscious use of species to provide positive reactions to the agroecosystem's negative feedbacks. For example, mixed farming, i.e. combing crop and animal production, enables effective balancing between biological production and consumption. It also enables placement of the decomposing organic matter (manure) precisely where it is needed most in the agroecosystem. The use of human waste as manure reduces organic matter and nutrient leakage from the agroecosystem. Deep-rooted crops bring leached nutrients up to the surface soil. Legumes fix nitrogen to replace what is denitrified and lost to the atmosphere. Sorghum and similar crop species withstand dry spells which agriculture exacerbates by deforesting the land. Teff and similar species slow down their growth to survive waterlogging, and rice even grows optimally under waterlogged conditions, which is is also exacerbated by deforestation. These various techniques of bringing about the positive impacts of agrobiodiversity on the agroecosystem can be made to occur simultaneously by planting the species in polycultures and/or sequentially by crop rotation in monocultures or in polycultures.

The physical methods developed by farming communities reduce or prevent soil erosion, reduce loss of water from the soil, drain the soil to reduce excess soil water, or bring in water for irrigation. Both irrigation and drainage can influence the physics and or chemistry of the soil, e.g. by causing salinization. They have thus caused much loss of good soil and biodiversity. But, used in combination with appropriate biodiversity and, as needed, other physical structures, they can be effective.

5. INDUSTRIAL AGRICULTURE: CREATING AN ECOSYSTEM MARKET

Industrial agriculture tries to produce a homogenous environment irrespective of the distinctiveness of the pre-existing ecosystem. It therefore uses irrigation extensively, often thereby geographically extending the age-old problems associated with it. It divorces animal production from crop production. It plants single variety monocultures as a continuum over very extensive areas. Ecosystem disruption thus becomes inevitable. One indicator of such disruption is the regular and quick collapse of crop varieties owing to emerging vulnerabilities to diseases and pests. This keeps breeders employed. It also gives the suppliers of pesticides and herbicides a captive market. Nutrients are leached out and washed away and have to be externally supplied at regular intervals. This gives chemical companies a captive market. Soil structure deteriorates and compaction becomes a serious problem. This gives agricultural machinery companies a captive market. The natural components of the ecosystem are thus replaced by tradable artificial components that are bought and sold in the market.

6. AFRICA AND THE ECOSYSTEM MARKET

Assuming that with these purchased replacements agroecosystems can achieve the same level of homeostasis as the natural ones, there would still be an objection to them: why pay when you can take the same free from nature? When it is realized that the suppliers of these replacement agroecosystem components are from industrialized

countries and the African farmer is getting into dangerous dependency, industrial agriculture as it stands now globally, should be feared by Africa. Since food is absolutely essential, the production by Africans within Africa of these substitute ecosystem components would then have become the top priority of the time.

In fact, these purchased ecosystem components do not make a homeostatic agroecosystem. They combine to destroy steadily the natural components of the agroecosystem. Unlike the natural components, these replacement agroecosystem components do not respond to feedbacks effectively. Therefore, the more they replace the natural components, the less homeostatic the agroecosystem becomes.

The suppliers of these replacement components want to increase their markets and they often come up with highly marketable quick-fixes to the market, creating fundamental problems. The most recent quick-fix, genetic engineering, is being championed not as a means of improving homeostasis, but as a means of producing crops that will grow in degenerating agroecosystems. The logical end result of degeneration is destruction. If transgenic crops can grow in an environment under destruction, it could lull us into accepting degeneration until it is too late to reverse it! As it is, so far genetically engineered crops have been used only to put more disruptive factors into the agroecosystem: poison to invertebrate animals in the case of Bt transgenic crops, and universal poison to other plants in the case of herbicide tolerant transgenic crops.

Without giving the issue much conscious thought, Africa is being lured into the agroecosystem market by industrialized countries. The forces of lure that can case a lapse in clear thinking about the issue are several.

One lure is that of turning Africa into a Europe by mere imitation. The thinking on development in both Europe and Africa is usually linear. It assumes that, if we in Africa are to develop, we must do what Europe has done. This makes us lose sight of the fact that Europe has been, and is, making many mistakes, which we can avoid. The industrialized countries are realizing their past mistakes in managing their agroecosystems and, as a reaction, they now have developed an ‘organic products’ market to stimulate corrective action. Their organic products supply a fast-growing niche market. Presumably in order to protect this niche market, the products have to satisfy some requirements that may have little to do with agroecosystem homeostasis. For example, they completely prohibit the use of chemical fertilizer. If an area is already deficient in a nutrient, say potassium, it would only help restore homeostasis at a higher level of production if a measured amount of potash were applied to kick-start the process. From then on, this increased production can be maintained by homeostatic feedbacks provided, of course, that the waste from the use of the biomass produced is returned to the agroecosystem. The criteria should, therefore become more robust to enable the effective restoration of homeostasis to the abused ecosystem. Even as the criteria now stands, much of Africa can, with little effort, produce for the growing organic food niche market of Europe and North America.

A second lure is technical and financial aid, which is effectively used by Europe and North America to make Africa adopt the new ways which they choose for it.

This lure is reinforced by the demand or assumed demand of the markets of the industrialized countries for a specified homogenous agricultural produce. Often, in fact, the market is fickle and it disappears after the assumed change in agriculture has taken place in Africa. For example, DDT and other pesticides were in the past pushed on Africa by the industrialized countries. Now, their continued application by Africa is used by those same industrialized countries as a reason for rejecting African products. This is a neat way of pre-empting competition. The prevaricating attitudes of industrialized countries towards eliminating subsidies as desired by the preambular paragraphs of the Agreement on Agriculture of the WTO is consistent with this view that they scheme among themselves to pre-empt emerging competition from developing countries.

The fourth and perhaps the most potent lure is the appeal to the African young of the European and American agricultural education systems. Both when we teach within Africa and when we send our young to industrialized countries, we use European and or American curricula and teaching materials. Young Africans are thus taught that the agroecosystem components have to be bought and sold, and they put them all in the market when it is not necessary in the belief that they are modernizing Africa. The industrialized countries use the argument that labour is expensive when they bring about trade in many of the agroecosystem components, e.g. the use of herbicides to avoid hand weeding. The educated African does not consider the massive unemployment when she/he accepts this trade in it.

It is time that the industrialized countries wake up and regulate the destructive marketing of replacement components of the agroecosystem. In Africa, this marketing is still not complete in spite the wishes of its elite. Thus we can and should reign in our elite and resort to helping re-establish homeostasis to the African agroecosystems: Nature is very quick at healing itself if it is given a chance.

7. THE NEED TO CONSERVE AGROBIODIVERSITY

The important role of agrobiodiversity in the functioning of agricultural systems means that we are concerned with the loss of genes, which are the basic building blocks of agrobiodiversity. This concern has always existed among farmers; there are multiple examples of farmers who maintain crop and animal genetic diversity for their own present and future use. The introduction of ecosystem components of the industrial agriculture in the form of improved varieties and input technology has in the last century led to an accelerated disappearance of genes from farmers' fields. The Green Revolutions had – like most revolutions – victims and losses. The call for conservation of genetic resources in gene banks, *ex situ,* was soon heard, but also criticized for its unavoidable shortcomings. This has altogether emphasized the importance of maintaining genetic diversity *in situ*, in farmers' fields, as a conservation strategy that is complementary to *ex situ* conservation.

In situ conservation of crop varieties and animal breeds inevitably requires that farmers continue to utilize them. This means that farmers have to be strengthened, protected, and supported against the negative impact of agroecosystem components from the industrial agricultural. This requires, initially attention to what farmers are doing and how they can directly be assisted in developing improved ecosystem components and techniques that fit their conditions. It also requires, however, important efforts to resist the every increasing lures that our society seems to face. Alternative policies for agriculture and management of genetic

resources, marketing and education are to be defined in order to create space for positive incentives for use of agrobiodiversity.

8. INCENTIVE MEASURES FOR MAXIMIZING THE USE OF AGROBIODIVERSITY

Because agrobiodiversity provides services to mankind as whole, and because information, market and policy fail to realize the full value of these services for their direct custodians (principally farmers), biodiversity is not utilized and managed in a sustainable way. The Convention of Biological Diversity therefore recognizes the importance of incentive measures that make up for the costs of loss of biodiversity in the activities that lead to this loss, and aim to provide information, support and incentives to sustainably use or conserve biodiversity. Hence, it encourages all contracting partners to "…adopt economically and socially sound measures that act as incentives for the conservation and sustainable use of components of biological diversity" (Article 11).

In other words, incentives can be positive and thus encourage required developments. They can also be perverse and thus hinder required developments. The agrobiodiversity incentives that now exist are, on the whole, perverse and they lead to agrobiodiversity loss. Positive and negative incentives can have a financial character (direct or indirect subsidies), but non-financial incentives are at least as important to consider and are hidden in the lures of policy, market, education and public awareness.

8.1 Perverse incentives

The trade in replacement components to create the same homogenous agroecosystem in all areas necessarily ends up by eliminating the agrobiodiversity that originally grew in these agroecosystems. This is the main global cause of the disappearance of crop species and varieties, domestic animal species and breeds, and agricultural soil animals, fungi and bacteria. It is not only the concerted effort of the private sector to create markets for its own products that is the cause of all this; there are also direct and indirect subsidies for the marketed replacement agroecosystem components that make the biological management of agroecosystems financially less attractive than the purchased unstable replacement agroecosystems.

8.2 Direct subsidies

All the industrialized countries subsidize agriculture to varying degrees. The agriculture of developing countries, on the contrary, has, on the whole, to subsidize the educational and health services, the building of infrastructure, and in particular the expansion of the pampered but often not very effective industrial sector. This puts the agrobiodiversity intensive agriculture of the farming communities of the South globally at a disadvantage. The Agreement on Agriculture of the World Trade Organization claims to aim to eliminate these agricultural subsidies. In practice, the Agreement is being used for interminably arguing between North America and Europe without significantly reducing their subsidies. The Agreement on Agriculture is, therefore, being used merely as a smokescreen to maintain existing Northern subsidies to industrial agriculture to the detriment of agrobiodiversity. By contrast, the hitherto unsubsidized agrobiodiversity rich agricultural systems of the farming communities of the South are prohibited from receiving subsidies on the argument that these would be new. Accepting new subsidies would go counter to the aim of the Agreement. Why

should old 'sins' be tolerated and only new ones condemned? This absurd situation prevails presumably because it is only by stimulating trade in agroecosystem components that these industrialized countries can maintain their lead in agriculture.

8.3 Indirect subsidies

Indirect Northern subsidies, which do not at all figure in the Agreement on Agriculture, are even more damaging. For example, tropical 'subsistence' agriculture uses about 30 times the energy in the form of biomass for each unit of energy coming out of the agricultural production process. But agriculture in the UK uses up 75 times (or 7500%) more energy than African 'subsistence' agriculture. Who pays for the energy subsidy in the UK? Conversely, if the African and other Southern subsistence farmer sold her/his produce at the international market without competition from produce that has not internalized its costs of production, would she/he not dominate the world food market? Would that not restore agrobiodiversity in agriculture?

It may be argued that the 'subsistence' farmers would not produce enough food for the world. It should, however, be pointed out that there is no 'subsistence' farmer that does not sell some produce when the opportunity arises. Therefore, competitive situations would stimulate the 'subsistence' production. And perhaps even the energy consumption for production purposes might increase, but not by the same rate as in industrial agriculture.

8.4 International moves to give incentives for the maximization of the use of agrobiodiversity

Local farming communities which are not seriously affected by the global market in replacement agroecosystem components are the maximizing users of agrobiodiversity. The CBC, especially in Articles 8(j) and 10(c), was the first international legal instrument that recognized the role of local and indigenous communities in the conservation and sustainable use of biodiversity, and their rights to be consulted when their biodiversity or their related knowledge and technologies are used by others. It also recognizes that those using the biodiversity or technologies should give a fair share of the benefits arising from the use to the local and indigenous communities. It expects countries to provide incentives to those who conserve and sustainably use agrobiodiversity (Articles 11 and 20 (1)), and hence to their local and indigenous communities. The detailed mechanisms of implementation of these rights are being developed under the CBD. Decisions III/14 of the Third Conference of the Parties (COP) of the CBD, which took place in Buenos Aires, Argentina, in November 1996 and Decision IV/9 of the Fourth COP of the CBD, which took place in Bratislava, Slovak Republic, in May 1998, have defined some of the rights of local and indigenous communities and also initiated moves to establish clearly stipulated rights. The most important of these moves is the creation of an "Ad hoc Open-ended Working Group" on the issue.

Starting from the CBD, the negotiations on the Revision of the International Undertaking on Plant Genetic Resources for Food and Agriculture (IU) under the auspices of the FAO have recognized Farmers' Rights, with the determination of the specific nature of those rights being left to each national law. Any state can thus legally recognize Farmers' Rights as a set of rights that the farming community itself recognizes as its own under its own customary (usually unwritten) laws.

Africa has developed such a Model Law for the Protection of the Rights of Local Communities, Farmers and Breeders and for the Regulation of Access to Biological Resources. African countries are domesticating the model law.

Farmers' Rights to use farm-saved seed will cushion Africa's farmers from the forced purchasing every season of seed to plant. This forced purchasing is effected by someone, usually a North-based transnational corporation, patenting the seed that the farmers want, intend, or even coerced, to plant. That is why the African Model Law prohibits the patenting of living things. This way, it tries to protect small-holder farmers from being controlled by companies and to help the farming communities to continue maximizing the use of agrobiodiversity and biological systems to maintain their agroecosystem at a homeostasis of a high level of productivity.

For this reason, the Agreement of Trade-related Aspects of Intellectual Property Rights (TRIPs) of the WTO is being championed by UPOV and WIPO, who are accusing Africa of violating TRIPs. In spite of what they say, however, the relevant provision in TRIPs, which is Article 27.3(b), does not state that seed has to be patented, it can be protected through Breeders' Rights.

Article 6 and 8 of the CBD require countries to conserve and sustainability use biodiversity, and Articles 11 and 20.1 require countries to provide incentives to those who conserve and sustainably use biodiversity. Following from this, the Third COP of the CBD made 2 decisions which are important for agrobiodiversity. Paragraph 9 (b) of Decision III/9 states that countries should "suppress or migrate negative incentives having a deleterious effect on biological diversity." Decision III/18 gives further detail on how this would be achieved.

Decision III/11 is a concise though detailed enough recommendation to countries on how to maximize the use of agrobiodiversity in agriculture. Even though the implementation of this decision has, on the whole, been poor so far, it can be used by Africa to good effect by putting it into practice in the context of the Community Rights and Farmers' Rights of the Model Law.

9. POSSIBLE NATIONAL MOVES IN AFRICA

As pointed out already in section 2.5, much of the agricultural produce of Africa's farming communities would qualify as 'organic' in industrialized countries. There is, therefore, need for the ministries of agriculture and trade in African countries to develop organic product certification systems that would be acceptable in Europe and North America. African foods could thus easily get into the global 'organic' niche market.

In fact, a new niche market could also be created. With some public relations exercise, African food products could be rightly described as coming from agrobiodiversity rich agroecosystems, and buying them as a means of conserving and sustainably using biodiversity.

Direct subsidies to agrobiodiversity rich community farming systems are unlikely in Africa because the agriculture sector subsidizes rather that being subsidized by other economic sectors. In any case, since African countries are already in the WTO without having had such agricultural subsidies registered, they will be prevented by the Agreement on Agriculture from

providing then to their farming communities. They could fight back through Articles 11 and 20.1 of the CBD and paragraph 12 of Annex 2 of the Agreement on Agriculture. Since, as already pointed out in Sections 2.4 and 2.5 of this paper, industrial agriculture is a major threat to the conservation and sustainable use of agrobiodiversity, the last part of Article 22.1 of the CBD could be invoked to challenge the Agreement on Agriculture of the WTO. Article 22.1 of the CBD states that when "a serious damage or threat to biological diversity" is encountered, rights and obligations entered in other international legal instruments can be set aside in order to make it possible to create a solution to the problem, perhaps along the lines of Paragraph 12 of Annex 2 of the Agreement on Agriculture. This paragraph exempts environmental programmes from having to have their subsidies removed, and agrobiodiversity is a major environmental issue. But, since the monetary incentive Africa would give, if at all, is small anyway, there is no need for a confrontation on this issue.

10. CHALLENGES FOR THE WORKSHOP

It is a challenge of the participants in the workshop to identify incentives based on experiences from Africa and elsewhere. You will share experiences with positive and perverse incentives in a range of areas. Marketing and Education are two of these areas, which have tremendous impact on what happens with our future. Awareness raising is a cross-cutting area that plays a very important role in changing policies; in policies related to agriculture and environment, but also on marketing and education policies. Finally, it is the policy that has the responsibility to create an enabling environment in which new ideas; new initiatives and incentives can be accommodated. However, policy does not change by itself. It changes through pressure and influence, stemming from successful examples, initiatives and from various actors in society. The challenge for the participants is to contribute to the pressure for such a more enabling policy environment. In the end, our ultimate objective of this process we have begun is to give the African farmer choice – to choose what is practicable and sustainable. They usually make the rational choice if given the opportunity. Let this Workshop provide the impetus to create such and opportunity.

INCENTIVE MEASURES AT THE FARMERS' LEVEL TO ENHANCE USE AND CONSERVATION OF AGRICULTURAL BIODIVERSITY

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1. INTRODUCTION

This paper draws on work conducted by various collaborative partnerships over the past five years: by the Intermediate Technology Development Group and the Overseas Development Institute in Kenya and Zimbabwe 1997–2000; by Saskia van Oosterhout and Elizabeth Cromwell in Zimbabwe 1995–1997; and by Rowland Chirwa, Elizabeth Cromwell, Patrick Kambewa, Richard Mwanza, and Kwera Development Centre in Malawi 1999–2000. It also draws on ideas developed in a paper for the Linking Policy and Practice in Biodiversity project of the UK Department for International Development which was co-authored by Elizabeth Cromwell, David Cooper and Patrick Mulvany during 1998–1999, and on information on plant and animal genetic resources in a paper by Conny Almekinders and Ilse Köhler-Rollefson prepared in 2000 for the GTZ Managing Agrobiodiversity in Rural Areas project. The full reports for these projects are highlighted in the bibliography at the end of this paper.

I wish to acknowledge fully the contribution of all the individuals and organizations involved in the work referred to here, but responsibility for any errors or omissions in presentation or interpretation in this paper lie with me alone. We are grateful for funding for the work provided by UK Department for International Development, UK Darwin Initiative and GTZ.

Most of the projects reported in this paper focused on crop aspects of agricultural biodiversity and so this paper reports mainly on farmers' relationship to crop biodiversity and incentives for conserving it, although also touching on animal genetic resources and other aspects of agricultural biodiversity. However, there is little integration between the management of animal and crop biodiversity considered most relevant for conservation at community and project level: these animal and crop genetic resources are used by different communities (pastoralists vs. sedentary farmers); the lower multiplication rates and longer reproductive cycles of animal genetic resources mean that the population dynamics of animal genetic resources are more comparable with perennial crops than with annual field crops and this influences the technical options for use and conservation.

This paper first discusses various dimensions of the relationship between farmers and agricultural biodiversity, and then assesses the values different stakeholders place on agricultural biodiversity. It then sets out potential local and policy interventions for supporting the use and conservation of agricultural biodiversity on-farm, and concludes by identifying two key challenges for providing support to agricultural biodiversity conservation on-farm.

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2. FARMERS AND AGRICULTURAL BIODIVERSITY

Agricultural biodiversity plays an important role in all agroecosystems. It is wide in scope and complex interrelationships are involved. Farmers add or remove components according to how well they meet specific goals and fit with farmers' asset base – these change over time. Poorer farmers rely heavily on agricultural biodiversity but may have difficulty in maintaining it and accessing it; richer farmers are better able to maintain it and should be encouraged to share it.

Many people think only of the most visible components of agricultural biodiversity such as crops and animals, but it is important to remember that agricultural biodiversity refers to all the variety and variability of living things in the agroecosystem, including plants, animals and micro-organisms at genetic, species and ecosystem level. The wide scope of agricultural biodiversity is illustrated in Table 1.

Table 1. Scope of agricultural biodiversity by biological taxa

Taxa	Scope
Plants	Crops and their varieties Harvested and managed wild plants for food Trees on farms Pasture and rangeland species
Higher Animals	Domestic animals and their breeds Wild animals Wild and farmed fish
Arthropods	Pollinators (e.g. bees, butterflies) Pests (e.g. grasshoppers, greenflies) Predators (e.g. wasps, beetles)
Soil biota	Organisms (e.g. earthworms) Microbes (e.g. Rhizobia, fungi, disease-producing pathogens)

Many of the less visible components of agricultural biodiversity are just as vital for sustaining the agroecosystem. For example, soil biota contribute to nutrient recycling, arthropods are important for pest control and pollination. These are essential processes for ensuring the continued functioning, resilience and productivity of ecosystems in which plant and animal components of agricultural biodiversity provide food, medicine, timber, etc.

Agricultural biodiversity plays an important role in all agroecosystems – although in industrial-type agriculture there may be less diversity in the higher plants and animals, insects and micro-organisms can still be vital. For example, honeybees are vital for pollination in plantation agriculture; insects and spiders make significant contributions to pest control even in industrialized rice monoculture (Settle *et al.*, 1996; Kenmore *et al.*, 1998).
The wide scope and complex interrelationships in `agricultural biodiversity' – particularly the more visible components – are clearly understood by farmers. In our research in Kenya, for example, farmers ranked *seven* types of agricultural biodiversity as important to them: livestock, seeds and biodiversity in farming systems, rivers, soils, and wild fruits and vegetables (ITDG, 2000).

Many research studies now agree that farmers assess agricultural biodiversity in functional terms (see, for example, Jarvis and Hodgkin, 1997; Teverson *et al*., 2000; as well as our own studies in Kenya and Zimbabwe), and use or abandon it accordingly. In terms of crop diversity, this means they add or maintain crops and varieties in their farming system to fulfil a range of specific goals: optimum yield across ecological niches (soils, water, disease risk across species); and risk mitigation between seasons (drought, disease over time); different end uses (human consumption, sale, animal feed, building materials, medicines, etc); cultural traditions (for celebrations and festivals).

Farmers interviewed in Kenya and Zimbabwe understood and valued agricultural biodiversity in terms of this totality and found it hard to discuss the contribution of individual components – such as crop diversity – in isolation (ITDG, 2000, 2001). This affects the kind of incentives that will encourage farmers to conserve agricultural biodiversity on-farm, as we shall see later in this paper.

On top of this, our research indicates that the mix of agricultural biodiversity in any one agroecosystem is determined by farmers' asset base. Assets can be defined as "a wide range of tangible and intangible stores of value or claims to assistance" (Swift, 1989:11) consisting of the natural, social, human, physical and natural capital available to farmers (see Appendix B for more details). The assets that influence the mix of agricultural biodiversity include:

- underlying ecological conditions (e.g. rainfall, soil type);
- farmers' knowledge and skill in managing agricultural biodiversity on-farm;
- farmers' ease of access to agricultural biodiversity off-farm from neighbours, wild areas, formal sector breeders, which depends on their labour, cash and knowledge and also on cultural and religious links;
- farmer's access to other capitals (e.g. agro-chemicals) that can substitute for natural capital (e.g. land and the agrobiodiversity within it).

In general, in traditional African small farmer agricultural systems that are less integrated into the market network, farmers rely heavily on the available land, water resources and agricultural biodiversity for their food, fodder, medicine and building materials. They try to minimize risk by growing a wide range of crops and varieties in order to increase stability and improve productivity. Crop diversification can thus be an important strategy for coping with the risk and variation inherent in traditional agricultural systems. This was clearly acknowledged by farmers questioned about the components of sustainable agriculture in Malawi in 2000 (Cromwell *et al*., 2000: 23-29). Local animal breeds are usually better adapted to the harsh conditions with lower feed quality and higher disease pressure than are modern breeds.

This is particularly important for poorer families, who have few other assets at their disposal. However, for crop diversity various dimensions of the low asset base typical of poorer families may give them problems maintaining and accessing diversity: the poor on-farm environment; the smaller holding; the limited cash resources; and the weaker social ties.
Regression analysis using one of the data sets for Zimbabwe (Cromwell and van Oosterhout, 2000: 230) showed that at household level there is a positive correlation between the number of crops and varieties grown and various dimensions of wealth: larger farms; a good on-farm environment (meaning few pests and fertile soils); secure sources of seed; and good extension contact. Other work has also identified this link, including one of the projects profiled at this workshop (Mulila-Mitti, 2001). Subsequent research in Kenya and Zimbabwe

(ITDG, 2000, 2001) showed that these factors have a positive effect because they permit a wide range of crop management practices. For example, on larger farms with good soils, there are the space and growing conditions to cultivate a range of different crops and varieties. High value attached to crop diversity was also shown to be significant; this appears to be related to age and gender (ITDG, 2001).

Of course, individual farmers' goals change over time, in response to changes in family composition, and changes in on- and off-farm opportunities. Their asset base can also change, for example as farmers' acquire more land, or access new varieties. These sets of changes lead to change over time in the mix of crops and varieties grown by an individual household. Changes in the mix of crops and varieties in response to changes in goals and assets have been documented in numerous different studies – see, for example, Thurston *et al.* (1999) for beans in East Africa; van Oosterhout (1996) for small grains in Zimbabwe; Cromwell and Zambezi (1993) for a range of crops in Malawi.

In the communities studied in Kenya, Malawi and Zimbabwe, family and neighbours are much preferred as off-farm seed sources; shops, agricultural research and extension, and relief handouts are mistrusted, because the varieties and quality of seed distributed by these sources are difficult for farmers to assess and may not be appropriate to their needs. Our research showed a majority of farmers give out some seed each year, without being 'seed specialists'.

Seed exchange also forms a major part of social relations – for example, marriage celebrations – as it does elsewhere in the sub-continent (see also Richards, 1996).

3. VALUING AGRICULTURAL BIODIVERSITY

> *The majority of farmers in typical African small-farming systems value agricultural biodiversity for the contribution it makes to their production and livelihood goals. Up to now, as stakeholders using agricultural biodiversity directly, they have had very little voice or market power. In the future, there may be some countervailing changes which will make it easier for these stakeholders to access agricultural biodiversity and use it sustainably. Although farmers in traditional African small-farm agriculture value having a wide* range *of agricultural biodiversity, there is no guarantee that* specific *crops and varieties and animal breeds will be maintained, as this depends on the incentives provided by the national policy framework.*

Farmers. In Zimbabwe, 85% of farmers participating in our research wanted to maintain or increase the number of crops and varieties they grow. In Malawi, farmers ranked crop diversification (growing a range of staple crops) top out of 15 indicators of sustainable farming [Cromwell *et al.*, 2000:23-29]. From this, we conclude that many farmers in typical African small-farm traditional-type agricultural systems find crop diversity makes a useful contribution to achieving their production and livelihood goals. Poorer farmers may be particularly reliant on agricultural biodiversity but have greatest difficulty in maintaining it on-farm. Richer families are able to maintain agricultural biodiversity on-farm and to source seed more easily, although they have less need of it for meeting production goals (because the land they farm is higher quality and more uniform) and may be more interested in it for consumption and social/cultural reasons.

Other stakeholders. Appendix A lists the different stakeholders with an interest in agricultural biodiversity. Up to now, stakeholders using agricultural biodiversity directly for sustainable livelihoods (i.e. farmers in traditional and industrial-type agriculture, providers and users of traditional medicine) have had very little voice or market power, whilst stakeholders with an interest in controlling access to agricultural biodiversity in order to capture its value (i.e. 'life science' companies researching and selling agrochemical, food and medical products) have been much more powerful. This has particularly been the case for crop genetic resources; the opportunities for applying modern biotechnologies to animal genetic resources are more limited and patenting of living animals has not been widely accepted. Even if it were to become more acceptable, compared with seeds, animals are bulky, harder to transport and multiply, not required by individual farmers in such large quantities each year, and their use is not tied into the use of accompanying agrochemicals in the same way.

In the future, there may be some countervailing changes:

- The end (through the WTO negotiations) to the global system of agricultural subsidies promoting industrial-type agriculture is leading to the development of new agricultural practices and technologies that are more biodiversity-friendly;
- The increasing voice of consumers demanding environmentally friendly agricultural production processes;
- The increasing recognition of cultural values and indigenous technical knowledge and promotion of benefit-sharing in important treaties such as the Convention on Biological Diversity.[2] Treaties are an important means of reaching agreement on agricultural biodiversity issues because the stakeholders involved have such dramatically different voice and market power.

4. INCENTIVE MEASURES AT FARMERS' LEVEL

At present, there is inadequate information for designing incentives for conserving specific animal breeds. A few options are available; these will probably need to involve the entire community, which can be difficult and time-consuming. There are more options available for providing incentives to maintain a wide range *of agricultural biodiversity; these focus on improving access to and use of information about available genetic resources for all members of the community, preferably based on community knowledge and capacities. Incentives for conserving specific crops and varieties require re-examination of national agricultural development strategy. The relative costs and benefits of these policy changes, as well as their practicality, would have to be weighed up against other national development objectives.*

As detailed above, we see that farmers in traditional African small farm agriculture value having a wide *range* of agricultural biodiversity for the functions it can fulfil within the farming system. However, the precision composition of farmers' agricultural biodiversity 'portfolio' changes over time in response to changes in their livelihood goals and asset base – there is no guarantee that *specific* crops and varieties and animal breeds will be maintained.

4.1 Animal genetic resources

Support to farmers' use and conservation of animal genetic resources has hardly been developed. More information is needed on the species and breeds that are under pressure,

[2]For more information on the Convention on Biological Diversity, see www.biodiv.org

the character of the production systems in which they occur, and factors affecting their use and management. There is little information on the roles and interests of different family members, including gender roles. Also, because animals are often kept in communal herds, working with key persons may not be sufficient and support initiatives may need to involve the entire community, which can be difficult and time consuming. The main options are:

- village breeding programmes;
- record keeping;
- animal competitions;
- development of niche markets for animal produce and services.[3]

4.2 Crop diversity portfolio

There are various ways in which farmers can be supported in maintaining a wide *range* of crops and varieties. Richer farmers can be encouraged to maintain a number of crops and varieties on-farm and to share them with others. Poorer farmers may not be able to maintain a large number of crops and varieties on-farm but can be helped to source seed of additional crops and varieties from others when they need it.

Potential interventions include:

- **Campaigns to raise awareness of the cultural and practical value of agricultural biodiversity**: information on the characteristics and utility of different seeds and practices can be provided to counter-balance the promotion of a few modern varieties by commercial seed companies that is common in rural areas. Useful given that most farmers like to access seed from amongst family and neighbours.
- **Participatory varietal selection (PVS) and plant breeding (PPB**): working with farmers on the development of useful new varieties and components, although for this to increase diversity, these varieties and components must be designed as *additions* to farmers' portfolios rather than replacements.
- **Farmer Field Schools (FFS):** working collaboratively with farmers in their own fields to improve field skills in crop management and seed production. The FFS approach was originally developed specifically for Integrated Pest Management and has not yet been widely tested for diversity management. However, from the few experiences to date, it would appear to offer considerable scope – see, for example, the Kenya experience reported at this workshop (Kimani, 2001). Note however that most research (summarized in Wright et al., 1994) suggests that technical advice on seed storage is less necessary.
- **Seed Fairs**: to improve access to the range of crops and varieties available locally.
- **Exchange visits** to other areas (and to relevant agricultural research institutes): to improve access to seed and information on different crops, varieties and practices.

For any intervention, it is important to take account of social relations aspects and to ensure participation by all appropriate members of the household and community. For crop diversity interventions, older people can be important sources of knowledge: often they are responsible for travelling for social purposes (to arrange marriages, etc.) and gain new information and seed in this way; they are patient in disbursing knowledge and they value it. Women dominate all stages of biodiversity management and so should be primary targets for support (although it is important to be aware that men's permission may be needed for seed sales or hand-outs). Our research results clearly demonstrate that poorer households have much to gain from improved access to

[3]For more on this, see Kohler-Rollefson (2000).

agricultural biodiversity, so special care must be taken to ensure they are able to participate in support initiatives.

In conclusion, incentive measures for using and conserving a wide ranging crop diversity portfolio focus on improving access to and use of information about available genetic resources for all members of the community, preferably using *participatory* approaches based on community knowledge and capacities, and local varieties.

4.3 Specific crops and varieties

Conserving *specific* crops and varieties requires that they continue to meet farmers' livelihood objectives. This implies no change in farmers' asset base or livelihood goals that might jeopardize this. This is much harder to achieve, as it involves the national economic and development policy framework rather than the local level technical initiatives outlined above.

This includes national and regional economic policy, the legislative framework and law enforcement, and multilateral and bilateral agreements. Re-examination of national agricultural development strategy may be required, which at present may be promoting a development path based on industrial-type agricultural systems, involving reliance on a few crops and high-potential yield varieties developed by the formal sector, together with high inputs of chemical fertilizer and pesticides. The reduction in subsidies under the current round of international trade negotiations may be useful in this respect.

National agricultural research systems and extension services, together with crop marketing arrangements, may all be geared to promoting this. For example, agricultural research may be geared towards breeding a few varieties of the major crops to be grown widely in place of the range of traditional crops and varieties. The agricultural extension service may not have any relevant messages for traditional crops and varieties, focussing instead on advising on the new varieties. Market traders may offer better prices for bulk purchases of a few crop varieties that can be sold on to large-scale industrial processors.

If farmers are to be encouraged to continue maintaining specific traditional crops and varieties, changes would have to be made. Traditional crops and varieties would have to be included in the mandate of agronomic research, plant breeding (changes in focus may be relevant e.g. to include incorporating improved genes into local varieties) and other aspects of national agricultural research work. Results would need to be fed into the agricultural extension service, so that it can offer relevant advice on these crops and varieties. The current emphasis on client-oriented research and extension is useful in this respect. Markets for traditional crops and varieties would need to be supported by research into processing and product development, and by consumer campaigns (potentially in Northern markets as well as in-country) to encourage their purchase and use.

The relative costs and benefits of these policy changes would have to be weighed up: do the benefits of conserving a particular traditional crop or variety on-farm outweigh the costs in terms of – for example – foregone production or disease susceptibility? In making this assessment, it will be important to measure true economic costs rather than financial costs alone, as industrial-type agricultural production systems contain a number of implicit subsidies (for example, the energy used in the production of chemical fertilizers and crop chemicals). A useful approach for this is outlined in Smale and Bellon (1999).

5. THE WAY FORWARD?

Two key challenges emerge: to test local initiatives (a number of projects exist but their impact on farmer management of agricultural biodiversity has not been assessed); and to assess the relative benefit and practicality of national policy change.

From this brief review of our research findings relating to incentives for farmer use and conservation of agricultural biodiversity, two key challenges emerge:

- **testing local technical initiatives** as – outlined above, there are a number of possible means of supporting the continued maintenance of a wide range of agricultural biodiversity by farmers. A number of projects already exist in various countries (descriptions can be found in Almekinders and Kolher-Rollefson, 2000: Annex 1; and Almekinders and de Boef, 2000). However, the real impact of these initiatives on farmer management of agricultural biodiversity has nowhere been thoroughly tested or documented. There is an urgent need to do this, to establish which initiatives are of most use, in what context, and what are the possibilities for scaling-up, given the location-specificity of some interventions.

- **assessing the practicality of national policy change:** supporting the continued maintenance of specific traditional crops and varieties requires changing national agricultural development policy, and associated research, extension and marketing systems, to provide incentives to farmers to do this. As we described above, this involves trade-offs against other policy objectives, and also changes in institutional culture. Some of these changes may be coming about as a result of wider trends (WTO, changes in research and extension practice) but others it will be necessary to assess how practicable they are, before attempting to implement them. This is a relevant topic for this workshop.

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Useful websites

http://www.ukabc.org

http://www.biodiv.org

APPENDIX A: STAKEHOLDER GROUPS IN AGRICULTURAL BIODIVERSITY

Direct stakeholders

Farmers in traditional-type agriculture Providing adaptation to lower input conditions is particularly important for poorer farmers in traditional-type agriculture who cannot afford expensive external inputs. In addition to these values which are captured by individual farmers, agricultural biodiversity also provides more general benefits in terms of fulfilling important functions in the wider agroecosystem, such as nutrient cycling, pest and disease control, introgression, and watershed protection

Farmers in industrial-type agriculture are highly reliant on agricultural biodiversity for new crop varieties, pollination and pest and disease control, maintenance of soil health, and ecosystem functions. Given that global food security depends significantly on production in industrial-type agricultural systems, it is relevant to note the important contribution of agricultural biodiversity to global food production.

Providers and users of traditional medicine may place a high value on certain roots, wild plants, extracts, etc. Few providers have secure access and rights to the agricultural biodiversity they may wish to use.

Multinational companies, including a range of agrochemical, food and medical companies in developing and developed countries. Their main objective is to profit from using agricultural biodiversity. This means they are often keen to protect the return on their investments in research and development through expanding intellectual property protection or technology that confers similar protection (e.g. terminator technology). They are also concerned to ensure their continued access to agricultural biodiversity *in situ*.

Scientists, including plant breeders, pathologists, environmental scientists and also food technologists and medical researchers. Scientists involved in basic research may be primarily motivated by scientific enquiry and their main concern in relation to agricultural biodiversity is likely to be to maintain open access and freedom of exchange. Those developing near-market technologies, such as plant breeders, food technologists and medical researchers, may be concerned with capturing some of the financial rewards of their work.

International genebank system, including national/regional, private sector and CGIAR genebanks. The Consultative Group on International Agricultural Research has 50 governments as members and, in its network of international centres, holds the world's largest *ex situ* collection of germplasm. This group aims to maintain continued freedom of access and exchange, whilst recognizing the need to better document and acknowledge the contribution of farmers.

Consumers, in the North and South, of fresh and processed food, and medicines, demand accessible, cheap, safe and, increasingly environmentally friendly products. In the North, the latter two concerns are leading to a growing market for organic food that is grown under systems which document and minimize environmental impacts. This can conflict with the desire for accessibility and low cost. As well as valuing biodiverse agricultural landscapes for leisure and aesthetic purposes, consumers also increasingly recognize the existence value of agricultural biodiversity. Communities in the South may also place a high value on agricultural biodiversity for cultural reasons.

Countries and country groupings hoping to capture some of the value of agricultural biodiversity managed and maintained by their citizens through the provisions of international agreements such as CBD and TRIPs. The level of government receptivity to the principles of sustainable use and equitable benefit-sharing for agricultural biodiversity varies.

NGOs and CSOs hoping to capture for their members, or assist the capture of, the value of agricultural biodiversity and to maintain free access.

Multilateral and bilateral donor organizations who directly or indirectly fund the protection and exploitation of agricultural biodiversity.

Source: summarized from Cromwell *et al*. (2001: 90)

APPENDIX B: CAPITAL ASSETS

Natural capital: the natural resource stocks from which resource flows useful for livelihoods are derived (e.g. land, water, wildlife, biodiversity, environmental resources).

Social capital: the social resources (networks, membership of groups, relationships of trust, access to wider institutions of society) upon which people draw in pursuit of livelihoods.

Human capital: the skills, knowledge, ability to labour and good health important to the ability to pursue different livelihood strategies.

Physical capital: the basic infrastructure (transport, shelter, water, energy and communications) and the production equipment and means that enable people to pursue their livelihoods.

Financial capital: the financial resources which are available to people (whether savings, supplies of credit or regular remittances or pensions) and which provide them with different livelihood options.

Source: Carney (1998:7)

EXPERIENCES WITH COMMUNITY SEED BANKS IN ETHIOPIA

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1. INTRODUCTION

There have been various approaches initiated as mechanisms to overcome shortage of seeds or planting materials in drought-prone and famine-sensitive areas of Ethiopia. Such activities are usually undertaken through relief aid operations that are often carried out by non-governmental organizations involved in relief work. A number of community-based seed stores have been built through such operations for distributing seed and grain to local communities, particularly in times of famine and natural calamities. In some cases such stores are designed as facilities used in income generating activities where seeds or grains are distributed on a loan basis. This has been helpful to the needy farmers who have lost options or are without any alternative of seed source. However, and as experience shows, the sustainability of such operations as a local seed security mechanism has been very limited except in a few cases. The major reason for the limitation in success is the lack of integration with local development activities. Similarly, the activities usually are without long-term commitment of external support and operate under circumstances where the sense of partnership by the local communities is weak or does not exist.

This necessitated the establishment of community seed banks (CSBs) as a community-based system of seed security, as a germplasm repository and as a grain reserve, but with various commitments and initial external support for making the system sustainable and self-supporting. The established CSBs that are functioning at the moment operate as components of community-managed genetic resources conservation and utilization systems. The major objectives of the seed bank system are to increase the number of options in using wide crop/plant genetic diversity and to decrease vulnerability to seed shortage, famine and crop/plant genetic erosion. One of the strategies of the system is strengthening of the traditionally established community seed networks, through facilitation of seed supply among farming-families through exchange of seeds and local markets. The CSB-system also involves mechanisms to create incentives for farmers in order to maintain genetic diversity on-farm.

2. SEED SYSTEM IN ETHIOPIA

2.1 The importance of diversity for farmers

In the Ethiopian farming systems, genetic diversity in crops/plants is critical for stabilizing production, and for minimizing risks from unpredictable environmental changes. Under normal environmental conditions, diversity is essential for intensifying production with limited resources and for promoting access to a variety of food and income sources. Under unfavourable conditions, diversity in crops provides stability for farming systems by balancing yield variability through the maintenance of a wide range of variation within and among crop

species. Failure of a particular crop or variety is always compensated for by the yields of other crops or varieties. For this reason, subsistence farmers in Ethiopia grow several genetically distinct varieties of crops in a single field, as a hedge against crop failure. This is how they always spread the risk of crop failure from pest and disease epidemics or adverse environmental conditions. This means that in such high-risk environments, access to diversity is an incentive for farmers as it contributes to food security.

2.2 Threats to crop diversity

Seed systems in farming systems in Ethiopia are characterized by the local reproduction of seeds by farmers themselves. They select and produce seed, save planting materials and exchange seeds within and among farming communities. Seed production in most cases is non-specialized, and is the integrated production of grains, roots and tubers for consumption and marketing. This traditional seed supply system is an important backup to the overall agricultural crop production in the country. It is mainly based on farmers' varieties, with the exception of cases where the seed system depends on improved or introduced crop varieties. Usually, dependency on introduced varieties is created by displacement of farmers' own varieties.

Although most of the diversity in crops is still in the hands of farmers, a lot of it is exposed to different threats. There is evidence that the impact also extends to the development and management system and knowledge of traditional varieties: much of the farmers' traditional agronomic practices and the associated traditional knowledge have been lost together with the varieties (Regassa, 1997). The loss of varieties is mainly attributed to repeated drought in some areas of high crop diversification, and to intensive diffusion of exotic seed varieties. Changes in crop pattern and land use system have also contributed to the displacement of farmers' varieties. In some regions of high crop diversification, native crops (e.g. durum wheat and barley) are suffering serious genetic erosion through the introduction of new commercial varieties. Certain places in which a surplus production programme was conducted in the 1980s have lost a larger portion of their diversity within a very short period of time. Seeds of the varieties introduced to these areas through programmes of those days are now disease vulnerable, and have lost adaptation to the locality. Sadly, those farmers' varieties that offered security against such situations are almost gone, leaving farmers without options for planting material. On top of this, replacement of diversity-based cultivars by uniform varieties is often accompanied by agroecological disruption This is usually due to changes in cultural practices and biological norms to make the environment suitable for the new genetically uniform varieties. There is a lesson learnt that restoration of the displaced diversity into such disrupted system has been problematic because of changes in the competitive adaptation of the original varieties to their own specific niches. This had been observed during the reintroduction of 18 genebank durum wheat samples of farmers' varieties collected 25 years back from Addaa region. Although the samples germination level was above 85% during laboratory tests before sowing, the physiological performance of all the materials was very poor and the samples had also been severely attacked by leaf rust. The poor physiological performance of the samples could be attributed to the long-term detachment of the farmers' varieties from their own natural agroecosystem. Similarly, and according to observations made during farmers' characterization of these varieties, it was only the elder farmers above 50 who were able to recognize and identify the varieties and the agronomic practices they require (Regassa, 1998). This illustrates the long-term detachment of farmers from their own varieties. From these experiences, one may conclude that the dynamics of genetic diversity of agricultural crops is a complex of interrelated social and biological factors. In cases where these

dynamics are interrupted, not only the diversity within and among crop species is vulnerable, but also the traditional farming systems, cultural practices and knowledge that developed the diversity itself.

3. OPERATION AND INSTITUTIONALIZATION OF THE COMMUNITY SEED BANK SYSTEM

3.1 Approach

The community seed banks in Ethiopia function as community-based seed supply networks for locally adapted crops and enhanced farmers' varieties. There are about 12 community seed banks established in different farming systems through financial support from the Global Environmental Facility (GEF). This paper focuses on the experiences in two districts of the central part of the country. These are high potential production areas where, due to introduction of new varieties, a high level of displacement of local varieties took place over the past three decades. The diversity of durum wheat, for which Ethiopia is a centre of diversity, has been severely threatened by introduced bread wheats. Similarly a number of legume crops are disappearing due to pests and disease that were introduced with new varieties. The whole cropping pattern has been disrupted, and due to intensive use of monocropping, use of high input varieties, and fertilizer in both districts, this has happened to a great extent across the entire county. The community seed bank system was developed as an instrument to create competitive advantages for farmers through external support. The strategy of the external support was to restore the disrupted systems through the creation of new opportunities for farmers at the farming community level. Together with the reintroduction of the local varieties, this process of restoration also required the reintroduction of elements of forgotten traditional practices and knowledge. Restoring diversity and strengthening traditional seed selection practices, as well free flow of seed were designed to be important elements of the CSB-system.

The CSB system offers the opportunity for integrating formal and informal efforts that link conservation to production at community level (Regassa, 1999). The CSB system was not solely created as an income-generating set-up that distributes seeds on loan basis. It was rather initiated with the objectives: (i) to serve as a community-based *ex situ* facility for seed reserve and as a grain repository; (ii) to satisfy farmers' needs by creating access to crop genetic diversity; (iii) to ensure a sustainable supply of planting materials for farmers; and (iv) to facilitate proper market access for farmers' produce. Through CSBs, farmers have the opportunity of evaluating the merits of a wide range of varieties, the effect of which eventually limited the undue expansion of introduced varieties that are expensive to manage and are also poorly adapted.

Since its establishment the CBS system has helped to minimize farmers' dependency on high-input varieties and has improved the farmers' market access for their produce. Recently the system has been able to create a mechanism whereby seeds of enhanced farmers' varieties of durum wheat can be supplied to local food industries that import these for the production of spaghetti and macaroni (Fig. 1). The combination of access to planting material of improved and low input-farmers' varieties, and better access to the market are adequate incentives for farmers to be involved in the seed bank programme. There are also non-market

incentives such as access to diversity – which contributes to food security – and seed security.

3.2 Genetic concept of the CBS system

The CSB system includes low-cost local facilities that are owned and managed by farmers individually on their own farm and collectively at the village level. There is a mechanism that links these facilities to the central seed banks that also maintain germplasm at community level and to the National Genebank. The central community seed banks store different mother populations of farmers' varieties and their enhanced forms. These enhanced forms of farmers' varieties are jointly developed and multiplied by farmers and scientists in a decentralized breeding system. The central community seed banks provide a backup to the local seed networks and are crucial in ensuring sustainable availability of locally adapted seeds to the farmers. In this way, the community seed bank system beyond offering seed security to farmers, also operates as a mechanism to sustain on-farm/*in situ* conservation and development of genetic diversity. As a lesson learned, one important challenge for on-farm management of crop diversity at subsistence farmers' level is how to make the practice sustainable and self-supporting. It is clearly understood that subsistence farmers do not conserve just for the sake of conservation *per se*. To them, the value of conserving diversity lies in its use and the benefits and services they may gain from the conservation of diversity on-farm. This is particularly true in the case of subsistence farmers who practice cultivation under the situation where farmlands are small in size and are fragmented.

4. MANAGEMENT OF THE COMMUNITY SEED BANKS AND EXPERIENCES

The village level CSBs are managed by the Crop Conservation Associations (CCA) that were formed for on-farm management of crop diversity. As illustrated in Figure 1, the seed banks are linked to the National Genebank and to the village-level local storage facilities existing within the

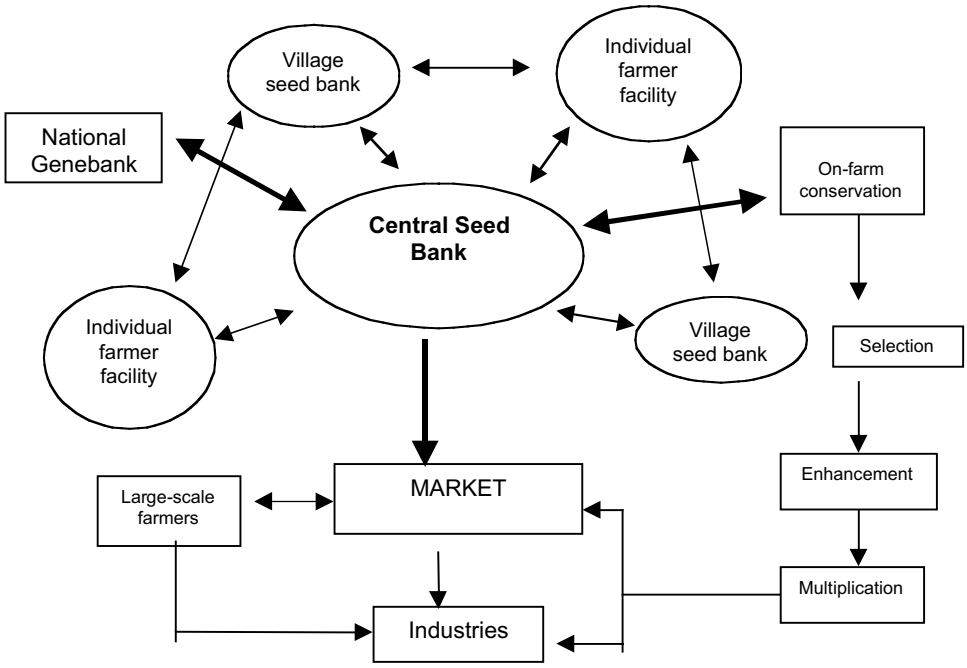

Figure 1. Seed network linking conservation and marketing.

Associations. Usually, the farmers' individual storage facilities maintain varieties used for various purposes by farmers themselves. These varieties are duplicated in the CSBs at the village level and in the National Genebank. The curators of the CCAs are mostly elder women and men who fully decide on the management of the activities of the Associations. Currently, involvement of women in the management and as beneficiaries has increased to over 21%. Under the CCAs are operating trained farmer trainers' groups who are actively engaged in the management and monitoring of the seed bank, in seed distribution and collection, in seed marketing and in other activities of on-farm crop management. Selection of varieties is usually conducted by elder farmers, both women and men, and with scientists. In this way, the CSB system has offered the opportunity to link directly the dormant formal *ex situ* system to a much more dynamic *ex situ* system at the community level and to on-farm crop management activities (Fig. 1). The National Genebank supplies the CCAs with germplasm materials, provides technical support and facilitates the capacity building of the system through the financial support from the GEF project fund. Capacity building includes training farmers and development agents involved in the activities.

The CBSs also offer various community services such as seed security, seed distribution and exchange, germplasm restoration and introduction, and seed marketing. Seed marketing is done through a revolving fund allotted for the seed banks though the GEF on-farm crop management project fund. In some cases, this mechanism has helped to protect farmers from being victims of low crop price. (Regassa, 2000). Access to proper market price for their produce, local seed security and availability of varieties of their interest have become strong incentives for farmers' involvement in on-farm conservation and development of crop diversity on a voluntary basis. That is how, by facilitating better market access for farmers' produce, the CSB system has contributed to farmers' seed security and socioeconomic gain.

The experienced approach has also enabled complementarity between formal and informal efforts, giving the opportunity to fill the exiting gaps between the use of high-input varieties, and the need to increase crop production through the maintenance and enhancement of better adapted farmers' varieties. It is envisaged that the experience gained will be expanded into other farming systems in the country and elsewhere, but with necessary modifications as deemed appropriate. The long-term sustainability of the developed system for certain depends on the consistency of commitments of all kinds to further support the system. Involvement of alternative or supportive extension channels such as non-governmental organizations would definitely contribute to the expansion and strengthening of the system (Regassa, 2000).

5. CONCLUSION

Farmers' objectives and needs vary according to the local seed system, and this determines the strategy of external support for on-farm management of crop diversity. In cases where crop genetic diversity still exists, on farms for example, the major task for external support for on-farm crop management activities is to develop competitive forms of farmers' varieties to ensure conservation through continued use. It is understood that such a production promotion approach entails risks of genetic erosion unless careful and systematic conservation measures are taken. In situations where genetic diversity has been under pressure and farmers' options have shrunk, the main objective is to replace the lost diversity in order to

increase farmers' options. The community seed bank system serves as an instrument in the last category of situations

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THE ROLE OF SEED GARDENS IN ENHANCING LOCAL SEED SECURITY AND IMPACT ON USE AND CONSERVATION OF AGROBIODIVERSITY

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1. INTRODUCTION

The use of high quality seed is one of the important factors in increasing crop productivity of smallholder farmers. The relationship between seed and food security on the one hand, and seed security and conservation of relevant crop genetic diversity on the other hand is generally acknowledged. While the impact of modern varieties on the diversity of the genetic resource base is generally perceived as negative, the experiences in Zambia support existing evidence from elsewhere, showing that modern varieties can also contribute to the diversity being grown and to farmers' food security.

The improved varieties (maize, cowpea and greengram) used in the seed-garden project during the off-season were introduced in the project area through the participatory variety selection and seed production activities carried out in the main growing season. It is clear that these improved varieties have contributed to variety diversity in the case of the open-pollinated varieties of maize as well as the two cowpea varieties, and crop diversity in the case of greengram. Farmers grow the improved varieties principally because of the higher yields. Farmers do, however, continue to grow the local varieties of maize and cowpea as they have special characteristics that are not found in the improved varieties. In maize, these characteristics include better storability, ease of pounding and larger kernel size. Some maize local varieties are also very good as green maize and fetch a very high price on the market. Some farmers with abundant water grow local maize in September to harvest green maize for sale in December.

In the case of cowpea, the local varieties have larger grain sizes and offer wider variety in colour. The project has also initiated seed fairs in the project area, which have verified the fact that farmers are still cultivating their local maize and cowpea varieties despite adoption of improved varieties. The improved varieties are therefore playing a complementary role to the local varieties already available in the project area. It should be appreciated that, given the range of local varieties grown and the values for which farmers continue to grow them, including their attractiveness, the improved varieties thus need to have very special characteristics and meet some specific objectives for farmers to use and conserve them.

This paper presents these experiences and draws some lessons from them that may be relevant for identification of incentives for use and conservation of crop genetic diversity.

2. CONSTRAINTS IN SEED SUPPLY TO SMALLHOLDER FARMERS IN SADC

In most SADC countries, smallholder farmers experience problems in acquiring seed of modern varieties especially for the traditional food crops such as millet, sorghum, groundnuts, beans, cowpeas as well as root and tuber crops. This is despite the tremendous improvement in research efforts during the 1990s both by the NARS and through regional networks supported by the CGIAR centers, which has led to the development of suitable varieties of these traditional crops for major cropping systems.

The majority of farmers continue to use seeds retained from their own grown crops or buy from others that also retain their own seed. The commercial seed companies have largely focused on producing seed of hybrid maize and high value crops such as wheat and soyabean.

Studies further indicate that even when seed of modern varieties of the traditional crops has been produced commercially, use of such seed by smallholders has been hampered by various problems. These include high seed prices, lack of local seed traders, poor funding of NARS for breeder- and foundation-seed production and lack of organized seed entepreneurship in the farming communities (Rohrbach *et al*., 1997). This situation calls for the development of interventions that effectively strengthen the informal seed sector to address adequately smallholder farmers' access to seeds of optimal quality and diversity.

In Zambia the problems are similar. In order to address the problems, a large number of Non-Governmental Organizations (NGOs) are actively promoting community-based seed multiplication programs for traditional crops. These activities have gone a long way in alleviating seed availability problems as well as increasing use of modern varieties.

3. INTRODUCTION OF SEED GARDENS TO IMPROVE SEED SUPPLY

3.1 Seed garden concept

The SADC/GTZ project on the promotion of Small Scale Seed Production by Self-help Groups (SSSP) is one of the development agents involved in promoting farmers' access to quality seed. The project has been supporting farmers in Choma and Kalomo districts in the Southern Province of Zambia since the 1997/98 season with the objective of enhancing local level quality seed provision systems and household food security. The project has been implementing its activities in collaboration with the Department of Field Services of the Ministry of Agriculture, Food and Fisheries and Africare. Consistent with the project's objective, the approach is based on a two-stage process that entails participatory variety selection and participatory seed production. Up to the 1998/99 season, all demonstration trials and seed multiplication plots were hosted during the rainy season.

In 1999, in addition to regular seed multiplication activities for improved varieties of open-pollinated maize, cowpeas and greengram in the main season, the SSSP decided to carry out a feasibility study on winter seed gardens as a new initiative for enhancing household-level seed security. This decision was based on a PRA exercise which established farmers' needs for improved seed security in the area. One of the primary objectives for the study was to

gather information on the suitability of seed gardens as an alternative and complementary local-level seed-supply strategy.

The gardens were expected to provide an opportunity for improved seed management by farmers, allowing the production of quality seed. Seed gardens are not a totally new concept: the use of winter nurseries is common in the NARS for advancing generations of breeding materials as well as seed multiplication.

Seed gardens are meant to act as a source of fresh and healthy seed at the start of the normal planting season (early November) through seed production in the off (dry)-season (May to October) by using wetlands or other sources of water for irrigation (e.g. dams or streams). Important considerations when setting up a seed garden include: availability and access to water, duration of water availability during the dry season and firm fencing around the garden to avert damage by livestock. In the Southern Province of Zambia, such conditions exist, using wetlands or water from dams and streams for irrigation.

3.2 Implementation of seed gardens

The seed garden concept has been tested in Zambia for two years in Choma and Kalomo districts of the Southern Province of Zambia. The crops used are maize (three early to medium maturing, open-pollinated varieties), cowpeas (two varieties) and one variety of greengram. These crops and varieties have been used in the communities since the inception of the seed program in the area. They are all modern varieties from the NARS, which have been adopted and are used by farmers in the project area following participatory variety selection and demonstration trials. The establishment of seed gardens is an attempt to develop a reliable source of good quality seed for these varieties and has proved to be effective in enhancing the use and conservation of agrobiodivesity by farmers at farm level.

The major activities in implementing seed gardens are:

- community mobilization based on already existing groups;
- identification of suitable sites for gardens (fertile soil, good access to water);
- establishing seed garden demonstration plots at a central place;
- training farmers in improved seed technology using participatory approaches (e.g. farmer field schools);
- conducting field days;
- monitoring and evaluation.

As a pilot project, the plot sizes used in the seed gardens are small. The plots are targeted at producing enough seed for 1 lima (0.25 ha) of maize, half a lima of the two cowpea varieties and a quarter lima of greengram.

3.3 Experiences

Generally, the seed gardens have been well established with management ranging from fair to excellent. Under top management, yields of up to 20kg maize seed (enough for 1 hectare of maize crop) are possible, while the average is above the 5 kg of seed required for a lima of maize. For cowpea, when well managed, yields of 3 kg per variety have been recorded. This is double the amount of seed required for planting a quarter of a lima. In a top managed greengram crop, it is possible to obtain a yield of 1 kg seed which suffices for planting a quarter of a lima.

Farmers have highlighted the following points as benefits derived from seed gardens:

- enhancement of seed and food security;
- good and quality seed harvested;
- only small area required (possibility for good management);
- surplus seed for sale;
- attainment of knowledge about winter seed production.

4. INCENTIVES FOR USE AND CONSERVATION OF AGROBIODIVERSITY

The introduction of seed gardens for off-season seed production has given a range of incentives to the farmers.

4.1 Desirable characteristics of modern varieties

The winter in Zambia is characterized by low temperatures and occasional frost, which renders the growing season rather short. As such, the seed garden activities have so far only included modern varieties of short to medium duration (maturity period ranging between 100 and 135 days), which are able to mature in good time for seed to be used in the main season. The local varieties are relatively later maturing and hence are not amenable for seed production in winter. In the case of cowpeas, the local varieties are mostly indeterminate and photoperiodic sensitive and as such would also take very long to flower under off-season conditions.

Three modern open-pollinated varieties of maize (Pool 16, MMV 400 and MMV 600) are popular in the project area. They are all early maturing, with higher yields than local varieties. In addition, the three varieties are also flinty and hence are more amenable to pounding (see Box 1).

Most small-scale farmers refer to Pool 16 as ‘the hunger fighter’ because when planted with the first rains (late November to early December in Southern Province), it matures late February to early March the time known as the hunger period.

The two improved cowpea varieties (Lutembwe and Bubebe) are also well known in the project area. Their special characteristics are the early maturity, significantly higher yields, drought tolerance and good leaf quality (especially for Lutembwe). The importance attached to the two varieties is evidenced by the planting of the two varieties as sole crops compared with the local varieties, which are intercropped at very low plant populations.

Greengram is a new crop in Southern Province although it is well known in the valley areas of Eastern Zambia. Greengram is a short duration crop with a maturity period even shorter than that of the two cowpea varieties. It is also highly drought tolerant.

BOX 1. CHARACTERISTICS OF IMPROVED MAIZE VARIETIES USED IN THE SEED GARDENS

Pool 16 is also popular among farmers because of the sweetness of the green maize. Another important characteristic for Pool 16 is its versatile nature. While Pool 16 gives some yield even under sub-optimal management, when planted early with optimum management the variety performs beyond expectations (responds very well to optimum management, contrary to the belief that it is a low input variety). This has made the demand for Pool 16 rather high among small-scale farmers throughout the country, thereby creating an opportunity for significant seed exchange within the community as well as commercialized seed sales for the variety. Farmers in Southern Province have, in the past, provided maize seed of Pool 16 to a seed multiplication programme run by World Vision International (WVI) in the Eastern Province of Zambia.

Farmers also find the open-pollinated varieties of maize easier to cultivate than hybrids as they can keep seed for several seasons without suffering significant yield losses and can also grow the varieties under low management conditions. This is important in the current era of structural adjustment policies, which have translated into very expensive farm inputs and poor access to credit for smallholder farmers. Hence these modern varieties are well suited to the prevailing farming systems of smallholder farmers.

4.2 Improved seed management and production opportunities, seed quality and health

Most farmers were able to manage the seed plots optimally (adequate weeding, fertilizing and watering) as they were small in size. Some of the farmers have indicated that from now on they will only produce seed in the winter season.

The introduction of the seed gardens has given farmers the opportunity to produce good-quality (genetically pure) seed of the modern open-pollinated maize varieties at a time when the chance of contamination is minimal as the field sizes are small and growers are few and hence it is easier to meet the requirement for optimum isolation distances.

Most farmers in the project area do not have large fields and most grow more than one variety in the same field, including local varieties. Hence, they have difficulty in meeting the isolation distances required to produce pure seed of their modern maize varieties during the main season. In addition, fields from other farmers are sources of pollen that can contaminate a seed production field. Time isolation is also difficult, as it requires good understanding of the differences in flowering time and duration of pollen shedding of the different maize varieties.

During the winter, crop disease incidence is significantly much lower and therefore seed health can be significantly improved. However, insect-pest pressure is rather high, even though the major insect pests are the same as those prevalent in the main season and hence farmers ought to practice crop rotation to reduce pest build-up. The fact that seed is harvested just before planting also eliminates the need for seed storage, and hence seed losses are minimized and viability is maintained.

The farmers appreciate the higher seed quality, as they would like to maintain the special characteristics, which they value, in these modern varieties. The high demand for seed of these varieties within and outside the project area and willingness to pay a higher price for quality seed is a great incentive for farmers to produce seed in gardens.

Farmers are trained in improved variety maintenance practices as well as aspects of physical quality enhancement. The improved seed technologies are also not very demanding as the varieties are open-pollinated (for maize) and self-pollinated (cowpea and greengram). Emphasis in the training is placed on ideal isolation distances (especially for the maize varieties) as well as optimum management practices to ensure both genetic and physical purity.

It should, however, be acknowledged that the farmers have maintained their own local varieties well as they manage a good number of 'varieties' which continue to have distinct characteristics despite the heterogeneous nature of the materials. However, the training provided by the project will be useful in improving upon this local knowledge of variety maintenance especially with the interest generated in growing modern varieties that are selected from the demonstration plots.

Data on yield of crops from seed harvested from seed garden is only available for the 2000/2001 season (just collected and analysed). In cases where farmers used reasonable plot sizes (0.25–0.50 ha) and provided some fertilizer (organic or inorganic), maize yields equivalent to up to 2.5 ton for Pool 16 and 3.0 ton for MMV 600 were recorded. Based on records of average yields of smallholder farmers nationwide (1.8 ton for smallholder commercial maize production) and considering the management levels in the area, such yields for open-pollinated varieties are substantial and can be attributed to better quality seed. In the case of cowpeas, even though the areas farmers planted were rather small (mostly 0.05 ha), the yields obtained were extremely high (a good number of farmers obtained an equivalent of 1.5 ton/ha) and are definitely a result of better quality seed.

4.3 Improved seed security and maintenance of seed diversity

Farmers regard seed gardens as providing them an excellent opportunity for the multiplication of the small seed quantities they are given into adequate amounts of good quality seed for planting in the main season. The farmers have identified other new modern maize varieties from the wide range provided by the project from the NARS as well as CIMMYT in the participatory selection trials and demonstration plots. They have requested pure seed from the selections to start their own seed production of these varieties in seed gardens.

Farmers also feel that with seed multiplication in the winter they can plan their planting better as they will know how much seed to expect and when it will be available – which is not always the case if they have to buy or obtain seed from development agencies. Winter-seed production also offers farmers an opportunity to increase seed in cases where seed losses have occurred or where they have access to only a small quantities of seed as long as the crop/variety in question is able to mature in time. Seed gardens can help farmers to maintain the diversity of seeds that is of interest to them and play a major role as an entry point for breeder/foundation seed in the community. The appropriate National Seed Policy and implementation of the Quality Declared Seed Control System have provided an enabling environment for the farmers in this respect (see Box 2).

BOX 2. APPROPRIATE NATIONAL SEED POLICY AND QDS

The relaxation of national seed policies in Zambia to facilitate the development of the informal seed sector has contributed positively to encouraging farmers to maintain seed of modern varieties. In terms of commercialization of informal seed production, the introduction of the Quality Declared Seed Control System. The Quality Declared Seed Scheme was designed by FAO to provide quality control during seed production that is less demanding on government resources than a comprehensive certification scheme, but adequate to provide good quality seed. The scheme also has elaborated seed quality standards, which are more appropriate to the informal sector. In Zambia some of the requirements for producing Quality Declared Seed include registration of seed producers with the Seed Control and Certification Institute (SCCI), and inspection of the seed crop and seed for sale by local extension officers. The class has accorded smallholder farmers an opportunity to participate in seed sales without having to fulfill the control and certification requirements of the other seed classes. For farmers engaging in seed production in the winter season, this relatively flexible seed registration (as compared with other countries) provides the opportunity to capture the benefits from their efforts to maintain varieties and produce seed (see also Zulu, this volume).

4.4 Food security and income generation

Apart from improving the seed security for these modern varieties at farm household and community level, farmers are also able to harvest some of the maize from the seed gardens as green maize to supplement their food needs. For cowpea, by having a crop during the winter, farmers have access to leaves and pods throughout the year. Some farmers with adequate water and labour for managing the winter seed crops have extended the area of their maize crop to allow for consumption as food. Farmers are also discovering and using the opportunity of winter production for cash crops (see Section 2.4: farming systems diversity).

5. POSITIVE IMPACT ON AGROBIODIVERSITY

The seed gardens have had a positive impact on the agrobiodiversity used by farmers. As elaborated in the introduction, the improved varieties of open-pollinated maize and the cowpea varieties have contributed to a broadening of variety diversity for the two crops in the area, while in the case of greengram it has contributed to increased crop diversity.

The seed gardens can also contribute to increased agrobiodiversity by providing an opportunity for the production of crops that do not thrive well in the summer but may be produced in winter. Farmers have seen the opportunities that exist for winter-season production. Through the seed garden activities farmers have already been asking for bean seeds grow in the gardens. Farmers have tremendous opportunities for getting a high market price for beans as it is a very popular food crop in the area but difficult to produce during the main season. The gardens are also an incentive for multiplication of cassava as well as sweet potato planting materials which are usually in short supply during the main season. A few farmers have also requested for seed of improved sorghum (variety Sima).

There has already been an increase in vegetable production in the project area as a result of the establishment of seed gardens. Farmers grow vegetables, side by side with the seed production plots. This is an example of a spin-off effect on crop diversity used by farmers.

6. CONSTRAINTS AND INTERVENTIONS

6.1 Constraint and interventions at the field level

The following were observed as major challenges to seed production in the winter:

- delayed crop emergence and general growth due to low temperatures especially for legumes;
- insect pest damage in both maize and legumes requiring regular spraying
- rat damage in cowpea and greengram causing 100% yield losses in some cases;
- water shortage;
- bird damage in maize. as there are too few crops in the field during the winter.

The following interventions are being considered by the project as a way of getting around the problems encountered in the seed gardens:

- use of mulch to increase soil temperature and hasten crop emergence;
- use of traditional methods for insect pest control (e.g. use of sweet potato skins);
- more strict observation of rotation to reduce insect pest build up between main season and off-season;
- planting of *Tephrosia* in gardens to control rats;
- access to more insect pest tolerant varieties.

6.2 Other limitations

While seed gardens are an excellent opportunity for enhancing access to quality seed at farm level, seed production in gardens is restricted to varieties that are able to mature early enough in readiness for the main season. This excludes modern varieties of long duration as well as local varieties. Crops that do not strive well during the winter largely due to photoperiodic sensitivity (groundnuts, bambara groundnuts) are also not amenable to winter seed production.

The inadequacy in the supply of breeder and foundation seed by NARS to replenish stocks at community level continues to be a threat to enhancing use and conservation of modern varieties at farm level.

NARS support is also required in supplying more insect-resistant cowpea varieties and also in addressing the problems of integrated pest management to improve seed yields during the winter.

There are opportunities for contract seed production as some interest has been shown by the private sector in the cowpea seed produced in the project area. However, lack of capital for investment into simple irrigation equipment (e.g. treadle pumps) will hinder the commercialization of winter seed production.

7. FOLLOW-UP ACTIVITIES

The results obtained so far from the seed gardens are very encouraging and the interest generated in the communities is overwhelming. The project will continue in the winter of 2001 to verify and consolidate the results obtained in the past two years.

In addition to the current practices for setting up seed gardens (planting of maize in July), demonstration plots for early-planted maize (April and May) have also been conducted to

determine performance as well as response to frost and insects. Other demonstration plots for newly farmer-selected open-pollinated maize varieties, as well as promising cowpea varieties from the main season demonstration plots will also be conducted during winter 2001.

Another NGO operating in the valley area of Eastern Province has begun to establish seed gardens with farmer groups in the area based on the experience in Choma and Kalomo – the first season will be winter 2001.

8. LESSONS LEARNT

Contribution of modern varieties to food security of small-scale farmers. The use and conservation of seed of modern varieties is enhanced by active participation of farmers in variety selection at farm level as varieties are chosen to meet specific farmers' needs.

Positive impact on use of crop genetic diversity. Cultivation of modern varieties does not necessarily lead to the disappearance of local varieties and thus in many situations increases diversity of varieties.

Some of the farmers in the project area only managed to plant decent areas of the modern varieties following seed production in the seed gardens and indicated that as a result their food security situation had improved. A few farmers also sold either seed or grain of the modern varieties to their neighbours. With the better food security situation as a result of use of higher-yielding modern varieties, pressure on use of local varieties to meet all the food needs and income is reduced and hence farmers are in a better position to also conserve and continue using their local varieties.

In a situation where the farmers' main objective is to be food secure and there is not much specialization in crop production (high commercialization), the introduction of modern varieties which meet well-defined needs of the farmers does not threaten the use and conservation of local varieties.

Essential role for formal system. NARS support of community-based seed programmes is critical for the success and sustainability of such programs. The support needed includes: improvement in supply of breeder and foundation seed of modern varieties; active involvement in participatory variety trials as means of monitoring performance of varieties and obtaining feedback for defining relevant research agenda; providing technical support in integrated pest management and use of alternative sources of nitrogen for improved soil fertility.

Incentives for the formal system. There is also an appreciation among researchers of the important role of on-farm seed production in sustaining crop production of smallholder farmers and the complementary role to the formal seed sector. Therefore, the objective and approaches used in the seed garden project are well appreciated by the NARS as they are in line with the current aspirations of the conventional research and development efforts in the country. The progress in mainstreaming the farming systems approach and participatory plant breeding in research programs has been hampered by poor funding. However, the concepts of farmer-participatory variety selection as well as *in situ* conservation of local varieties as well as modern varieties (as opposed to exclusive *ex situ* conservation) are supported and viewed as absolutely essential in

effectively addressing smallholder farmers' seed security problems and safeguarding agrobiodiversity.

Richer farmers tend to be custodians of seed diversity, largest impact of incentives on poorer farmers. The fact that the most successful farmers (food secure and in a position to generate some income) are the ones who tend to have the largest portfolio of both modern and local varieties testifies to the fact that continued use and conservation of local varieties is enhanced when the food security situation is favourable. Through seed fairs organized in the project area it has been established that farmers who have adequate seeds of the modern varieties also have a large number of local varieties of the same crops and others not being promoted by the project. Extremely food insecure farmers are not in a position to keep adequate and diverse seed at all.

Community operation. In order to achieve effective isolation and minimize contamination of seed, community cooperation is very important. In the project area, the farmers have cooperated very well in this aspect by accepting to grow the three different maize varieties in zones and then agreeing to exchange among zones after seed is produced. In this way all participating farmers can have good-quality seed of each maize variety.

Successful seed production at farm level is facilitated through active well-established Community Based Organizations (CBOs) that are essential for effective community cooperation. This cooperation will become even more important once farmers adopt more improved varieties from their demonstration plots and also especially critical if farmers want to exploit opportunities for contract growing on behalf of companies, which is very likely in the project area.

Foodsecurity and Genetic conservation. The portfolio of crop genetic resources that farmers are interested in maintaining/conserving will include all their local varieties as well as modern varieties which meet their needs. Crop conservationists may, however, not be interested in the same range of genetic resources. In most cases, their interest is exclusively for local varieties.

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Further reading

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MARKETING INCENTIVES TO ENHANCE THE USE AND CONSERVATION OF AGROBIODIVERSITY

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1. INTRODUCTION

Ladies and Gentlemen, it is a great pleasure for me to talk to you today about the impact of trade on agrobiodiversity, in particular in its role in rural livelihoods. By way of introduction, I would just like to mention that I am working for V.J. & C Consulting in areas of Product and Market Development. We are involved in market research and development, and we dealing specifically with certain agro-based products, e.g. organic and fair trade goods. One of our main tasks is to identify markets and to find products that can be exported by developing countries.

I have visited the region several times over the last five years to carry out market research and to participate in several buying missions of various food products. Based on this experience, I am convinced that markets exist locally, nationally and regionally. South Africa offers very promising market possibilities for exporters in developing countries, including those in the region. There are lots of opportunities in terms of range of products the region could offer the market. However, there are various limiting factors such as awareness of possibilities and limitations at consumers' end, networking links within producer groups are not structured and processing capacities are either non-existent or limited. The limitations are mainly in terms of technology and project finance, and also in access to market information and markets.

Some of you may know that the International Trade Center, Geneva, recently published a market survey, entitled Organic Food and Beverages: World Supply and Major European Markets. One of the major conclusions of the study was that demand is growing rapidly in most markets, and that insufficient supply of organic products is the main problem rather than lack of demand. In reality however it is extremely difficult for producers in the developing countries to access these markets, as I will show in the presentation. There are two major problems however that distort the market. This is first of all the fact that *product diversity* is not keeping up with the market demand for novelty items. This has resulted in seasonal products such as bananas, pineapples, nuts, etc. saturating the demand for these particular products, but leaving opportunities for using the consumers' interest in other products unused. The other factor is the ever-changing regulations on agricultural products imported into major markets. It is on this background that I would like to discuss trade in agrobiodiversity.

In this paper I will differentiate different market segments: the market in Europe and North America and the market in developing countries, the market of the well-to-do and the market

of the less well-off. Product interest of the consumers and their behaviour in these market segments is different, offering different opportunities and requiring different approaches if marketing opportunities are to be utilized and translated into incentives for use and conservation of agrobiodiversity.

2. WHAT IS THE CORRELATION BETWEEN AGROBIODIVERSITY AND TRADE?

Crop and animal genetic diversity, the agrobiodiversity that this workshop focuses on, forms the principal component of an agricultural production system that actually forms the output of the system. Its management by farmers is holistic in character, including agroecological and socioeconomic considerations and phenomena. Crop and animal genetic diversity are a farmers' resource and its optimal use (and there through its conservation) should guarantee maximization and sustainability of production.

When a farmer is in the position to produce a surplus, there exists the possibility of 'commercializing' surplus, i.e. the exchange of goods for cash or for other purposes (exchange for other produce, hiring labour, gifts). Where farmers opt for commercialization, that is where use of agrobiodiversity ties in with marketing. Planning is therefore imperative to production, right from the time the decision is made to produce a given product for marketing, through to output.

In addition to conventional ‘product marketing’, I will briefly explore the exploitation of particular agrobiodiversity-like characteristics of the products to increase the value of products on the market (fair trade, nature friendly products) attached to produce and ecotourism.

2.1 Constraints and opportunities

There are good reasons to conclude that the market for agrobiodiversity products is growing rapidly in most developed countries, and even in a few developing countries. Expectations of growth are underscored by a strong and increasing consumer awareness of health and environmental issues.

Poor people have production practices or produce products that add value to the environment. In this way the person serves the community. However, the incentives are often not present in order for the person to sustain this function. For example, the fact that poor people do maintain crop varieties and animal breeds that at a global level are considered important to conserve, is not expressed to the producer unless this value is realized. Marketing is a strong tool through which such value can be realized. However, awareness of the other stakeholder, in order to pay the price is crucial. Thus, awareness highlights the fundamental issues or reasons behind the consumers' association with a product or the production process. If such awareness can be raised, opportunities open for small-scale producers.

Small-scale producers and large processors and retailers can form promotion inter-linkages. This would increase competitive advantages in reaching a wider consumer network at lower cost. Product development and innovations in processing and packaging by major companies could be another opportunity for small producers to use technology innovation in processing and packaging through inter-linkages.

Whilst government policies in producer countries can be positive to growth of agrobiodiversity products, market measures might actually be barriers to trade in such product. I want to believe, however that the implementation of regulations – in particular in Europe – can be working for products in Africa's advantage. All we have to do is acquaint ourselves with these and make them part of our production guidelines. From experience they only form barriers before they are known government policy in many countries.

It seems also clear – at least in the short- to medium-term – that insufficient supply of agrobiodiversity products will be the main problem rather than lack of demand. I will also address some of these issues in a latter part of my presentation.

As we have seen above, many countries in the region produce a range of organic products and several are already exporting. However, most countries are still faced with a number of constraints, like lack of technical know-how, e.g. on organic farming, processing methods and certification, and lack of market information regarding the products to grow, which markets and distribution channels to choose, competition, market access, lack of financing, etc. These are more or less the same issues that affect agrobiodiversity products, in particular because the organic product market forms a very important market for agrobiodiversity products that we talk about in this workshop: food crops and products from farm animals.

3. ORGANIC PRODUCTS

3.1 World trade in organic products

Since there are no official foreign trade statistics, it is impossible to give a complete picture of world trade in organic products. However, it is clear that the European Union, the United States and Japan are, by far, the largest markets, though there are smaller but interesting markets in many other countries, including some developing countries. Our research indicates retail sales of organic food and beverages in 1998 of more than US$13 billion in Western Europe, the United States of America and Japan (with a forecast of about US$20 billion in 2000). Trade in organic foodstuff has indeed become a very important and global agribusiness.

The organic trade is of particular interest in a development context because of the spectacular growth that has taken place in recent years, with growth rates of between 10% and 40% expected over the medium term, depending on the market in question. It should be noted that the continuous growth in the organic sector is all the more remarkable since overall food sales is experiencing either slow growth or stagnation. Furthermore, it should be noted that organic products are usually, though not always, sold at premium prices.

Now, which products are we talking about? The main organically produced products, which are traded internationally are mentioned in table 1. As you can see, the list includes most internationally traded exotic food products. In addition, I would like to mention the following non-food organic products: animal feeds (necessary to produce organic meat, dairy products, eggs, etc.), grain seeds, natural pesticides and insecticides, cut flowers and pot plants, cosmetics, textiles, e.g. cotton, cleaning and washing articles, wood and wood products.

Table 1. Main organically produced products that are traded internationally

Fresh fruit and vegetables	Dried fruits and nuts	Processed fruit and vegetables
Coffee, tea and cacao	Spices and herbs	Oil crops & derived products
Sweeteners	Cereals and grains	Dried leguminous vegetables (pulses)
Meat, dairy products, eggs	Alcoholic beverages	Processed food and food preparations

3.2 Production

Let us have a brief look at the supply situation. Worldwide, about 130 countries produce certified organic products in commercial quantities, including 30 countries in Africa; 30 countries in Asia; 20 countries in Central America and the Caribbean; 10 countries in South America; 5 countries in Australasia and the Pacific; most countries in Europe; as well as the United States and Canada. These figures include at least 90 developing countries of which about 15 are LDCs.

It is interesting to note that most countries represented here at this meeting produce a range of organic products:

- Malawi produces and exports a range of herbs and spices, e.g. lemongrass
- Mauritius (fruit, spices and sugar); Mozambique is in a start-up phase, but already produces some nuts (cashew)
- UR of Tanzania produces organic fruit and vegetables, nuts, oil and oil seeds, coffee, honey, herbs and spices. Exports of certified organic products include black tea, hibiscus tea, essential oils and spices.
- Zambia has a considerable production of organic fresh produce, most of which is exported to the UK.
- Zimbabwe produces a wide range of products, including fresh fruit and vegetables, dried mushrooms, nuts and cotton.
- South Africa is in a build-up phase as far as organic agriculture and trade are concerned. Production includes cereals, fruit and vegetables, herbs, teas and wines. Some companies already export to the European Union, and several others are now planning to.

3.3 Marketing characteristics

From the experiences with these products in the market, emerge a number of observations that are valuable for this workshop:

- most products are fruits, and rather luxury or fancy food items; there are few examples of typical food crop and animal crop products that involve crop varieties and farm animal products from farmers in rural areas;
- organic products meet a demand for health and quality products, i.e. the incentive for people to buy these products is the contribution of the products to their health;
- organic product do also appeal to people who want to consume 'sustainably produced' products, including not only environmentally sustainable (i.e. organic), but also socioeconomically sustainable (i.e. fair trade);

- organic produce is principally bought by consumers who can pay a higher price, but quality standards are high (import regulations, consumers' standards on uniformity of quality).

Because of the character of agrobiodiversity products that we talk about in this meeting, tying in this organic produce market seems to offer the most obvious and important incentives for 'adding value' to these products through marketing. Some points and examples are elaborated below.

3.4 Product and market value: health, quality

Many small-scale farmers in Africa and elsewhere are producing 'organically' because they just cannot access or afford the use of inputs. This is also the reason why many farmers prefer to plant local varieties and use local animal breeds: these tend to be better adapted to low input levels. Often they also better tolerate local pests, diseases and other stresses, which makes it possible to produce without chemical crop production. The local varieties and animal breeds are usually highly valued by local people for their excellent taste and nutritious value. This makes these product excellent organically produced health food items.

However, we should bear in mind that organic agriculture and agrobiodiversity-friendly or agrobiodiversity-rich production is not necessarily the same. Nevertheless, organic agriculture provides opportunities for sustainable use and conservation of agrobiodiversity since in low input agriculture usually plays a more pronounced role and the organically produced products have the potential to fetch higher prices.

The development of a market for these products is easier when it concern a product that is clearly distinguishable for the consumer, such as the example of organically produced quinoa and yellow potato from the Andean Region, Latin America, or traditional leafy vegetables. It is more difficult to develop successful products that distinguish themselves in (non-visible) quality or by the fact that they are products from valuable local varieties and animal breeds.

Sometimes, the successful health-food market has important spin-offs for conservation of closely associated biodiversity. For example, the Miombo forests that are only found in South Africa produce honey that has a unique flavour, smell and medicinal qualities. Demand for the honey has led to conservation of trees through controlled harvesting of bark for the hives. Another example forms the mopani worms. Mopani worms were food for the poor in some parts of Sounthern Africa but have since found their way as an export product to South Africa, but are also served in restaurants in other parts of Southern Africa as a traditional delicacy. The growing demand of this product has led to conservation of the Mopani tree.

3.5 Cultural values

Cultural values tied to products can form an important incentive in the marketing of agrobiodiversity products. Many of the agrobiodiversity products we talk about have until recently been associated with 'backwardness', like for instance the consumption of semi-wild and wild leafy vegetables and road runner or bush chicken. However, times are changing and with the globalization of economy and communication, we regain the interest in our cultural roots. What we felt as 'backwards' before is now slowly acknowledged as valuable. It now reckognized as part of our cultural heritage and contributing to agro-ecological and socioeconomic sustainability. Here the marketing opportunities tie in with public awareness

issues! This development favours opportunities of locally and culturally important food and dishes, as well as other traditions. The challenge is to make use of these opportunities in marketing

For instance, now with the introduction of the off layers there is a niche in the market for the bush chicken. It is currently selling for the taste. The price is affected by the size. Maybe something could be done to improve the breeds and come up with a fleshier bush chicken.

3.6 Certification

Certification remains a major obstacle for many farmers and exporters, though the organic trade is fully aware of the problems and working towards a solution. For example, the National Department of Agriculture (NDA) in South Africa has recently drawn up draft regulations for organically produced products, which are expected to come into effect within a year. They are in line with EU regulations and the International Federation of Organic Agriculture Movements (IFOAM) standards.

Alternatively, certification could be one of the ways to overcome market-entry barriers. With certification it is possible to achieve a 'recognizable' product, that makes it distinct from others and that can point to its additional value (more healthy, more taste, produced/processed in a particular way, by particular people, in a particular region. Certification can be a promotional tool, but requires careful planning and organization. It requires also answering questions such as:

- What is distinct about your product?
- What is needed to make your certification/brand name succeed in cashing in on this 'distinctiveness'?

Trying to sell the product through certification asks for characteristics that are of common interest to the buyer and the seller. The amarulla berry for instance was popularized by the elephant presence. The fruit has been processed into a jam in Swaziland that has found its way to various markets at home and abroad. It has now made way to supermarkets by implementing HACCP certification. Amarulla jam is no longer being sold for charitable reasons but is now a product like any other. Once the area and product was known, the kumquat, which used to grow in the wild, is also finding its way to the same market and so is the pineapple. Organic certification was also achieved for honey in Zambia and the market has grown. There is now room to market honey from the Miombo region. Interestingly enough the eclipse was around the remotest areas and we could take advantage of the natural event.

3.7 Products and opportunities to build on

We have all the ingredients for cooking that have links with Europe. processing them further leaves us with products like cook-in sauces that are in high demand. There is demand for fruit snacks with an African touch. We could start off with the ones that have already found their way to the market. This would make them easily adapted to the market. We could supply only some certified components of the products. Like our cocoa from Africocoa in Ghana, Fruits of the Nile in Uganda and NWBP's ogarnis honey from Zambia are processed to make snack bars and various chocolates for the fair trade market. Coffee, tea and herbal teas are also other areas of demand to be considered.

The cost of certification is getting higher and higher, but could be curbed with interlinkages across the board.

3.8 Market and demand in Africa

Most African countries do not yet have much of a home market for organic products, which will be needed to build up a sustainable business. However, the domestic market has started to develop, and major supermarket chains in S.A. like Hyperama, Pick´n Pay, Shoprite Checkers and Woolworths, have begun to sell organic foodstuff or are planning to do so. As the domestic market expands, it will not only provide outlets for South African farmers, but it will also help them produce larger quantities and of the right quality necessary to meet the requirements of export markets.

In the longer run South Africa will also offer interesting opportunities for organic producers in developing countries, including SADC-members and others in the region. Primarily, such products will include those that are not produced in South Africa, or are produced in insufficient quantities. However, most of the products that you may export to South Africa in conventional (non-organic) form, may also eventually find an outlet in organic form. What is even more important is that a given product may find a market in organic form, where there is no import market for the conventional product.

The fact that a market does not exist does not necessarily imply that there is no one willing to sell or to buy. This is nowhere clearer than with agrobiodiversity products, for which there also exists an important home-market. For example, in Zimbabwe and elsewhere, prestigious hotels organize African nights or African dinners, but have difficulty in finding constant supply and diversity. The Matabele porridge, made of sorghum was in demand and sold well in the markets in Harare. However, the processor discontinued the product because supply was not sufficient. Multiple examples exist which show that demand and supply for agrobiodiversity products have difficulty in finding each other. This may form the most significant constraint in developing a market for the products at this moment since, as I mentioned earlier, there is demand. However the demand works via highly concentrated channels, i.e. supermarket chains, export/import firms. The supply however, is highly fragmented and the producers find themselves in an unfavourable position (lack of access to information, expertise and capital). There is a tremendous challenge there. Organization of small producers and facilitating access to the market seems to be able to create a win-win-win situation for producers, commercializers and consumers. In addition, conservationists may be favoured as they see the continuation of planting of valuable genetic resources in farmers' fields. The remaining contrast however is the fact that with the objective to add extra value to the agrobiodiversity products as an incentive for the farmers, we create a disincentive for the poor urban people who have equally strong interest in buying healthy, tasty food that is part of their culture.

Taking up the challenge of organization of supply (production in terms of volume and time planning, processing and packaging) requires, as always marketing, understanding of the demand and getting to know the buyers. A first characterization of the different potential buyers (Table 2) can be made, but for a more complete analysis, more information is needed.

Table 2. Characteristics of potential buyers of agrobiodiversity products

	European/North American consumers	African consumers		
		Urban rich	Urban poor	Rural
Opportunities	• cultural diversity • novelty interest • health food interest • environmental interest • able to pay premium price	• connected with same cultural values • trend setters • familiar with the products • health food interest • environmental interest • able to pay premium pricee	• connected with same cultural values • familiar with the products • health food interest • demand basic	• connected with same cultural values • familiar with the products • health food interest • availability of own produce
Constraints	• demanding high product standards, processing and packaging • requiring constant supply • need for relatively large volumes of uniform quality	• perception local food and dishes – demanding high standards?? • need for constant supply and relatively large volumes??	• not able to pay a premium price • possibilities to store/conserve • available time and fuel for preparation	• not able to pay a premium price • possibilities to store/conserve • available time and fuel for preparation

On the basis of such analysis a market development plan can be made, taking into consideration the points elaborated in the next section.

4. DEVELOPING A MARKET

I spoke earlier about the correlation between production and marketing. Now I give a detailed outline of what we need to look at to achieve a sustainable process of market development. Our integral planning process should embrace from the planning through to output the following:

Product identification and range planning

This process covers an in-depth understanding of market stipulation per selected product. One needs to take into account the prerequisites of the targeted products in relation to specifications, taste, colour, measurements, weights, distribution channels and packaging requirements. One has to consider the production requirements versus the adaptation of product to meet market expectation. It is important to pick products that are complementary either in terms of production, for example products that would use the same type of machinery for processing and/or packaging, or in terms of products that would use the same human skills etc.

Production capacity and seasonality (producer capabilities)

The potential demand would govern the output and machinery requirements. Seasonality should be married to market demand, e.g. for products sold to Europe one has to make sure

the product supply does not clash with local availability. Products should use more of the locally available skills, raw materials, technology, etc.

Producer networks and inter-linkages – comparative advantages
On selection of products one should consider linkages that could be accessed e.g. further processing links with bigger producers, packaging materials linkages to consolidate packaging materials procurement. This could also apply to small-scale producers not necessarily producing the same products but procuring raw materials externally to consolidate transportation of goods to and fro and cut costs.

Processing possibilities and reusability of by products or waste
It is highly important in product selection to maximize use of materials. There are various spin-off products that result from core production, e.g. wax production in areas where honey is produced. Diversification into other products such as candles, beverages, candy etc. One could also look at manure and compost produced from waste grain stalks. The manure would surely find itself entry into the gardens of the rich and transported at the same time with other products.

Quality assurance standards and certification
As deliberated on earlier implementing quality standards and certification would be one way to get a product to the expected customer specification. Though perceived as market entry barriers, once attained this becomes not only a promotional tool but also a way of constantly improving the processes. Implementing HAACP in food processing for dried fruit in Uganda and canned jams and preserves in Swaziland changed the ordinary man and woman in terms of hygiene, personal health and, in turn, triggered awareness of HIV/AIDS.

Potential markets requirements
Market requirements range from individual consumer specifications right up to national, regional and international specifications. These represent minimum requirements for a product to leave a producer to a local, national, regional and or international market or consumer. These also trigger innovation and new ideas in terms of style, range, and inputs, production processes and also enhance diversity.

Harnessing the stakeholders
Governments, international, regional and national trade bodies have a very important role to play in terms of creating conducive environments for trade and commerce. They have a facilitatory role that addresses key issues around access to resources, support services and markets. In the agro-based sector there are a lot of barriers due to protectorate laws that were introduced to safeguard the huge investment in agriculture in general. Changes are taking place to try and smoothen the relaxation of these laws, but a lot more still needs to be done.

The private sector is the producers' big ally and the two have to work jointly in terms of attaining comparative advantage and speaking with one voice that will influence a smoother transformation to getting easier access to markets. Co-relationships need be established jointly to facilitate producers to cope with the dynamic market situation. These could be in procurement, distribution, transport, promotion or marketing.

Consumers are the most crucial stakeholder as they determine what sells and what doesn't. There are various segments that need be assessed and understood in terms of cultural diversity, gender, age groups, economic demographics, etc. – the list is endless. The consumer also determines the price that is paid for the goods. The more reason the producer has to effectively reduce the distance between them and the consumer. This would be mainly through sharing product knowledge, keeping the consistency of supply, volumes, varieties or range and quality.

5. WHAT CAN YOU DO, IF YOU WANT TO EXPLORE THE AGROBIODIVERSITY MARKET POTENTIAL?

As illustrated above, each stakeholder has a lot to contribute to this game play. Whether you are a farmer, extension worker, agriculturist or a marketing body, it is of utmost importance to keep abreast of market events. Understanding the markets, the products and the production systems is part of managing and implementing a sustainable agrobiodiversity product. This goes beyond the point of food security or even converting surplus into cash to a commercially viable and sustainable activity. The fundamental question might be where do we begin?

- Join a national agrobiodiversity/trade association or other relevant organization in your own country to find out where the organic industry stands. You may be pleasantly surprised. Discuss with and learn from those already in the business. In most cases some form of co-operation at the national level will prove useful. The annex provides names of relevant organizations.
- Look at other regional stakeholders not only as a potential future market for agrobiodiversity products but consider it also a possible partner in various forms of co-operation within farming, processing, certification and marketing of organic products.
- Your country may participate in various forms of regional cooperation, for example through the Africa Council of Organic Associations (ACOA), Lusaka.
- Keep yourself informed of developments in agrobiodiversity farming and trade through information sharing, reading of trade journals, the internet, etc. Visit relevant trade fairs, e.g. South African Organic Trade Fair and Exhibition, South Africa and BIO FACH in Nuremberg, Germany. Make good use of the ITC studies on similar product studies.
- Most of all – **think outside the box!!!**

Have you ever thought of tying in:

- Agrobiodiversity grain with tourism?
- Agrobiodiversity good products with Sial or Anuga Food Fairs?
- The challenges in processing these products in ventures with food processors in your country?
- The in-store promotions you could establish with retails food chains?

If we can have mobile movies, mobile libraries, etc., who says we cannot have mobile agrobiodiversity food museums, mobile agrobiodiversity food festivals for both rural and urban schools and colleges? This would guarantee us a market for life spun of that generation in school today.

Ladies and Gentlemen, I hope that I have been able to give you some idea of what is going on in the area of market development and, in particular, of business opportunities that exist in related fields. I would be pleased to discuss this further with you over the next few days.

MARKETING RARE BREEDS IN SUB-SAHARAN AFRICA

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1. INTRODUCTION

The long-term future of any breed of farm animal depends largely on its commercial value – and/or its ability to meet specific needs through sometimes, unique traits. This applies particularly to many indigenous breeds that are often perceived as having no real commercial value.

In recent years, at a global scale, animal agriculture has seen a dramatic decrease in numbers in many of these breeds - mainly because they were unable to 'compete' with international breeds and composites. Rare and endangered breeds are often conserved by enthusiasts and conservationists - some of whom are aware of the importance of maintaining as much biological diversity as possible and the fact that many of these breeds have unique traits that either are/or could become important in modern animal production systems. Lasting conservation of Farm Animal Genetic Resources (FAnGR) will however depend, to a large extent, on the sustained use of local breeds by their traditional owners. This, in turn, will depend on the commercial value of the breeds concerned. It is therefore important to capitalize on any traits that will make a breed an economically attractive and, thereby, viable alternative to more popular breeds.

Sub-Saharan Africa has a number of lesser-known and endangered breeds that fit into the above categories. Relatively small carcass size, non-uniform colour patterns and a general lack of information on production potential have made traditional owners change to often less-adapted exotics. Such changes are often support by, or on, the initiative of leaders and developers who have similar perceptions of the value of local breeds. The paradigm of 'bigger is better' will, however, only change to 'locally adapted may be cheaper and more efficient' if user-friendly information can be linked to incentives farmers and traditional owners such as access to viable and long-term markets for the breeds concerned.

In discussing possible incentives to promote the marketing of lesser-known and rare breeds, a model of community-based breeding and marketing is suggested. Within this model, ideas to operationalize the support to marketing from servi-centers in communally grazed areas and marketing breeds through an annual show and sale or by 'catalogue' are presented. The opportunities to use the adding value concepts for traditional animal breeds are highlighted.

2. COMMUNITY-BASED BREEDING AND MARKETING SCHEMES

Communities that have indigenous breeds or that show an interest in farming with endangered breeds can be assisted to establish breeding and marketing schemes where individually or group-owned animals are marketed. This can be either at an annual production

sale or through local sales or even through an export channel. Figure 1 shows the basic concept of a community-based breeding and marketing scheme.

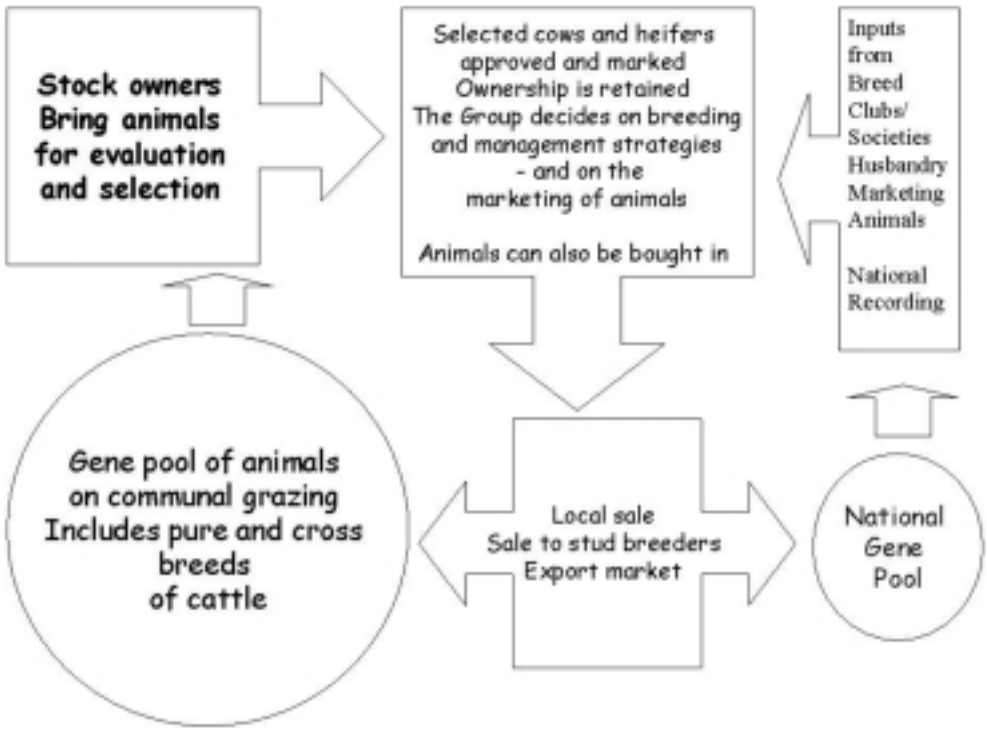

Figure 1. The basic framework of a community-based scheme.

Community schemes can be enhanced by establishing 'one-stop' service centres to provide inputs such as central collection facilities, single-channel marketing and information and advice on critical husbandry issues. Such centres also have the capacity to provide assistance to a broader spectrum of stock owners in the community.

3. STRATEGICALLY PLACED SERVICE CENTRES IN COMMUNALLY GRAZED AREAS

Very often, stockowners in the traditional areas are unaware of the fact that markets do exist for their specific breeds. Access to these markets is often limited by problems such as transport, communication and facilities to inspect and process the animals (health clearance, identification etc.). This often leads to exploitation by breeders and traders in the commercial sector. By establishing a marketing facility at a strategically placed service centre, stockowners would not only be able to sell animals on a more regular basis – but also would have easier access to information, training and basic stock remedies.

A basic holding facility could be constructed to serve for the inspection and clearance of animals to be sold – and as a mating and calving camp (Figure 2). Basic facilities for artificial insemination (AI) could also be included – if there is a need and if the management of the animals in question is at a level to justify such a step. In addition, the service centre could act as a store for hides and skins – and could also be used to process skins (in particular) as this

can be done on a small scale. The processed skins could then be used to make items for local cottage industries. Such centres need not be elaborate. Dip tanks and extension officer complexes could be easily adapted for this purpose.

Figure 2. Marketing breeds from a strategically placed service centre.

4. SHOW-AND-SALE CONCEPT FOR USE IN SUB-SAHARAN AFRICA

The NGO Rare Breeds Survival Trust (RBST) is an established breed-conservation oriented organization in the United Kingdom. Part of RBST's annual activities includes a show and sale of rare UK breeds. This activity takes place over a few days on the Royal Show Grounds near Leamington. All the animals shown are for sale, and all the respective breeders' clubs or societies are represented. The show-and-sale also includes a wide range of value-added products such as wool, mohair, clothing, leather goods, meat and milk products. A wide range of related items such as stock handling equipment, stock remedies, processing equipment, reference books, artwork etc. is also sold. This has become a major event in the UK and is well supported by the general public, breeders and enthusiasts. A number of breed societies also hold their annual general meetings during this event.

The South African breed conservation NGO, the Farm Animal Trust (FACT) reviewed and adapted the RBST model. The first South African show-and-sale of local and lesser-known breeds was held during 1999. The show-and-sale aimed to influence public awareness, to further the distribution of genetic material, and to broaden the emerging farmer sector's access to markets for their indigenous breeds. It is hoped that this will become an annual event. The possibility of two sales – one to serve the predominantly cattle-orientated North and one to serve the mixed small-stock cattle areas in the South of the country is currently being investigated. Figure 3 illustrates the basic concept of a show and sale.

The testing and development of this model need not be elaborate. Where possible, an existing infrastructure (such as a local showground, service centre) or saleyard should be used to test the concept. If successful, alternative and more convenient venues can be used.

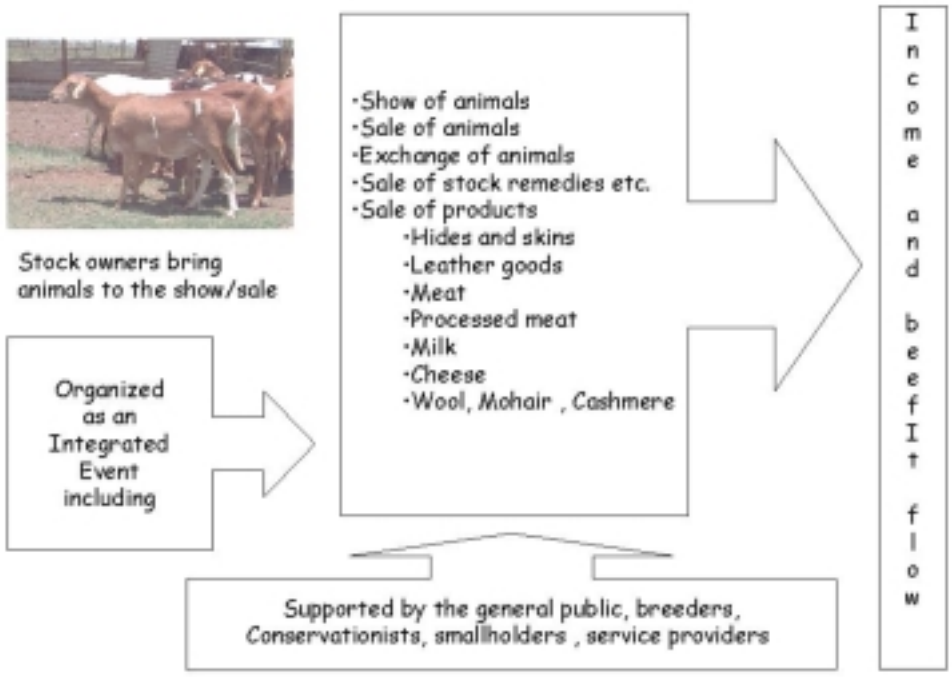

Figure 3. A basic framework for a show and sale of local breeds.

5. MARKETING BREEDS BY 'CATALOGUE'

During 1999, FACT published a book on South Africa's indigenous and locally developed breeds as part of an initiative to conserve breeds through commercial use. Information on production environments was included to help match animals with farming system conditions. It also serves as a useful reference on 'value-added' traits that are often overlooked. This could give the breeds in question a competitive edge.

The book has been distributed locally, regionally and globally, and is being used as a reference in some schools, colleges and universities. It has enabled prospective breeders and producers to contact suppliers of genetic material and services – either through the respective breed societies and clubs or through individuals advertising in the book. It is hoped that traditional owners of some of the breeds will also become involved in the supply of breeding material as well as in the direct exchange of genetic material with established commercial breeders such that the lion-share of the added value is not 'consumed' by middle men.

6. ADDING VALUE TO INCREASE BREEDER AND CONSUMER DEMAND

A lasting market for a specific breed is largely dependent on both breeder/producer demand for animals – and consumer demand for products such as meat, milk, fibre and leather.

Table 1. Economically important traits: adding value to Nguni cattle

Trait	Links	Added value
Adaptability	Direct link with fertility, feed utilization	Minimum care breed
Fertility	Cow productivity; production per unit area	Cost effective production
Cow productivity	Milk production; Adaptability	Link to minimum cost farming
Temperament	Cow productivity, fertility	Link to fertility, meat quality
Ease of calving	Skeletal structure – sloping rump	Link to cow productivity and industrial crossing Custom-bred feeders
Parasite tolerance	Adaptability, Fertility, Cow productivity, hide quality, grooming behaviour	Cost effective production; better quality hides; meat marketing (no dips)
Disease tolerance	Adaptability	Cost effective production; meat marketing (no stock remedies)
Meat quality	Early maturing type; Crossbreeding potential	Top quality beef – potential for branded beef market Link to Custom breeding for feedlots
Colour patterns	Short hair covering; Symmetric patterns	Market hides and products – hair on hides sell for R2000 up.
Hide quality	Parasite tolerance	Unblemished thin hides – ideal for upholstery

Breeder- and producer-demand considers traits such as fertility, adaptability, ease of birthing, tolerance to parasites and some diseases, and the ability to produce consumer-demanded products as efficiently as possible. Linking all this information on the animal breeds together in a user-friendly form and developing markets for unique products such as 'grass-fed beef/mutton', residue-free milk, quality fibre and leather is all part of a value-adding process. In discussing value-adding to increase breeder and consumer demand, local breeds of cattle, sheep, goats and pigs offer ample opportunities. Some examples are presented below.

6.1 Nguni cattle

For many years, Nguni cattle were perceived to be inferior to other cattle breeds – largely because of their often-smaller size and varied colour patterns. This situation has changed. Research into the potential of the breed and the establishment of a breed society has helped to bring about this change. Information on the unique characteristics and added advantages of the breed is now more readily available.

On-going development of markets for products such as hides and branded beef will ensure that the Nguni is in demand as a commercial breed – and not just as a breed to be sold and marketed between stud breeders.

6.2 Indigenous sheep

South-African indigenous sheep breeds include fat-tailed (Pedi, Damara, Zulu, Afrikaner) and fat-rumped varieties (Persian). In comparison to some of the locally developed composites such as the Dorper (Dorset horn–Persian) and the Afrino (Afrikaner–Merino), these breeds have a smaller carcass and have also been downgraded in the past as a result of the fat tail – or fat rump.

Although not always seen as a value-added advantage, indigenous breeds are often used to develop hardy composites. This often helps conserve a pure nucleus.

The average market carcass weights of some of the pure and composite sheep breeds in South Africa is illustrated in Table 2. Farming with pure indigenous sheep breeds can be made more profitable by considering some of their characteristic traits from an economical perspective: see Table 3.

Table 2. Average market carcass weights of some South African indigenous and composite landrace sheep breeds (source: Snyman, 1998)

Breed	Carcass weight
Mutton Merino	22
Namaqua Afrikaner	18
Afrino (Merino x Afrikaner)	20
Persian (Somali)	13
Dorper (Dorset x Persian)	18

Table 3. Adding value to indigenous sheep – economically useful characteristics

Characteristic	Added value
Quality skin	In demand for fashion items and garments
Parasite tolerance	Less damage to skin – lower maintenance costs – stock remedies
Fat tail	Sold as a delicacy– or as an ingredient for locally made meat products (fresh and dried sausage)
Residue-free meat; quality meat	Capitalize on the market for healthy meat as well as a branded (local sheep) mutton.

6.3 Adding value to indigenous goats

The South African Improved Boer goat is an example of what can be achieved by improving an indigenous breed for a specific purpose. The Boer goat is in demand in a number of Countries for use as a meat-producing goat and genetic material has been exported to Canada, USA, Australia and New Zealand.

Unimproved goats, of which there are a wide variety, are generally regarded as having little to no economic value – and some ecotypes could become endangered fairly shortly as a result of this perception. Value can be added to these goats by capitalizing on one or more of the following:

Characteristic	Value
Resistance to heartwater (Cowdria)	Lower mortalities; minimal use of stock remedies
Tick tolerance	Less damage to skin; minimal use of stock remedies
Quality skin	In demand for fashion items and garments
Capacity for crossbreeding – milk	Potential to develop hardy composite milk producers
Capacity for crossbreeding – cashmere	Quality cashmere as an added product
Capacity for crossbreeding – meat	Can be used to breed a more hardy meat producer in areas where pure Boer goats are unable to survive without additional management and remedy inputs

Cashmere could become a useful value-added product and initial trials have shown that South African indigenous goats produce good quality cashmere. Selection for higher production could lead to the development of a multi-purpose goat – meat, milk and cashmere.

6.4 Indigenous pigs

South Africa has two basic indigenous pig breeds: a short-snouted 'Kolbroek' and a longer snouted 'Windsnyer'. Both are often seen as less efficient than the more modern pig breeds and their tendency to put on excess fat is also considered a disadvantage. Despite these perceptions, these breeds are capable of generating a good income and are, in fact, viable alternatives to more modern breeds under less intensive production conditions.

Table 4. Adding value to indigenous pigs: economically useful characteristics

Characteristic	Value
Conversion of coarse fibre rations and root crops	Suitable for free range systems; less dependence on expensive high grain rations
Parasite tolerance	Less expense on stock remedies
Strong feet	Can be used to improve the feet of modern breeds with foot problems
Excess fat	Fat can be trimmed off the carcass and reduced for sale as lard and crackling
Meat	Niche market potential – tasty and additive free pork

7. CONCLUDING REMARKS

A large portion of the lesser-known and rare breeds of farm animals in Sub-Saharan Africa are owned by the traditional/family sector where information on, and access to, markets for these animals is often limited.

These resources are, however, of critical importance: to the well being of the owners and to the maintenance of diversity in both local and regional FAnGR.

Developing and improving market opportunities for these breeds and for value-added products such as hides and skins, branded meat, milk, fibre and processed goods will encourage stock owners to continue farming with the animals in question, and enable those considering a change to often less suitable breeds from the global gene pool, to re-think their decision.

Combining the value-adding process with the development of one or more of the models discussed could result in a much-needed paradigm shift towards the hardy adapted breeds of the region – and towards lasting conservation through sustainable use.

Government departments and NGOs involved in the development and enablement of rural communities and stock owners should consider taking the initiative to plan and implement such models – with the full cooperation of the people in question.

Such models may also be attractive to international development agencies as they will facilitate, and be largely dependent upon, optimal people participation.

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COMMERCIALIZATION AS AN INCENTIVE AND THREAT FOR *GNETUM* SPP. (ERU) IN CAMEROON

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SUMMARY

Gnetum is the most exploited and commercialized vegetable in Cameroon (Besong, 1998a,b). This forest vegetable plays a key role in the livelihoods of the people of Cameroon, particularly in that of local communities. *Gnetum*, commonly referred to as Eru (YDC, 2000), is very important in terms of its social, cultural, medicinal, nutritional and, above all, economic values. Eru provides employment to many women and children who collect and sell it throughout the year. The leaves form part of the diet in almost all the social strata in the country, particularly of people from Manyu Division. In addition, Eru is known to be high in protein (Schippers and Besong, 2001) and has medicinal properties. Large quantities are shipped to Nigeria for local consumption and for export to Europe and the USA. *Gnetum* is a threatened species in all areas of Cameroon where it grows.

1. INTRODUCTION

Gnetum still grows wild in Cameroon and is not cultivated. There are two species of *Gnetum* found in the forests of Cameroon. *Gnetum africanum* has small leaves and is more available, and therefore more popular and widely consumed. *Gnetum buchholzianum* has larger leaves and occurs less frequently. The larger leaves make this last *Gnetum* species easier to harvest, requiring less time to shred and more easily fills a market bowl or dish with small number of leaves (Nkefor and Ndam, 2000). Because of its economic importance and its very high demand – particularly from neighbouring Nigeria and Gabon – it is harvested and sold by whosoever can afford to do so; in particular, children and women from the communities around the forests where *Gnetum* is found. *Gnetum* is commercialized in different forms: entire or shredded leaves, or as prepared food in markets, workplaces, public schools etc. according to the consumption habits of the buyers/consumers.

2. *GNETUM* COMMERCIALIZATION

Like other indigenous vegetables, *Gnetum* is commonly sold in bundles, and women are the major traders. A woman can harvest up to 100 bundles in a day. These are sold locally at 100 FCFA2 per bundle. This woman earns 10 000 FCFA per day, which is higher than the defined average threshold for poverty in Cameroon (Cameroon Human Development Report, 1998).

SA'A is a community near Yaounde, the capital of Cameroon. SA'A and neighbouring villages are the source of most of the *Gnetum* that is exported through the coastal seaport of Idenau in the South West Province of Cameroon to Nigeria. Studies carried out by the Mount

Cameroon Biodiversity Conservation Centre, showed that wholesalers go to SA'A and buy all the *Gnetum* harvested for 100–150 FCFA (US$0.15–0.22) per bundle. Each bundle is estimated to weigh 1 kg. The *Gnetum* is packed and transported in buses and on their carriages to Idenau for export to Nigeria. It has been estimated that on average a bus carries between 1.7 tons and 2.5 tons of *Gnetum*. About 30 buses of *Gnetum* go to Idenau weekly. Consequently *Gnetum* exported from the Idenau coastal port alone (to Nigeria), is calculated to generate an annual revenue of 1 060 800 000 to 1 560 000 000 FCFA (US$1 500 000–2 200 000).

A study carried out in the local markets in the Fako Division of Cameroon shows that women are, as usual, the main sellers of *Gnetum*, mostly selling it in shredded form. These sellers buy from nearby markets and from middle-women who buy from the major collection/contractual points in the villages. Depending on the size of the market and also on the season, a middle-woman trading *Gnetum* buys between 15 and 20 bundles a day to shred for selling in the village/small market whereas the seller in the town/bigger market buys and sells 30 bundles of shredded *Gnetum*. One bundle of *Gnetum* is equivalent to 3 bowls/dishes with shredded leaves. The shredded *Gnetum* is sold at between 200 FCFA and 300 FCFA per bowl. Therefore, a seller of *Gnetum* in these markets can make 144 000 FCFA or more per month, during the wet season, and twice the amount during the dry season.

3. LINKAGE OF *GNETUM* TO USE AND CONSERVATION OF AGROBIODIVERSITY

As is clear from the market study that trade in *Gnetum* is very important in Cameroon. The study also showed that there is an increasing demand and supply of *Gnetum*. The increase in demand is the result of an increase in the population. In Cameroon, the population is growing at a constant rate (2.83%, Cameroon Human Development Report, 1998), which has doubled the population over the last 20 years. Economically, *Gnetum* contributes to poverty alleviation. It provides employment and income for many, especially the vulnerable (rural women and children). Culturally, the leaves form part of the diets of almost all of the social strata in Central Africa and Nigeria. *Gnetum* is very nutritious – rich in protein, minerals, and contains the eight essential amino acids. It can therefore be used to fight malnutrition. *Gnetum* also has medicinal uses: in addition to treating enlarged spleen, sore throat, piles and high blood pressure, it is used to treat nausea, arrow poison, to hasten maturation and to ease childbirth. The leaves are also used in the production of a commonly exported whisky to Nigeria (Mbah and Mih, 2001)

One may wonder how the many uses of *Gnetum* can be linked to conservation of agrobiodiversity. Obviously, *Gnetum*'s resource base is threatened. With a constant source of supply and the fact that harvesting is a widely spread practice, occurs frequently and is destructive (through the cutting down of its shade cover and support base), *Gnetum* species risk extinction. Differently than other forms of agrobiodiversity, i.e. crop varieties, wild and semi-wild growing plants that are used for food and agriculture can be lost to overexploitation. With such loss, not only valuable genetic resources are lost, but also the knowledge of its uses in dishes and as medicine. Also the livelihood security of people who are in a vulnerable position is directly affected. The irony of the situation is that these same people are the ones who harvest and commercialize the *Gnetum*, thereby undermining their own resource base. To counteract this risk of extinction, the government of Cameroon has put in place a policy to

control its harvesting through community forest management. Research institutes, conservation projects, farmers, non-governmental organizations (NGOs), and community-based organizations (CBOs) together are making increased efforts to conserve *Gnetum* (Ndam *et al*., 2001).

Cultivation of wild and semi-wild growing food plants is generally considered a viable strategy for these threatened resources. Shiembo (1997) recommended vegetative propagation for *Gnetum* cultivation. The Mount Cameroon Biodiversity project has a genebank of the two *Gnetum* varieties, and has developed a simple and low-cost technology for propagation of *Gnetum* cuttings. A method for sustainable harvesting of *Gnetum* has also been developed. Individual farmers and farmer groups have been trained to produce their own planting materials and adapt their harvesting techniques. Some farmers are already producing *Gnetum* in their farms. The National Institute of Agricultural Research for Development (IRAD), in collaboration with related institutions and farmers, is testing the production of *Gnetum* in agroforestry systems. This particular production technology is recommended since *Gnetum*, apart from being shade tolerant, is a climber and therefore requires support.

4. RECOMMENDATIONS

Despite all the strong market forces and the many incentives that make *Gnetum* an attractive and a successful vegetable in Cameroon, technologies for cultivated production are still experimental, while the demand for it continues to rise. Bulk production remains a problem. The production period of *Gnetum* and thereby the realization of benefits take a long time. The threat on *Gnetum*'s resource base is still very real. Therefore, our recommendation is to tackle the issue from three sides, i.e. through research, training and extension, all to be implemented through participatory/partnership approaches:

- Research – conduct agronomic and economic trials, and establish germplasm and genebanks.
- Training – of (a) technical staff (long and short-term training; (b) other stakeholders (farmers, extensionists, researchers, conservationists and policy-makers). They should be trained in the various aspects of conservation, including the cultivation of *Gnetum* (conservation by cultivation), market and post harvest issues
- Extension – introduce and adapt on-station generated technologies to enhance adequate use and conservation of *Gnetum* as a means to preserve agrobiodiversity by all stakeholders.

Gnetum is a typical example in Cameroon. Therefore the challenges that can provide incentives for a sustainable use for Cameroon are:

- for the government to make more farm land available;
- to domesticate through *ex situ* cultivation;
- to conserve *in situ* by creating many germplasm collections and genebanks;
- to match the production of *Gnetum* with the high population growth, a major investment is required for commercial farming;
- to explore other propagation methods such as tissue culture;
- to develop strategies to accelerate *Gnetum* production through seeds.

It is important to realize that there are many threatened wild and semi-wild plants in Africa that are used for food and agriculture, while human and financial resources are scarce. Exchange of experiences and information can contribute to overcoming this problem.

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POLICY INCENTIVES FOR ON-FARM CONSERVATION AND USE OF AFRICA'S AGROBIODIVERSITY

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INTRODUCTION

This paper analyses a number of policy and institutional issues that arise in the context of promoting the on-farm conservation and sustainable use of agrobiodiversity in Africa. The paper is divided into two parts: Part 1, written by John Mugabe, provides participants at this workshop with a common conceptual understanding of what is meant by the terms 'agrobiodiversity' and 'incentive measures'; it also includes a preliminary discussion of, and recommendations concerning, policy and institutional reforms that should be instituted to create incentives for conservation and sustainable use of the biodiversity in Africa. Part 2, written by Michael Halewood, offers a preliminary analysis of the potential impacts of different forms of intellectual property and access laws on the on-farm conservation and use of agrobiodiversity.

PART 1: INCENTIVES, AGROBIODIVERSITY, AND POLICY CONSIDERATIONS

1. CONCEPTUAL ISSUES

The concept of agrobiodiversity (or agricultural biodiversity) has acquired such common usage in international and national policy dialogues that often its precise meaning is taken for granted. Some use it interchangeably with plant genetic resources for food and agriculture. Others tend to restrict it to cultivated and wild crops, not appreciating its ecosystem and animal facets. The various interpretations and definitions of agrobiodiversity mislead public policies intended to promote its conservation and sustainable use.

Then, *what is agrobiodiversity*? Within the frameworks of the Convention on Biological Diversity (CBD) and the Food and Agriculture Organization (FAO), there have been attempts to define agrobiodiversity. For the CBD, agrobiodiversity "means the variability among living organisms associated with cultivating crops and rearing animals and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems" (UNEP/CBD/COP/3/14). A joint workshop of the CBD and FAO in 1999 defined agrobiodiversity as "variety and variability of animals, plants, and micro-organisms which are necessary to sustain key functions of the agro-ecosystem, its structure and processes for, and in support of, food production and food security" (FAO, 1999).

The first definition offered by the third Conference of Parties to the CBD is one that has been embraced or adopted by many African countries in their national strategies and action plans on biodiversity. While it moves perception to non-crop, non-plant components, it fails to capture those aspects of agrobiodiversity that are not cultivated and reared. It essentially ties agrobiodiversity to agricultural practices. The latter definition by the CBD and FAO emphasizes the ecosystem facet, and accommodates micro-organisms as part of the agrobiodiversity realm. It also articulates functional aspects of diversity.

Others have defined agrobiodiversity in terms of its constituent parts. For example, Mutta *et al*. (1999) defined it as encompassing "edible plants and crops, including traditional varieties, cultivars, hybrids, and other genetic material developed by breeders; and livestock (small and large, lineal breeds or thorough breeds) and freshwater fish; organisms vital to soil fertility, structure, quality and health; naturally occurring insects, bacteria and fungi that control insect pests and domesticated plant and animal diseases; agro-ecosystems components and types (polycultural/monocultural, small/large-scale, rain-fed/irrigated, etc.), indispensable for nutrient cycling, stability and productivity; and 'wild' resources (species and elements) of natural habitats and landscapes that can provide services (for example, pest control and ecosystem stability) to agriculture" (Mutta *et al.* 1999).

The CBD and FAO, and other definitions are however silent on the socio-cultural underpinnings of agrobiodiversity. This diversity is obtained in and enhanced by a social context. It does not exist in a social vacuum. It is a product of many years of co-evolution between social and ecological systems. Farming as a socio-economic activity has been responsible for the formation and enhancement, and sometimes the destruction, of agrobiodiversity. Thus, any discussion of agrobiodiversity must as of necessity adequately appreciate social factors. Any measures to sustain agrobiodiversity are unlikely to succeed if they ignore the social fabric of agricultural change and development.

Traditional farming systems are an extremely rich source of agrobiodiversity. Around 60%of the world's agricultural land is still farmed by traditional or subsistence methods. Shifting and subsistence agriculture, which involves 500 million people on less than 8.5% of the world's tropical land area, is characterized by very abundant agrobiodiversity. These properties are attributed to the many indigenous technologies developed by traditional farming communities to meet different ecological and socio-economic needs. Based on centuries of experimentation, traditional farmers have evolved cropping patterns that suit their particular situations and demonstrate their excellent ability to manage intra-specific diversity of the plants they grow, which include native or 'wild' species and naturalized ones. The traditional varieties in these systems tend to have a greater inherent, intra-varietal diversity than modern ones. In many African countries, small-scale farmers play a central role in managing and conserving germplasm through its active and daily use. These systems or practices include rotation, use of transitional crops, agro-forestry, homestead gardens and mixed-crop farming.

The appreciation of the social context for the conservation and sustainable use of agrobiodiversity can be demonstrated by the kinds of measures that countries put in place. Indeed, countries that appreciate society's contributions to agrobiodiversity often demonstrate that appreciation by formulating and implementing policies, laws and programmes that create *incentives* to local households to conserve and sustainably use it.

What is an incentive? The Secretariat of the CBD has defined an incentive as "specific inducement designed and implemented to influence government bodies, business, non-governmental organizations, or local people to conserve biological diversity or to use its components in a sustainable manner." (UNEP/CBD/COP/3/24). In this discussion we perceive an incentive as an action or measure deliberately instituted to encourage individuals and institutions to invest and engage in (including supporting) the conservation and sustainable use of agrobiodiversity. Such an action or measure can be either economic or non-economic. Economic incentives are monetary or fiscal inducements. They could be in the form of money given to individuals and/or institutions to induce or encourage them to conserve and sustainably use agrobiodiversity. It can also take the form of economic policies such as tax relief and subsidies. Non-monetary incentives may be in the form of such policies and laws as those that create and provide access to and security of ownership of land.

The role of incentives is to influence private and public decisions and actions in support of the goals of conservation. They are established to change actions that destroy or contribute to the destruction of agrobiodiversity. Incentives may also be instituted to ensure the maintenance of practices that conserve and sustainably use diversity.

2. OVERVIEW OF AFRICA'S AGROBIODIVERSITY

Africa is one of the genetically rich regions of the world. It is well endowed with a diverse range of agro-ecological systems with unique species of plants, animals and micro-organisms. It has some of the world's rare and endemic species and ecosystems. The region has some of the Vavilov centers of diversity centers. Eastern African sub-region is the origin of 12 of the world's agricultural crops. Ethiopia is believed to be the origin of coffee (*Coffea arabica*), barley (*Hordeum vulgare*), sorghum *(Sorghum bicolor),* wheat (*Triticum* spp.), teff *(Eragrostis tef),* niger seed, *noog* (*Guizotia abyssinica*), linseed *(Linum usitatissimum),* sesame (*Sesamum indicum*), castor bean *(Ricinus communis),* pea *(Pisum sativum)*, chickpea *(Cicer arietinum),* lentil *(Lens culinaris),* ensete *(Ensete ventricosum)* and chat *(Catha edulis)*. Of particular importance is the species richness of the montane grasslands of Ethiopia, which has contributed *Eragrostis pilosa,* tef's progenitor, *Sorghum arundinareceum,* one of sorghum's progenitors, and wild legumes *Cicer cuneatum* and *Lens culinaris*.

Over the past centuries Africa has also received genetic diversity from other diversity centers. African countries are heavily dependent on agriculture for their subsistence as well as for their overall national economic growth. On average, agriculture contributes over 30% of the gross domestic product (GDP) and employs more than 70% of the region's population. The growth and sustenance of the economies is thus tied to the extent to which biological diversity in general and agrobiodiversity in particular are managed. Agrobiodiversity supports rural livelihoods and contributes to national food and nutrition security and scientific crop improvement.

Agrobiodiversity yields multiple benefits to rural livelihoods through traditional farming systems for subsistence agriculture, scientific crop improvements and national food and nutrition security. Experience and research show that agrobiodiversity has many properties of value to agricultural development. In effect, conservation, sustainable use and enhancement of agrobiodiversity can contribute to Africa's food, livelihood security and sustainable agricultural development. Agrobiodiversity can:

- increase productivity, food security, and economic returns;
- make farming systems more stable, robust and sustainable;
- contribute to sound insect pest and disease management;
- conserve soil and increase natural soil fertility and health;
- diversify products and income opportunities;
- reduce or spread risks to individuals and nations;
- reduce dependency on external inputs;
- improve human nutrition and provide sources of medicines and vitamins.

Thus, conservation and sustainable use of agrobiodiversity are not just technical issues but matters of public policy and politics.

Despite the central role that agrobiodiversity plays in their economies, the countries are losing genetic resources for food and agriculture at fairly rapid rates as a result of a wide range of complex and interrelated factors. *First*, many of the existing national policies of the countries tend to promote the introduction of exotic germplasm and undermine traditional farming systems. They often lead to the erosion of traditional genetic material. *Second,* and related to above, public agricultural research institutions have for many years focused their research and extension services on a narrow range of exotic crops. They have ignored the range of traditional crops and genetic resources that form a large part of local small scale farming systems in the region. *Third*, agro-ecological systems are under increasing pressure from high and growing human population densities. Growing populations without corresponding technological options for sustainable agriculture are destroying Africa's unique ecologies. *Fourth*, many of the countries posses policies that act as disincentives for conservation and sustainable use of agrobiodiversity. For example, tenure policies of many countries create a high measure of insecurity in land ownership. Small holders are often denied land ownership title and tend not to invest in conservation and sustainable use of agrobiodiversity.

3. POLICY AND INSTITUTIONAL ARRANGEMENTS

Addressing the causes of agrobiodiversity destruction and loss requires innovative public policies – policies that create and maintain incentives for individuals and communities in Africa to invest in and benefit from conservation and sustainable use. The CBD has put the conservation and sustainable use of agrobiodiversity high on its agenda, and requires governments to institute policies and programmes for achieving its objectives. Its third Conference of Parties recognized the "the close relationship between agriculture and biological and cultural diversity…and agricultural biological diversity as a focal area in view of its social and economic relevance and the prospects offered by sustainable agriculture for reducing the negative impacts on biological diversity, enhancing the value of biological diversity and linking conservation efforts with social and economic benefits" It thus established "a multi-year programme of activities on agricultural biological diversity aiming, first, to promote the positive effects and mitigate the negative impacts of agricultural practices on biological diversity in agro-ecosystems and their interface with other ecosystems; second, to promote the conservation and sustainable use of genetic resources of actual or potential value for food and agriculture; and third, to promote the fair and equitable sharing of benefits arising out of the utilization of genetic resources; and which, in support of the implementation of ongoing or the initiation of new policies, programmes and plans in the field of agrobiodiversity."

The Convention expects each Party to integrate its conservation and sustainable use of biological resources of relevance, i.e. agricultural, into national decision-making. Integration can take place at the policy, planning and management levels. The effort needs to be supported by effective legal and regulatory frameworks as well as incentive measures (which include economic instruments, market and other incentives). In addition, agrobiodiversity needs to be featured prominently in the integrated environmental and economic accounting systems needed to implement sustainable development.

The CBD obligations are intended to reinforce and guide the work already being done by the relevant international, regional and national institutions and market-based activities in agrobiodiversity. Recent international policy efforts to promote conservation and sustainable use are articulated Chapter 14 of Agenda 21, from which the international community, mainly through the Food and Agriculture Organization (FAO), has formulated a Global Plan of Action (GPA) on Plant Genetic Resources for food and agriculture. GPA was adopted by governments at the Fourth International Technical Conference on Plant Genetic Resources held in Leipzig, Germany in June 1996. Other important scientific and technological measures, such as international agricultural research activities under the Consultative Group on International Agricultural Research (CGIAR), have led to efforts to conserve and use agrobiodiversity sustainably. Other relevant activities are carried out by the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP) and the World Bank, among other inter-governmental organizations. These worldwide initiatives and efforts have yielded valuable lessons and form an important basis for integrating agrobiodiversity concerns into agricultural development at national level.

4. EXAMPLES OF INITIATIVES IN AFRICA

Some African countries have formulated policies to promote the conservation and sustainable use of agrobiodiversity. For example, Ethiopia has articulated conservation imperatives in its overall environmental policy. Section 10 of the policy contains the following national objectives

1. to promote an *in situ* conservation system in a nature reserve, a farmer's field, as the primary target for conserving both wild and domesticated biological diversity; and to promote an *ex situ* system in genebanks, farms, botanical gardens, ranches and zoos to supplement *in situ* conservation;
2. to promote *in situ* conservation of crop and domestic animals, biological diversity and other man-made and managed ecosystems through conscious conservation of samples of such ecosystems, even when change as a whole is taking place;
3. to ensure that factors such as the vulnerability level, uniqueness, importance and economic and environmental potential of the genome be taken into account in determining conservation priorities;
4. to ensure that the conservation of genetic resources *in situ* maintains a dynamic system of genetic variability in an environment of constant selection pressure that is normally present in the natural, or human-made ecosystem.

5. SOME RECOMMENDATIONS

Specific activities as well as policy and institutional measures that African governments may wish to consider include:

Each country should *conduct an assessment of the status of its agroeological systems* to identify the specific species and genetic wealth of these systems. Such assessment should identify processes, activities, policies and laws that contribute to the degradation and loss of agrobiodiversity.

Countries should, if they have not yet, *establish research and monitoring mechanisms* (including those for identifying key environmental changes and processes that contribute to agrobiodiversity degradation and loss). These mechanisms should be developed and implemented with the full participation of local farming communities.

Economic (including fiscal) and legal incentives for the sustenance of traditional farming systems should be explored and instituted. Such measures should aim at promoting the use and further development of traditional agricultural practices, and redirect investments from ecologically unsustainable agricultural practices.

Programmes to *raise awareness* of the economic, social and environmental costs of agrobiodiversity degradation and loss, and to build and/or enlarge a political constituency for concerns of agrobiodiversity should be established at local and national levels in the countries.

More *research on the nature of traditional agro-ecological management systems*, and on ways of sustaining these systems, is required to inform policies and practices of governments as they plan for and invest in agricultural development. Such research would generate options for modernizing agriculture without destroying traditional systems that nurture biological diversity. More research is also required to develop alternative agrobiodiversity management techniques, suited to the ecological and socio-cultural conditions of the countries.

The above measures, if carefully instituted, may contribute to the conservation and sustainable use of agrobiodiversity and thus enlarge prospects of attaining food security in the region. Given the diversity in the region – each of the countries possesses unique socio-economic and political systems as well as policy-making approaches – it is crucial that each government carefully identifies those specific measures it can institute and implement with its available resources.

On the whole, each country of the region needs to take concrete measures, where lacking, to intensify conservation efforts and implement programmes for conservation and sustainable use of agrobiodiversity. Specific efforts should be made to raise awareness of agrobiodiversity issues and to increase investment in long-term biodiversity planning at all levels. Such efforts should promote more research on traditional farming systems that enhance and conserve agrobiodiversity.

PART 2: IMPACTS OF IPRS AND ACCESS LAWS ON ON-FARM CONSERVATION AND USE OF AGROBIODIVERSITY

This second part of the paper, by Michael Halewood (IPGRI), is divided into two sections. Section A consists of a description of an ideal on-farm conservation and use scenario. Section B consists of an analysis of whether or not different forms of intellectual property (IP) and access laws support or undermine that ideal scenario. In this context, we narrow our focus to examine IP and access laws impacts on one particularly fundamental aspect of on farm conservation and use of agrobiodiversity: access to as wide a range of germplasm as possible to introduce into local planting and crop improvement systems.

1. IMAGINING AN IDEAL ON-FARM CONSERVATION AND USE SCENARIO

Public policies should reflect collectively determined ideals. An analysis of the impact of policies in the context of this paper must therefore be informed by a vision of a (realistic) ideal scenario regarding on-farm conservation and use of agrobiodiversity. It is only with such a vision in mind that we are able to evaluate the potentially negative or positive impacts of different policy options.

One salient feature of an ideal on-farm agrobiodiversity scenario is that the conservation and use of that agrobiodiversity it is integrated into the sustainable, daily socio-economic lives of farmers. For farmers to use locally bred and adapted varieties, those varieties must represent means by which those farmers can improve their livelihoods. It is not realistic to expect farmers to keep planting the same crops year after year, from the same seed, when better alternatives – either introduced from abroad, or locally derived – may be available. Conservation of a wide genetic base of breeding material is not the goal of most farmers; improving their livelihoods is. A realistic *in situ* agrobiodiversity conservation and use scenario therefore, is one that involves farmers using a broad range of genetic material because it provides them with options for an improved livelihood.

A vital component of the ideal scenario is that farmers have access to and use the broadest possible range of materials in their pursuit of improved livelihoods. Ideally, there is a demand, from farmers and consumers alike, for products and materials with a broad genetic base. Complementing this demand, local consumers and farmers must be aware of and appreciate the diversity of different material that can be locally produced. Farmers, in particular, must be aware of the existence and potential value/usefulness for crop improvement of the diversity of material that is available in their own regions. It is a point worth underscoring that as far as farmers' breeding and selection is concerned, the most useful material to integrate into their local crop improvement schemes [as base material] is generally that which is from the same or adjacent regions (as it is usually adapted to local conditions). For example, improvements to finger millet in Uganda will require access to materials elsewhere in Uganda or perhaps Kenya; it will depend less upon GR from South Asia. That is not to say that foreign material is not also a critical component of on farm conservation and use of agrobiodiversity; in fact, ideally, farmers would always have access to foreign material with useful characteristics to introduce into their own crop 'portfolios'. I will address this aspect below.

Furthermore, ideally, there are local and/or regional 'reservoirs' of *ex situ* and *in situ* material that are available to the farmers. These reservoirs have comprehensive collections of material from the region concerned, and facilitated access to collections of other material in (or from)

other parts of the world. For short hand, I will call these reservoirs genebanks, on the understanding that ideally, they maintain much closer ties with local farmers than most 'genebanks' do today. Farmers have a dynamic relationship with the local/regional reservoirs or genebanks. They are in regular contact with the genebanks to provide them with material, and to provide advise on both what local they should be collecting, and what the farmers' needs with respect to foreign materials. They must have an open-door policy in terms of making materials available to farmers for experimentation and for local institutional breeders to use in their breeding efforts as well. Local genebanks are well connected with national and regional genebanks, in order to obtain materials on a regular, facilitated basis, they do not hold themselves.

There is locally or regionally based breeding. In some cases, these local 'breeders' are farmers with a reputation for always having good seed, and supplying seed to other farmers on an exchange or cash basis. These farmer specialists are encouraged to concentrate their local breeding efforts, to the point where they become a reliable source of improved seed for other local farmers, the genebanks and seed multipliers. In some cases, there are established formal sector breeders. In these instances, the formal sector breeders are sensitive to local needs, limitations, and markets. They breed materials that can be grown within the local economies of scale. They engage local farmers in their breeding programs.

Foreign material is accessible through the genebank system and frequently used. However, it is not used to replace local materials. Instead, it is mixed into local breeding and multiplication programs, and adapted to the local environment over time. This has the effect of broadening the genetic base of local materials without replacing them.

There is a local or regionally based seed multiplication and distribution system. Multiplication and supply must be responsive to and informed by the needs of farmers. Through this system, a wide variety of seed is accessible to farmer groups differentiated by income, social status, ethnicity and so on. The seeds are available on an ongoing basis through easy-to-access channels; they are not simply available on a 'once off' basis. This is so because the poorest farmers in heterogenous regions often lose seed of desirable varieties and need channels through which they can re-access that material.

There is a market outside the local system for at least a portion of the crops grown and seed produced locally. Realistically, it is impossible to expect that niche markets can be promoted that would provide a market demand for the whole wide range of materials that would ideally be conserved and used on farm. Nonetheless, farmers groups, civil society organizations and government support agencies are constantly searching for such marketing opportunities.

There is support from domestic governments in the form of credits for farmers, local/regional breeders and multipliers, grants to genebanks and awareness raising programs.

There are civil society organizations in the form of farmers' collectives, lobbying organizations, institutions dedicated to research and development and 'watch dog' groups – all of them fulfilling 'backstop' functions to ensure that the individuals and institutions involved work together in a complementary, cohesive manner.

All of these are important elements that work together to promote agrobiodiversity on farm. Crop improvement is a never-ending process. Farmers and breeders work together, with farmers indicating and/or selecting the characteristics that they think are most important. This constitutes an incentive for the introduction of greater diversity in the attempts to emphasize and facilitate farmers' selected traits. The genebanks make available previously collected local material and foreign materials for breeding and experimentation to the farming communities. Specific diversity or traits can be “bred into local material” to improve it. In this way, the genebank system plays an essential role in re-injecting diversity into the fields and, thus contributes to a broadening of the genetic base of our crops.

2. EVALUATION OF THE POLICY OPTIONS

The following subsections 2.1 and 2.2 evaluate access and intellectual property laws impact on a vital component of on-farm conservation and use of agrobiodiversity: farmers’ access to seeds.

As stated above, there is a range of policy options that are relevant to this subject. We have focused on intellectual property and access laws for three reasons: one, because they remain the two most controversial kinds of laws governing control over genetic resources; two, there is still relatively little analysis about their effect on systems of seed supply for on-farm conservation and use of agrobiodiversity; and three, time and space does not allow for a protracted analysis of other options.

Anticipating the conclusion of this Part of the paper, we will argue that there are elements of intellectual property laws and bilaterally oriented access laws that work against the sustainability of on-farm conservation and use of a broad range of PGRFA. On the other hand, we note that there are some means available to mitigate their negative impact. Furthermore, we take the position that multilaterally oriented systems of facilitated access to PGRFA are supportive of agrobiodiversity conservation and use on farm.

2.1 Patents and sui generis *plant breeders’ rights effect on farmers’ access to seed*

Article 27(3)(b) of the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), explicitly requires member states to provide patent and/or ‘effective *sui generis*’ intellectual property protections for plant varieties.

In this section, we will analyse the effect of first, patents and subsequently, different forms of *sui generis* IP laws on farmers’ access to seed.

Patents

The most direct impact of a patent grant on a plant or plant variety is that parties seeking to use the plant or plant variety for any purpose (in the jurisdiction where the patent has been granted)[1] must obtain permission from the owner of the patent. At the very least, this

[1] Whether or not a patent confers absolute exclusive rights to the patentee is subject to national laws. Arguably in the USA, one cannot use a patented plant variety for research purposes even if all of the patented plant material is not included in the eventual new plant variety that is created. Presumably patents granted in conformity with EU law would not have this effect. However, EU patent law would certainly prohibit release of a new variety that included the patented elements of the material used in the creation. In this way, all patents are distinct and much more restrictive than PBRs.

represents a procedural and administrative impediment to the use and flow of PGRFA. Even if all patent holders always approved all requested uses, the need to obtain permission of patent holders represents a very significant hurdle. The potential for such procedures to slow down exchange and flow of material should not be underestimated. Any costs associated with such procedures, no matter how small (and they could be big if lawyers or other 'go-betweens' are involved) could have the practical effect of taking that material outside the range of (often resource poor) local systems of *in situ* conservation and use. In addition, these procedures would cost in time: time for the local farmers and breeders to figure out who owned what materials and how to ask for access to them, and time waiting for approval from the patent holders. Even if these time pressures are small, they too could have the practical effect of taking the material beyond the range of local farmers and breeders.

Furthermore, patent holders will not, of course, always approve such requests. They could often say 'no', or 'yes' only upon the payment of fees that would be too high for farmers engaged in the system of *in situ* conservation we described above.

UPOV compliant sui generis *laws*

There is still no consensus regarding what constitutes 'effective *sui generis* protection' pursuant to article 27(3)(b). Most agree that implementing the standards set out in the UPOV Agreements of 1978 and 1991[2] would satisfy TRIPS. On the other hand, TRIPS does not specifically mention the UPOV Agreements in this regard. It has been argued that *sui generis* laws with less exacting conditions of protection, and less exclusive bundles of rights vested in 'owners' would satisfy the TRIPS requirement (Leskien and Flitner, 1997). In this subsection, we will analyse the impact of national laws that comply with the UPOV Agreements. In the subsection immediately following, we will analyze other possible *sui generis* options.

National plant breeders' rights (PBR) laws that are consistent with the international UPOV agreements provide rights holders with less exclusive controls over third parties' uses of protected materials than patent laws do. For example, UPOV 1978 sets out minimum standards for a national PBR law that includes both research and farmers' exemptions. Because of these exemptions, it is not necessary in countries with UPOV 1978 compatible laws to the seek the permission of a PBR holder when using protected material to either (a) breed new varieties or (b) save seed to 'plant back' the following year. Some countries – Zimbabwe for example, in its plant breeders' rights law – have interpreted the farmers' exemption to allow limited exchanges of seeds between farmers on non-commercial bases. [3]

The farmers' exemption is not included in UPOV 1991; implementing countries however, have the discretion to include a farmers' exemption in their national PBR laws pursuant to UPOV 1991. In this way, national PBR laws that include farmers' and research exemptions include far fewer negative incentives than a national patent law that extended to the same material.

[2] The 50 current members of UPOV are: Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Canada,Chile, China, Colombia, Croatia, Czech Republic, Denmark, Ecuador, Estonia, Finland, France, Germany, Hungary, Ireland, Israel, Italy, Japan, Kenya, Kyrgyzstan, Mexico, Netherlands, New Zealand, Nicaragua, Norway, Panama,Paraguay, Poland, Portugal, Republic of Korea (as from January 7, 2002), Republic of Moldova, Romania, Russian Federation, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Trinidad and Tobago, Ukraine, United Kingdom, United States of America, Uruguay.

[3] See article 14 of the Plant Breeders' Rights Amendment Act, 2001 of Zimbabwe.

Of course, there is a relatively obvious counter point to be made in this context: the protected material would not exist but for the efforts of the plant breeders whose efforts are rewarded by the grant of PBRs in the first place. Including sweeping exemptions from those rights in national laws will undermine the incentives those rights are meant to represent. National policy-makers have to decide what balance they want to strike between the rights of breeders and farmers.

Other sui generis *options*

Some have argued that wider exemptions, (or the conferral of less strong rights in the first place) than those included in the UPOV agreements could be included in national laws that would comply with TRIPS' requirement for 'effective *sui generis* protection'. For example it has been suggested that there should be an exemption for subsistence farmers from having to seek permission with respect to any use they would make of protected material (Crucible II Group, 2001). In theory, this kind of exemption protects the breeders' interest in exploiting the commercial market for their seed by requiring farmers with money to pay public interest in providing a boost in livelihood for farmers that would not have money to pay for the seed in the first place.

The same principle could be extended further to create an 'agrobiodiversity conservation and use exemption' pursuant to which farmers, who could demonstrate having used a sufficient degree of diversity in their farming practice, would qualify for an exemption from the need to seek PBR holders' permission to use their seed. This exemption would have the effect of reducing the restrictions on access to protected materials for farmers who are engaged in on farm conservation and use of agrobiodiversity. That said, the standard could prove to be tricky to administer, and it is possible that it would fall below intended meaning of 'effective' *sui generis* protection as prescribed by TRIPs. This is an option that has never been 'tested out' by being included in the national law of a country purporting to implement the TRIPS agreement.

Quite apart from their immediate effect on farmers' access to protected materials, it is argued that IPRs have an even more serious long term effect on farmers access to all seeds, protected or not. For example, GRAIN argues that IPRs in general (i.e. both patents and PBRs) are a critical element in the cycle of replacement of heterogenous agroecosystems with 'elite' crops with relatively narrow genetic bases (GAIA/GRAIN, 1998). The existence of these varieties, complemented occasionally by government programs to subsidize their use, leads to the replacement of heterogenous agroecosystems with agro-monocultures.[4] In this way, it is argued, IPRs indirectly contribute to the historical diminution of the overall genetic diversity that would otherwise be available to farmers. IPRs, therefore, can function as disincentives to *in situ* conservation in two ways: first, they can limit farmers and breeders access to protected materials to promote the diversity of their farming systems. Second, even when they are not functioning to block access to protected varieties, it is argued that they

[4] The counter argument of course is that plant breeding is a means of creating diversity, and that to the extent that IPRs encourage plant breeding, they promote diversity. Plant breeders create new varieties; they do not force farmers to forsake or replace their locally bred varieties. Plant breeders are not responsible for the extent to which farmers use their varieties to replace the diversity of material in their fields.

work as part of a larger system of perverse incentives to completely overwhelm or replace diverse agroecologies with elite, relatively homogenous materials.[5]

At this point, it is important to stress that we are not debating the ultimate utility of improved elite material as opposed to locally used heterogenous material, such as their role with regard to food security. In this section, we are limiting our comments to the *immediate* effect of patents and *sui generis* PBRs on farmers' access to seed.

Developing countries that are members of the WTO had until 2000 to implement TRIPS; least developed country members have until 2006. By requiring much larger number of countries to create IPR protection for plant varieties, TRIPS will have a multiplying effect on the impact of IPRs on farmers' access to seed.

2.2 Access Laws impact on farmers' access to seed

In this section, we will analyse the effect of bilaterally and multilaterally oriented access laws on farmers' access to seed.

Bilaterally oriented access laws

To date, some 50 countries around the globe either have or are in the process of developing laws to regulate foreign access to genetic materials within their own borders. The basic framework of the bilaterally oriented laws is the same. They establish procedures whereby:

- parties seeking access to a genetic resource within a country must make an application to the relevant governmental authority, and if a community is affected, to a representative of that community;
- all parties then have to negotiate acceptable terms concerning that access and related benefits;
- the negotiated agreement has to be reduced to writing;
- the written agreement has to be registered with the government;
- the accessing party's behaviour is monitored and if that party does something improper, some form of legal action (e.g., public prosecution, private law suits) can be initiated.

This means of regulating access can be time consuming, and expensive. Such a law might be worthwhile in the case of some categories of genetic resources, for example, endemic species, or species which are not available in many other countries, or resources which enjoy added value by virtue of associated knowledge (of a local community perhaps) regarding the way it can be used.

This kind of regulatory regime is not appropriate however, with respect to a wide range of PGRFA that is already the subject of exchanges between farmers and institutions within the

[5] GAIA/GRAIN (1998). It has also been suggested that alternative, looser conditions of protection that extended to more heterogeneous plant varieties would work to counteract the incentive that currently exists for plant breeders to breed plant varieties with relatively narrow genetic constitutions. Pursuant the UPOV Conventions, member states must provide PBR protection for varieties that are distinct, uniform and stable (DUS). Plant breeders develop highly uniform crop plants which will stay uniform over a period of time. Plant breeders 'breed out' the genetic variability that would otherwise allow for variability of expression within the group of plants they want to protect. Looser criteria, for example requiring only that the variety be distinct and identifiable, would remove one potential negative incentive to breed out heterogeneity.

country, in the region and around the globe (An example of relevance to this workshop would be materials flowing to and from the SADC base collection in Zambia, as part of joint public research and conservation programs involving institutions in different countries in the SADC region and/or around the world, between farmers on either side of national borders; to and from collections held by International Agricultural Research Centers held in trust through the FAO for the benefit of all humanity). Policy makers need to consider that much PGRFA is already spread around the region and the globe and therefore not amenable to country-by-country regulation of access, and that its continued exchange and use is vital to food security. Imposing a bilaterally oriented regulatory regime over top of these patterns of exchanges will upset, restrict, and in some cases, completely block them.

Countries engaged in developing national access laws therefore need to engage in an informed cost benefit analysis concerning:

- when they can obtain more benefits by facilitating exchanges on a relatively open basis within a region and internationally in support of their ongoing research and conservation efforts; or
- when they can obtain more benefits by subjecting others' access to those same resources on a case-by-case, relatively high cost negotiations.

It may well be the case that after such an analysis, policy makers will conclude that it would be beneficial to treat some PGRFA to different, less restrictive criteria in order to continue to be able to continue these alternative beneficial uses of these same materials. (Certainly this is the conclusion that signatories to the International Treaty arrived at with respect to materials explicitly listed as falling within the multilateral system of exchange created by that agreement. We examine the IT in the following sub-section.

To the authors' knowledge, none of the bilateral laws in existence or in active consideration take the special, interdependent nature of PGRFA into account, making it beneficial that they would be subject to less stringent conditions of access. Nor do any of the laws explicitly anticipate the need to do so in the future. At the very least, one would expect to see provisions in national access laws recognizing the possibility of exceptions from bilateral strictures for: (a) listed materials that will be subject to facilitated multilateral access pursuant to the International Treaty on Plant Genetic Resources for Food and Agriculture (IT), and (b) materials that are routinely exchanged with neighboring countries to support each other's breeding programs. While countries understandably want to protect their 'green gold', bilateral access laws overall act as an impediment to, not an inducement for, regular, low cost, exchanges of genetic materials for food and agriculture.

The standard counter-argument to this position is that the benefits derived from bilateral access deals regarding farmers' varieties can be ploughed back into conservation, and on-farm conservation in particular. Evidence to date suggests, however, that benefits realized through such deals are highly irregular and yield very low levels of compensation. As the scenario above illustrates, on farm conservation needs more than irregular infusions of financial support.

Multilateral access arrangements

Given the importance of constant inputs of PGRFA into all forms of plant breeding, it is important to have agreements between states and institutions that facilitate routine

exchanges of material as quickly and efficiently as possible. As has already been discussed above, longstanding informal arrangements of unlimited exchange between communities, genebanks and breeding stations on either side of international borders can be disrupted when one of the states puts a national, bilaterally oriented and restrictive access law in place for PGFRA. In light of the potentially rapid proliferation of bilateral regimes that threaten (as an unintended result) to undermine crucial patterns of exchange, it is now more important than ever for states to be proactive about securing multilateral arrangements for the exchange of PGRFA.

The International Treaty on PGRFA

The International Treaty[6], establishes a multilateral system of exchange for a list of 35 genera of crops and 29 species of forages. Two criteria for the selection of materials included in the agreement were their importance to food security and their interdependence. The IT supports *in situ* conservation by farmers of crops and forages to the extent that it more or less guarantees access at low cost with minimum administrative hurdles to materials included on the list. The list of material under the revised IU however, is limited, and provides of course no support for farmers' *in situ* conservation and use of materials that are not included on the list.

Especially in light of the relatively short list of crops and forages on the IT list (which is unlikely to be expanded in the near future) national policy makers should work to formalize additional regional agreements wherein they secure access to materials that are important to their domestic breeding programs and systems of on farm conservation and use.

3. CONCLUDING REMARKS ON CRITIQUE OF CURRENT TRENDS AND OPTIONS

Access to the widest possible range of plant genetic resources is a critical aspect of on-farm conservation and use of agrobiodiversity. Intellectual property laws, designed to reward relatively high tech, commercially oriented plant breeding and biological innovation have the effect of constraining farmers' access to protected seed. In this paper we explored a few means by which these constraints could be loosened. We also argue that bilaterally oriented national laws to regulate access to genetic resources will undermine the frequent, low cost, facilitated exchanges of PGRFA that are critical to support on farm conservation and use of agrobiodiversity. By way of contrast, we argue that systems of multilateral facilitated exchange on global, regional and domestic bases ultimately support agrobiodiversity use and conservation.

We are not able to provide a straight forward, two or three-stage prescription for an on-farm agrobiodiversity conservation and use panacea. We caution against such approaches: for example, we warn policy makers away from the notion that access deals forged through the application of bilaterally oriented national access laws can, on their own, pay for on-farm conservation. It is unlikely that there are enough niche markets locally and globally to support all the on farm conservation and use that is necessary. Benefit sharing mechanisms included in national, bilaterally oriented access laws may provide welcome ancillary support, but they will not *drive* on farm conservation and use of agrobiodiversity. What is necessary are working systems that support constant exchange and local use and experimentation with the widest

[6] The text adopted by the Commission was adopted by the FAO General Council in November 2001. It will come into force 90 days after the ratification or accession of the fortieth country.

possible range of PGRFA. We hope we have provided a useful starting off point for discussion at the workshop.

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THE OAU MODEL LEGISLATION FOR THE PROTECTION OF THE RIGHTS OF COMMUNITIES, FARMERS AND BREEDERS AND THE REGULATION OF ACCESS TO BIOLOGICAL RESOURCES

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1. INTRODUCTION

The African Model Law for the Protection of the Rights of Local Communities, Farmers and Breeders and for the Regulation of Access to Biological Resources was prepared by an Organization of African Unity (OAU) Task Force in 1997. The OAU Ministerial Session, followed by the OAU Summit of Heads of State and Government, adopted this Model Law in Ouagadougou in 1998, and recommended that it be the basis of African national laws.

The OAU Model Law provides a legal framework that serves to recognize and protect rights which have been traditionally ignored and excluded from the realm of 'legal rights'.
The objective of the OAU Model Law is to provide a framework to craft out specific national legislation consistent with, among other factors, national objectives and the level of socioeconomic development. It is written for policy-makers, public authorities, local communities, non-governmental organizations (NGOs), lawyers and anyone with an interest in the conservation and sustainable use of Africa's rich biodiversity such that present and future generations can continue to enjoy its abundance and benefits.

The framework provided by the Model Law provides an incentive to holders, users, breeders and recipients to contribute towards the conservation of biological diversity including agrobiodiversity. The Model law seeks to achieve the provision of incentives by recognizing and protecting rights of those involved in agrobiodiversity by ensuring that the activities that are crucial to the conservation and sustainable use of agrobiodiversity are not eroded, illegalized or compromised in such a manner as to render the conservation and sustainable use of the resources susceptible to genetic erosion and scarcity. It further provides for the rights of modern breeders, thus making the Model Law the most balanced piece of legislation on bio-resource use, rights thereto and conservation.

The OAU Model Law involved a series of consultative meetings/workshops and debates at national and regional levels on common issues affecting access to Africa's resources, conservation and sustainable use practices, knowledge, rules of regulation that are relevant to the conservation and sustainable use of biodiversity.

The Model Law has been consolidated into a booklet of which the OAU Council of Ministers has specifically recommended that African countries develop national laws, as well as regional regimes and common negotiating positions in international law and related issues.

The southern African countries have developed guidelines for the implementation of the Model Law.

The major challenges facing the implementation of the Model Law include the legal capacity to develop a more comprehensive legal framework at national levels that incorporates the Model Law. Africa has been the recipient of written legal frameworks for so long that incorporating a first legal product of Africa itself is now proving to be a daunting challenge.

2. IMPLEMENTATION OF THE MODEL LAW

Having outlined in brief what the aims of the Model Law are, it is necessary to discuss the opportunities and processes by which the Model Law can be made operational at regional and national levels.

At SADC regional level, cooperation on shared natural resources is becoming more common as countries within the region aim to achieve sustainable development and use of natural resources. These include rivers and lakes, transboundary migratory wildlife and critical ecosystems that transcend international boundaries. Within that sphere of natural resources are also shared biological and genetic resources (plant, fisheries and animal) that require protocols or memoranda of agreement to be made on their management and the equitable sharing of benefits therefrom. These transboundary resource management areas (TBNRM) are occupied, managed and the resources are used and conserved by communities. The rights of those communities become important as interests move beyond local and political boundaries. The Model Law provides a framework from which the legal rights of the communities involved are actually recognized to ensure not only that benefits accrue to the communities concerned but also that an enabling environment and a sense of ownership and responsibility are bestowed on the communities. This will provide for an incentive to continue conservation and sustainable use of resources.

At national level, the recognition of rights to resources is important for providing an enabling environment for incentives to conserve and sustainably use resources. There is evidence on the ground that legal rights of communities are grudgingly acknowledged and sometimes recognized as being of importance for a number of reasons. These include poverty reduction, growth of local economies, job creation, utilization of resources in a sustainable manner and conservation. The community rights are not necessarily accorded legal status for political and other reasons. However looking at practices on the ground it is clear that recognition and application of rights of communities is necessary and is somewhat practised to a certain extent already. Thus the Model Law is not advocating for something completely alien.

Regulatory instruments – economic instruments that seek to reduce rural poverty, create rural agriculture, tourism development should where applicable accommodate and consider the rights of communities the policies or legislation seeks to empower or to provide benefits to. Large populations of people in Southern Africa live in rural areas and are directly dependent on soil, resources and availability of genetic diversity. In Namibia a system of conservancies has developed in which communities form a Trust with exclusive rights to manage and benefit from the wildlife in their areas of management. CAMPFIRE is an old example in Zimbabwe of community involvement in natural resources management and the economics involved, in

Botswana communities register Trusts (Community Based Resource Management) to manage resources in tourism areas with the aim of economic empowerment. These activities indicate a tacit recognition of rights of communities as embodied in the Model Law. Of course the practices described above fall short of conferring legal rights. However, a review of these practices to incorporate at a higher degree the rules of law found in the Model Law may provide one of the opportunities to implement the Model Law.

Land tenure systems – the laws relating to land tenure systems in most SADC countries are based on Western notions of private ownership. Land that is supposed to belong to communities is held by the state on behalf of communities. In most cases the allocation of land ignores the rights of ownership and usage of resources on that land. Often communal land is allocated for residential, farming and small industry purposes. The manner in which it is allocated is akin to the notion of exclusive rights of ownership despite the unanswered question of other community members to the resources on the land. This has a direct impact on the conservation and sustainable use of resources. The laws relating to land tenure systems need to be revised to take into account the rights of communities. In Namibia there is an attempt to address the rights relating to communal ownership of land to factor in the question of communal land ownership though the Communal Land Reform Bill.

Resource governance laws – in most SADC countries legislation relating to resources governance does not consider community rights. In order to provide a conducive environment for conservation and sustainable use of resources it is necessary to review some of these laws: land law; wildlife law; forestry law; water law; agricultural laws etc. to take into consideration the relevant customary law rules that are contained in the Model Law.

The opportunities for the implementation of the Model Law discussed above are not conclusive and are not a guarantee that there will be instant success. Threats of powerful competing interests exist. Most SADC countries like many developing countries are into privatization of which it is now being regarded as a panacea to most economic problems. In fact the land tenure systems in place in most of the region's legal frameworks are an excellent springboard for privatization of land and the resources that go with. Perceived threats to global trade and progress such as the issues of intellectual property rights as per the TRIPS agreement pose real threats to the protection of community rights and the conservation of resources.

Note that Namibia's experiences will be used as a case study in the actual presentation. Other countries in the region will also be referred to in the discussion of the instruments referred to above.

SEED LEGISLATION IN ZAMBIA AND POSSIBLE INCENTIVES FOR USE AND CONSERVATION OF AGROBIODIVERSITY

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1. INTRODUCTION

Seed is a carrier of technologies to farmers and an important ingredient of agrobiodiversity. It is a repository of genetic resources upon which crop development and improvement depend. The subject of incentives for use and conservation of agrobiodiversity therefore will not be complete without making an appreciation of the useful role that seed as a messenger plays in conveying incentives to beneficiaries.

Recognition of the importance of seeds in agricultural development in sub-Saharan Africa has generally been weak until recently. The current thrust is towards promotion and utilization of improved varieties by farmers. Concern about improved varieties not reaching farmers was exemplified by the World Bank (WB) under the auspices of the Special Program for African Agricultural Research (SPAAR). Leaders of African national agricultural research programs and sub-regional organizations such as the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA), Southern Africa Center for Cooperation in Agriculture and Natural Resources Research and Training (SACCAR), Institut du Sahel (INSAH), and the Conseil Ouest et Center Africain pour la Recherché et la Development Agricole (CORAF) expressed concerns over little returns being realized from investments made in African agricultural research due to inefficiencies in the seed delivery systems and restrictive and, in some cases, cumbersome seed legislation. Introduction of improved varieties is however seen as a major threat to use and conservation of agrobiodiversity. This paper discusses the changes in the Zambian seed regulatory framework and the impact on the use of crop genetic diversity by farmers in relation to conservation objectives.

2. STATUS OF SEED SUPPLY IN ZAMBIA

2.1 Seed sector players

In Zambia, the seed system is considered to comprise the formal and informal seed sector. The formal seed sector is led by seed companies, linked to organized research and quality control and the certification system. A relatively relaxed seed quality control system based on the FAO-concept of Quality Declared Seed (QDS) scheme has been being implemented and in use since 1999. Principally, the QDS is a system in which seed quality control and standards are less rigorous. In many cases only germination and analytical purity are considered sufficient to market the seed, and the seed may not necessarily undergo field inspections. The seed is labelled and sells at a lower price than the certified seed.

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The informal seed sector in contast comprises seed activities led by NGOs, donors and government-supported projects and the farmers' traditional seed activities. The seed activities by NGOs and projects in Zambia are mainly the promotion of improved crop varieties that seed companies have not found sufficiently profitable.

2.2 Characteristics of seed marketing

In accordance with the distinction between formal and informal seed sector activities in the Zambian seed system, it is possible to distinguish marketing of seed from formal and informal sources. Marketing of formal sector seed is highly organized and is centered on hybrid maize, soya bean, wheat and, to some extent, hybrid sorghum. Varieties featuring are mainly those that have been officially released and the seed is marketed under the regulations of the QDS scheme.

Marketing of seed from the informal sector is semi-organized and includes barter-mechanisms such as seed for work, for ordinary grain or for other commodities, as well as for gifts and cash. The traditional seed activities involve the use of farmers' varieties which are not necessarily released. Seed production and marketing are not organized and formal seed quality control is absent. Seed packaging can take the form of buckets, bottles, clay pots, etc.

2.3 Constraints in the seed sector

The seed system in Zambia does not meet the needs of the majority of small-scale farmers in the country. Seed companies are by and large meeting the requirements of seed for the commercial farming sector, especially hybrid maize. However, they fall short in meeting those of the small-scale sector, despite the availability of adequate improved seed varieties that small-scale farmers could use. The farmers' low buying power limits their access to commercial sector seed. Further, the distribution of these seeds in outlying areas by seed companies is difficult and costly because of poor infrastructure and low economic activity in these areas. Seeds of crops such as sorghum, finger millet, pearl millet, cowpea, groundnut, beans, cassava and sweet potato, are not adequately catered for mainly because they do not attract economic significance. As a result, these crops are not a priority for many seed companies.

As a consequence of this imbalance, government policy has been to encourage seed production on-farm. This promotion has been based on improved varieties from research systems. Farmers' varieties are not usually included in these efforts.

As the national programmes spread in intensity and coverage in line with government policy, improved varieties will most likely take more prominence on farmers' fields. Tripp (1999) reported that by 1995, about 15% of farmers in Kalomo (Southern Province) were growing improved varieties of sorghum, Sima and Kuyuma, while in Senanga (Western Province), 30% of farmers were using these varieties. In the same period, Chisi *et al.* (1997) observed that approximately 27% of small-scale farmers' sorghum area in Zambia was estimated to be planted in modern varieties. A similar trend was observed for groundnuts. A recent evaluation study, Zulu *et al.* (2001) of the Multiplication and Seed of Improved Planting Materials Project showed increased utilization of improved varieties by small-scale farmers in southern, Northern, North-western and Western provinces of Zambia (Boxes 1–3).

BOX 1.

Case study of Mr Alfred Makaba of Gwembe district Southern Province of Zambia. He has been with MDSP since its inception in 1997–98. His farm is located 6 km east of Gwembe. He has grown improved varieties of cassava (Bangweulu, Kapumba and Nalumino), cowpeas(Lutembwe), beans (Chambeshi), sorghum (Kuyuma) and groundnuts (MGV4 and Chipego). The area under study is not a traditionally cassava area, but with these organized seed activities of the MDSP, the crop has been introduced and is spreading. The impact of cassava at his household has been significant. He is currently able to meet his subsistence needs from cassava alone without other crops such as maize. He has sold cassava cuttings to over 34 local farmers in his community and to projects such as Masikili (World Vision). He also sold to MAFF who distributed to 65 other farmers.

BOX 2.

Mrs Mahombe of Choma's reputation is growing rapidly within Choma and beyond. She started with five bags of sweet potato vines from MDSP and planted a few lines of each variety (Chingovwa, Luapula, Zambezi, L9-68/17 and L9-68/16). Her husband and the rest of the family did not help her as they concentrated on cash crop tobacco. However, in terms of impact, sweet potato had helped her more than any other cash cash-income generating crop. Food security has improved for her entire household. She sold her planting materials (cuttings) for cash, and in exchange for labour, livestock and maize. She had raised enough to buy one cow, two beds, a dressing mirror, food, minor household goods and to pay school expenses. She acquired 5 goats and 27 chickens. Her planting materials, especially sweet potatoes, have diffused as far as Livingstone (200 km) and Chikanta (150 km).

BOX 3.

Mr Watambwa is the Chairman of Solwezi Seed Growers Association. He started growing seed in 1997–98 seasons. Before the project he only grew maize and sunflower but now has cassava, finger millet, sorghum and groundnuts. He has seen that the introduction of new varieties and crops gave important seed-marketing opportunities.

The area under cassava cultivation has increased but availability of planting materials was not meeting the high demand of people diversifying from maize. Project improved crop varieties had higher yields than local ones. Project groundnut varieties recorded three times the yield of local ones. Traditional varieties are late maturing compared with project crops. Cassava was now able to mature within 18 months compared to 3 years for traditional varieties.

However, some improved varieties were not successful. Beans had potential, but the variety; Chambeshi introduced in the area could not compete with the local one (Solwezi) as it needed fertilizer. Sorghum variety WP 13 was said to have a problem of reddish colour, which many farmers did not like, however, it has a place for brewing. He had made ZK6 million (approx. US$4000) project related income. He bought oxen, a plough and paid children school expenses.

There is no doubt that most small-scale farmers, especially women, still cling to their traditional varieties and continue to grow them every year due to certain desired and valued attributes of these varieties. However, the demands for increased food and cash economy may eventually discourage continued cultivation of these varieties on a relatively large household scale. This will ultimately result in under utilization of farmers' varieties and some could be lost from memory.

The drought years of early 1990s followed by partial droughts in the late 1990s, resulted in farmers losing their seed and this attracted an emergency seed relief supply to restore farmers' production capacity. Neither the impact of that drought nor the impact of the massive injection of emergency seed relief that followed (mainly seeds of improved varieties) have been well studied, but both pose a real threat on farmers' used and maintained agrobiodiversity.

Thus, not surprisingly, the stimulation of improved varieties via support to on-farm seed production through the QDS scheme, have increased adoption of the varieties. There is no doubt that improved varieties are higher yielding and are making positive and significant contribution to household food security, livelihoods and economies of the majority of small holder farmers. The concern, however, is the gradual replacement of farmers' varieties, which farmers often prefer because of their taste and other traits and which are valuable in the management of soil and climatic variation. In addition, they are also useful as building blocks for further crop development and improvement, which gives these varieties a value to mankind in general.

3. LEGISLATIVE AND POLICY CHANGES

The Zambian seed legislation has undergone positive changes in line with the policies of liberalization and the changing roles of certification systems all over the world. The seed control system in Zambia is shifting emphasis from being a conventional seed certification agency with a policing role to one of facilitating seed industry development.

3.1 Seed control and certification

Also important in this shift is also the adoption of the QDS system. Official seed quality control produces important information for farmers, such as germination capacity and analytical purity. Problems have arisen when certification is made compulsory. When all seed has to be certified, the choice of seeds is limited to a small number of released varieties. Also the possibilities for farmers to obtain seeds legally from other sources than registered seed houses are reduced. Strict laws prescribing all seed in the market place to be certified make sale or transactions or exchange among farmers illegal. It means that farmers cannot specialize in seed production and marketing without requesting field inspections, seed testing and using officially produced seed generations.

Zambia recently reduced the number of crops under compulsory certification list, which now only includes hybrid maize, wheat, Irish potatoes, hybrid sorghum and sunflower. Other crops fall under voluntary certification, but they have to be registered and 15% of the registered seed crop area is to be inspected. Next to the certification authority, currently seed companies and seed personnel are licensed to carry out seed inspections, seed sampling and testing in Table 3. Seed certification and QDS standards

	Isolation (M)		Genetic purity		Analytical purity		Germination capacity	
Crop	**CERT.**	**QDS**	**CERT.**	**QDS**	**CERT.**	**QDS**	**CERT.**	**QDS**
Maize, OPV	200	200	0.3	10:1000	99.0	99.0	90	90
Maize, hybrid	400							
Finger millet	5	5	0.1	10:1000	98.5	96.0	80	70
Pearl millet, OPV	200	10	0.3	30:1000	98.5	96.0	75	70
Pearl millet, hybrid	400							
Sorghum, OPV	200		0.3	10:1000	98.5	97.0	80	70
Sorghum, hybrid	400	300						
Rice	5	5	0.1		98.5	97.0	85	75
Wheat	5	5	0.1	50/10m_	97.5	97.0	85	75
Fibre crops								
Cotton	300		0.1		98.5	80.0	75	70
Kenaf	300		0.1		98.5	80.0	70	70
Oil crops		10						
Groundnut	10	40	0.1	5:1000	97.5	96.0	80	75
Sunflower, OPV	400	0	0.2	40:1000	98.0	97.0	85	80
Sunflower, hybrid	1500				99.0			
Soybean	5	5	0.1	10:1000	98.5	98.0	75	70
Castor bean		5		5/10m_		98.0	75	70
Sesame		25		5:1000				
Pulses								
Bambara nut	10	5	0.1	5:1000	99.0	98.0		70
Bean	25	25	0.1	5:1000	99.0	98.0	75	70
Broad bean		25	0.1		99.0	98.0	75	70
Cowpea	5	10	0.1	5:1000	98.0	98.0	75	70
Pea	50	50	0.1				75	70
Velvet bean	100	100	0.1					
Root crops								
Cassava		10		5:1000				
Sweet potato		10		5:1000				
Irish potato								
Other crops								
Tobacco	400				99.0		90	90

accordance with set regulations. This has broadened coverage and speeded up delivery of seed services.

3.2 Supporting policy measures

Steps have also been taken in line with government policy of decentralization of services by setting up satellite seed-testing laboratories at provincial level as a way of bringing this service closer to farmers. Seed testing laboratories have now been opened in three provinces as support in the development of seed provision systems in rural areas.

One of the landmarks of the Zambian seed legislation has been the development of seed regulations to promote informal seed production and entrepreneur-ship. These regulations are based on improved varieties from the NARS and IARCs and they currently do not support involvement of farmers' varieties in the seed provision.

Legislation on intellectual property rights for protecting the rights of plant breeders and farmers has just been drafted and will undergo the necessary approval process before

enactment. It is envisaged that this piece of legislation will stimulate investment in the area of variety development and seed industry advancement.

A National Seed Programmes Implementation Committee (NSPIC) has been formed. This committee provides a forum and an opportunity for all involved in seed to discuss problems, experiences and the way forward for the Zambian seed industry. Participation includes various seed projects, NGOs, seed companies, breeders, policy and planning of the ministry of agriculture, and the extension and certification agency, which is the committee activity coordinator. Issues of agrobiodiversity are, however, not represented on this committee and as such they are not discussed. Discussion of agrobiodiversity issues in this committee with representation with representation from the National Plant Genetic Resources Program could greatly contribute to the inclusion of seed regulations suited to the needs of farmers' varieties.

4. LEGISLATIVE ISSUES IMPACTING ON INCENTIVES

Seed legislation sets the rules and provides standards to be attained in different seed classes. Seed legislation can act as an incentive for use and conservation of agrobiodiversity. However, it can also act as a disincentive when the set standards are unjustifiably high or wrongly applied. In the Zambian situation, incentives and disincentives can be observed in the current seed legislation especially in:

- the variety release system;
- seed control and certification;
- registration for marketing, processing and production.

The use of QDS seed scheme along with its regulations has in part stimulated greater and better utilization of improved varieties and can be said to be contributing to incentives for use and conservation of agrobiodiversity. Due to legislative requirements for seed enterprise and a supporting policy, small-scale farmers have been trained through various programs involved in seed. As a result of the combination of these incentives, many small-scale farmers are beginning to be skilled and organized in producing seed of improved varieties.

Farmers' increased knowledge on seed production and processing is likely to filter down to, and be applied to, the traditional varieties as well. Small-scale farmers are also in the process of acquiring skills of seed entrepreneurship along with better storage skills that preserve viability of seed. It allows them to gain additional income through seed sales. This is illustrated by the cases of Mr Makaba of Gwembe who supplied seed to other farmers in his community. The story is similar to those in areas where seed projects are operating, such as Mrs. Mahombe of Choma and Mr Watambwa of Solwezi.

Because of implemented regulation and on-farm seed-support activities, confidence has grown among small-scale farmers in quality of seeds from their colleagues in the communities. In the past, rural farmers used to rebuff seed from their neighbours, opting instead for that produced by seed companies. They could not believe that a neighbour could produce seed, well packaged and labelled and with good capacity to germinate. The QDS has thus been important in giving recognition to farmers' produced seed, which has resulted in increased incentive for producing seed and the availability of, and access to, crop genetic diversity.

Despite the positive changes and incentives that may have accrued, there is still more that can be done in the area of legislative change and reform to bring about incentives. The current seed legislation has by and large been centered on improved varieties, it does not offer real opportunities for the development of a seed system where farmers' varieties have a chance to feature as a commodity for organized seed production and commerce, and as such, it offers fewer prospects for incentive. There is need to review the current legislation with the possibility of facilitating inclusion of farmers' varieties.

5. REMAINING CONSTRAINTS AND SCOPE FOR ADDITIONAL INCENTIVES

5.1 Variety release system

A variety release system in Zambia was put in place in 1984 with a view to streamlining release of varieties from research systems. Along with it was the setting up of a Variety Release Committee (VRC) to recommend varieties for inclusion or removal from the variety list. Recommendations of the Committee are based on variety testing. Variety testing for VCU generates valuable information for breeders, seed producers and seed quality control agencies on the agronomic value and the important distinguishing characteristics of a new variety. This also helps to give a variety a name. However, the variety testing and release systems also means a restriction and in part can be blamed for the relatively few varieties from which seed can be purchased. In addition, the requirements for DUS testing may restrict the development and introduction of genetically heterogeneous varieties, which maybe a useful form of agrobiodiversity for farmers to attain yield stability.

5.2 Seed control and certification

Although regulations on seed testing and control for certification have been importantly adapted (see above), the requirements and implementation pose a constraint to small-scale farmers.

BOX 4. RULES OF THE VARIETY RELEASE SYSTEM

The features of the variety release system are that a formal application by the owner of the variety must be made with the certification authority including a preliminary variety description and a seed sample of the variety. This must be accompanied with a fee, which is currently at US$100 per variety per season. A variety must be tested for two seasons before it can be released and marketed. The owner of the variety or proxy must appear before the committee and make a presentation in support of the release of the variety in question after testing by the certification authority.

The testing of a variety includes testing for value for cultivation and use (VCU) of the variety at 6 sites representing the country's three agro-ecological zones: i.e. two sites in each agroecological zone. The variety is also tested for distinctness, uniformity and stability (DUS) in order to give it an identity. This test is performed at two sites and for two seasons. These tests are carried out by the certification authority and are carried out concurrently. Upon release, the variety is entered in a List of Recommended Varieties after which commercial seed production can commence.

Table 4. Number of varieties registered per crop and test years in Zambia (1999)

Cereals	Variety no.	Pulses	Variety no.	Fibre crops	Variety no.
Barley	Nil	Bambara nut	2	Cotton	4
Hybrid maize	58	Bean	3		
OP maize	3	Broad bean	3	**Oil crops:**	
Finger millet	3	Cowpea	2	Groundnut	9
Hybrid pearl millet	Nil	Pigeon pea		Sunflower,	5
OP pearl millet	5	Pea	3	Sunflower,	7
Hybrid sorghum	7	Velvet bean	2	Soybean	7
OP sorghum	5			Castor bean	1
Rice	6	**Root & tubers**		Sesame	Nil
Oats		Cassava	3		
Wheat	8	Sweet potato	3		
		Irish Potato	5		

Source: SCCI Variety Release Register (2000).

First, there is a fee to pay for registration of a new variety. In addition, seed standards are perceived to be high, even under the QDS system, and small-scale farmers are unable to meet them. Isolation standards are often difficult to be achieved by farmers. Because of the village rural setting, isolation distance requirements are particularly difficult to achieve in communal areas (Table 4). There is need to formulate standards that would facilitate movement of seed to include farmers' varieties. Nor seem these high standards to be paying off in the conditions under which the seed is used.

In the execution of certain aspects of quality control, delays have been experienced and this has in some cases discouraged farmers from engaging in seed production as they cannot get quick return on their seed. Delays in seed testing and harvest clearance have in some cases resulted in farmers selling seed as ordinary grain and at a lower price.

Registration for seed selling, processing, production and other requirements

A seed sellers' license is required for any one wishing to *sell* seed and this should be displayed at the premises of sale. A retail license costs ZK 5000 (Zambian Kwachas: US$1 eq. ZK 3700). This fee sounds very little, but with the kinds of volume that small-scale rural seed businesses deal, the amount is still restrictive. Sale of seed without a license is illegal and the seed can be impounded, destroyed, or the seller can be fined or imprisoned. The licence will require a renewal every year with an appropriate fee.

Anyone *processing* seed for commercial purposes needs to be licensed and inspected. Anyone processing seed without a license commits an offence in this regard. Many women in villages who are the custodians of seed would be surprised to learn that in fact they have been committing an offence by processing seed without license!

It is a requirement that anyone *producing* seed for the purposes of sale should register as a seed grower, currently at ZK 1000 per hectare for QDS seed; otherwise the crop being produced will not be regarded as seed. The would-be seed grower is required to fill in a

registration form, which must be accompanied with an appropriate fee. The crop will be inspected and should meet the necessary field standards (Table 5)

Labelling is required in accordance with the certification scheme on a prescribed label material not easily destroyed. This label must contain information prescribed by the certification authority. Seed without prescribed label would ideally not be sold, including that of QDS.

It is required to seal the seed in the bag or container after being tested in such a way that it is not easy for anyone to break the bag and adulterate the seed. Sealing, although not strictly required, it is nonetheless usually done in the QDS-system, including the use of special packaging material.

Import and quarantine requirements can sometimes prevent free movement of germplasm. Seed imports in Zambia for the purposes of sale require that applications be made with the Seed Control and Certification Institute by filing in the Notice to Import. Application must also be made with Plant Quarantine and Phytosanitary Services. Applications are further scrutinized by a committee at the Ministry of Agriculture, Food and Fisheries who then issue an import permit.

5. CONCLUSIONS

The current QDS system developed to support the informal seed sector, in particular the use of improved varieties, has contributed to farmers undertaking organized seed production in their own communities. This has partly facilitated inflow and spread of improved and varied seed to farm households.

The requirement for quality control in seeds has helped small-scale farmers to be trained to produce quality seed, which in turn has enabled households to get a better return on their seed. These skills are also being extended to producing quality seed of farmer varieties.

Achievements in quality seed are resulting in confidence-build up among small-scale farmers for locally produced seed. Currently, more farmers are becoming interested in seed production as business.

Some aspects of seed legislation have not supported variety access and utilization and as such they have not helped in providing incentives to small-scale farmers to use agrobiodiversity. The notable ones are those related to variety release, certification and registration formalities which require a review to make them more enabling. Seed quality control easily leads to delays in possible seed sales, meaning strong disincentives for farmers.

There is need to include in the National Seed Programs Implementation Committee representation from the National Plant Genetic Resources to ensure that issues of maintenance and management agrobiodiversity are part of the agenda of this committee.

The on-going development of the rural seed system should take cognisance of the important role that farmers' varieties can play in the agrobiodiversity equation and therefore should explore opportunities that exist for their inclusion.

The current seed legislation in Zambia is not tailored to the needs of seed of the very traditional seed sector. The Quality Declared Seed regulations are at present only meeting the needs of improved varieties being supported by various seed projects. In the majority of programmes, farmers' crops and varieties have not yet featured. There is need to review the QDS seed scheme with the possibility of addressing the position of farmers' varieties.

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THE ROLE OF LEARNING IN STRENGTHENING THE USE AND CONSERVATION OF AGROBIODIVERSITY

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1. AGROBIODIVERSITY AND LEARNING

For specialists involved in the management of agrobiodiversity in rural areas it may not be immediately evident to have a keynote paper on the role of *learning* in enhancing the use of agrobiodiversity. Specifically not when learning is further broken down into institutionalized learning (education, for that matter) and training. Yet, this is precisely what we will do in this paper.

Current research claims that the levels of agrobiodiversity in production systems are determined by a number of key factors (Cromwell, 1999):

1. Ecological conditions
2. Farmers' skills in on-farm agrobiodiversity management
3. Farmers' access to useful agrobiodiversity off-farm (neighbours, adjacent wild areas, plant breeders),
4. Farmers' access to other capitals that can substitute for natural capital (e.g. agro-chemicals).

Regarding these four factors, *learning* relates to numbers 2 and 3: applying agrobiodiversity in farming is a skill that is learned somewhere and learning from neighbours or environment plays a role in this respect (actually, *learning skills* as such also play a role, because the individuals' learning skills influence the extent to which they are able to learn from their own experience and learn from and with each other (Gielen *et al*., 2000).

The extent to which farmers have developed these skills is strongly related to their culture, to the genetic diversity they have access to, and to the level of exposure to external influences. Within communities the management capacities vary considerably (see Bellon, 1996, Cromwell and van Oosterhout, 1999), for instance between men and women.[2]

If we as promoters of agrobiodiversity want to influence the capacity of farmers, then we have to take into account how people learn.

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[2] Howard-Borjas (2001) claims that 'women collectively hold the majority of knowledge about the world's plants', through their roles as housewife, as gatherer, as gardener, as herbalist, as plant breeder and seed custodian. She gives numerous examples of research all over the world that supports her statement.

2. WAYS OF LEARNING

As we all know, children start learning through *copying* what they see others doing. Adults can stimulate the learning of a child by demonstrating a desired behaviour and stimulate imitation by showing approval. Another basic way of learning of children is that they *try out* behaviour by themselves: try-out ways to handle things and situations. When they are learning in this way (by trial-and-error, i.e. experiential learning), they also meet 'society' at one moment or the other, because adults approve or reject the child's behaviour according to the local culture.

The way learning takes place in the formal educational system has been very different. Entering a primary school, a child is forced to behave in a structured way, not only in its overt behaviour (e.g. sit and keep quite, only answer when asked), but also in the way it processes the educational content in its brain. In school, drilling and reproduction of knowledge has taken the place of voluntary imitation and individual exploration.

Education to adults has many examples of a different set-up since for long time. Generally, it is recognized that adults have built up experience and it is acknowledged that building on prior experience is an efficient way of learning. The content of the training should be experienced as relevant or directly applicable. Also, adults are considered weak in passive learning and reproduction of knowledge only is not attractive to them. Balancing challenges and experiencing success are also found to be important for the motivation of the adult learner (Meeder, 2001).

For a number of years, the set-up of formal education to children and youngsters has begun to change. The focus has shifted away from only *knowledge* to the *ability of performing tasks* (Competence-Based Education, CBE, or Outcome Based Education). To perform a task, a person needs competences. A competence is then defined as the total of inter-linked personal qualities (cognitive skills, personal characteristics, technical skills) necessary in a certain situation to achieve a predetermined result (Gielen *et al*., 2000) Simply said, a competence is the combination of necessary knowledge, skills and attitudes to perform a certain task.

Table 1. Comparison of traditional education with CBE

Traditional education	Competence based education
Subject matter and discipline oriented skills are the starting point for the curriculum	Realistic real life cases are the starting point for the curriculum
The teaching process is central	The learning process is central
The teacher coordinates the process	Teacher coaches the process
Passive students	The students direct the process
Modules mainly cover one subject	Modules integrate more than one subject or discipline
Skills are acquired separately	Skills are integrated and are acquired as part of the whole curriculum
Examination is the task of the teacher	Self-reflection and self-examination play a fundamental role in the learning process

It has been recognized that the learning environment prevailing in schools must change in order to foster learning for the desired outcomes or competences.

In Table 1, some characteristics of the traditional learning situation are compared with those required in Outcome Based or Competence Based Education (from Meeder, 2001)

Based on all that is scientifically known nowadays about the translation of the requirements for effective learning to the design of teaching-learning situations, recently the following 'rules of thumb' for educators were proposed (Bransford *et al.,* 2000).

The teaching-learning process should be:

1. Student-centred, especially in the sense of starting from what the student already knows or thinks about the subject that is treated;
2. Aim to teach little adequately rather than much superficially;
3. Assessment-centred: continuously keeping check on what is actually learned by the individual students, what is the real outcome (also at intermediary stages);
4. Context-oriented.

We will use the above-sketched framework of thinking about learning as guidance in the further development of our theme in this paper.

Many countries in sub-Saharan Africa are currently in the process of changing their educational systems in the direction of OBE. Once that is achieved, the difference between formal education (for children and youth) and informal training and education (for adults) will have been bridged and similar principles will guide both.

This prevalent change in the educational systems is interesting in the view of our wish to promote agrobiodiversity. First, we will explore the role formal education can play in this respect. Thereafter, we will have a look at the opportunities for learning in favour of agrobiodiversity in the Agriculture Knowledge and Information System (AKIS). The following model shows a number of links between the two systems that may be important for the strategies of intervention to develop:

3. OPPORTUNITIES FOR INCLUSION OF AGROBIODIVERSITY IN PRIMARY EDUCATION

Specifically primary education is an important vehicle for influencing people in favour of agrobiodiversity, because primary education is about the only system/service that has a broad reach within the population. This applies with extra vigour for the rural population, which is mostly excluded from access to secondary and formal vocational[3] education because of

[3] In most countries, the formal system of secondary education has two parallel subsystems, general education (mostly seen as preparation for entrance to the university) and vocational or (on the higher level) professional education. Or there exist one system of secondary education, with options to choose a vocational stream (directed to different economic sectors) at various levels. (Formal) vocational education is meant as preparation of youth for entering the labour market at a certain level. Normally, the whole formal system including its vocational/professional component, is under the exclusive authority of the Ministry of Education.

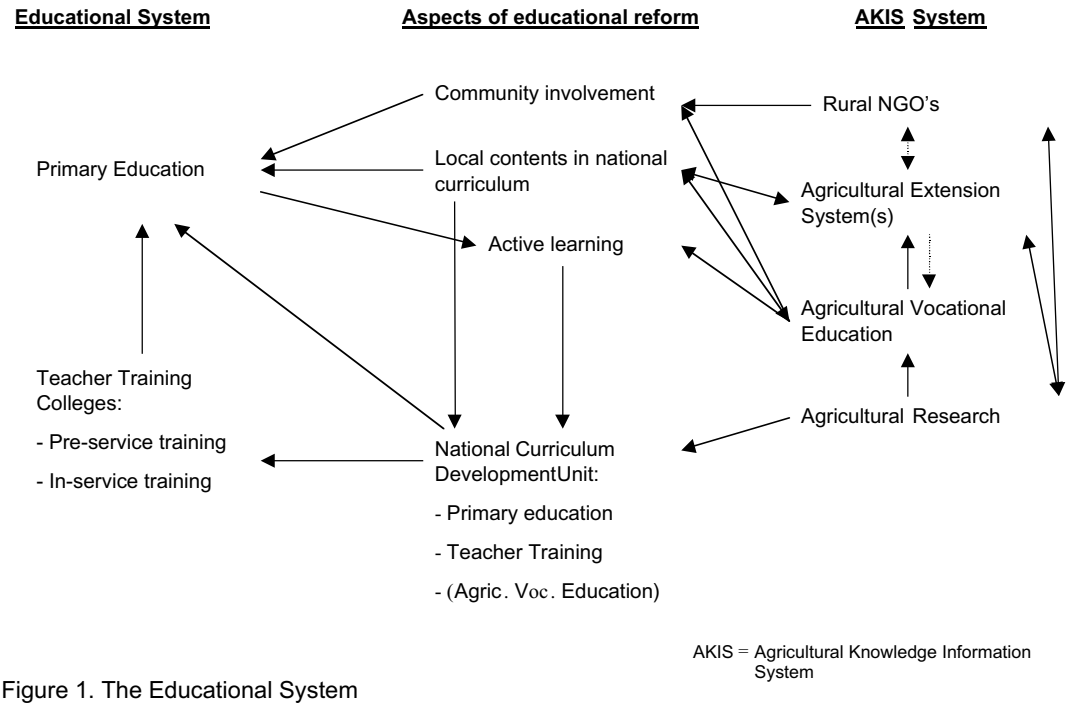

Figure 1. The Educational System

skewed distribution of educational services in the countries and high poverty levels in rural areas.

In principle, environmental education is part of almost all new national curricula for primary education, which were introduced since the 1990s in the various countries (e.g. Tanzania, Mozambique, Uganda, Kenya, Burkina Faso). Mostly, environmental awareness and an attitude of taking care of the environment is mentioned as one of the objectives of primary education, and various topics around this objective are part of the curriculum, for example within the subject area of biology and natural sciences. Often school gardens are also promoted, and the objective of transmitting basic knowledge and skills for agriculture is included in the curriculum, because one of the aims of primary education is the development of basic life skills. The awareness of agrobiodiversity and knowledge about that issue may be introduced as a part of these topics. Care should be taken not to overload the textbooks, by only adding another chapter. Instead the new element should be integrated into the overall objectives related to ecological sustainability, and the teaching should concentrate on the grasp of essential concepts, adapted to different age groups (Rule of thumb 2).

However, there is a tendency in primary schools to give parts of the curriculum such as natural sciences less priority than the basic skills of reading, writing and arithmetic. So the inclusion of a subject in the official curriculum is by no means a guarantee that it really will be treated with the majority of children throughout the country.
Further, it is a fact that primary school teachers have no agricultural training. This means that solutions should be found to prepare them for taking care of the agrobiodiversity/sustainable agriculture theme when it will be included in the curriculum, or for having other people (local farmers, pupils' parents, agricultural extension workers) take care of these themes in their classes.

Another innovation in the new primary education laws is that they require participation and decentralization. Participation means that the community should be involved in the school,

that parents should participate, for example in decision-making about finances. But the participation may also be extended to the actual teaching.

Decentralization as it applies to the curriculum *content* means that within the national educational objectives and broad curriculum themes, locally adapted content may or even must be used, and that teachers are free to apply the most effective teaching methodology in the particular conditions of the school. It is essential to take advantage of these aspects of participation and decentralization in order to offer meaningful, context-oriented learning to the children (Rule of thumb 4).

However, up to now it has proven very difficult to put into practice the above-mentioned aspects of the educational reforms in SSA. A professional competence is needed for this that the majority of (primary school) teachers does not possess. So, a programme to enhance agrobiodiversity through (primary) education should pay attention to the training and support of teachers in aspects of 'new teaching–learning methodology' and parents'/community participation.

An advantage of a programme directed to (primary) school teachers that combines treatment of the agrobiodiversity/sustainable agriculture topic with development of teachers' competences to cope with the requirements of implementation of the educational reforms in general is, that such a programme will respond to felt needs of the teachers themselves. This will function as an incentive to them to follow the training and implement what they learn.

If primary education is to fulfil its promises in relation to agrobiodiversity, then agrobiodiversity has to be integrated in the national curriculum and, as explained, in that of the teacher training as well. Currently, the national curricula are mainly influenced by the results of 'scientific agricultural research' and provide blanket recommendations that in many areas are not appropriate.

The teacher-training curriculum should develop basic awareness and knowledge of the concept of agrobiodiversity, and the reasons for enhancing the use and conservation of it. Additionally, future teachers need training in methods to treat these subjects with their pupils while working in their local surroundings and drawing on the knowledge of agrobiodiversity of the pupils' families and the local community in general (specifically thinking of the role of women in this respect).

Regarding the learning process of the teacher trainees, it is important to use the knowledge of biology they have acquired in their education already (Rule of thumb 1). It certainly will be a change in perspective to use this knowledge for understanding the question of biodiversity and its links with agricultural production (jumping the boundaries of disciplines, and also the boundary between learning for school and learning for life outside of school).

This change of perspective on learning regarding the teacher trainees is an example of the process that is necessary in general for the promotion of agrobiodiversity: actively linking scientific knowledge and skills with individual, local skills and knowledge developed by experience and tradition (Almekinders, 2001).

When the above-mentioned topics are integrated in the curricula of the Teacher Training Colleges (the so-called pre-service training), then new teachers will be familiar with it. For teachers currently working in schools, these topics need to be integrated in existing upgrading courses (in-service training).

It is important that the new elements for teacher training be integrated in the official pre-service curriculum and the regular in-service training, in order to avoid 'adverse incentives' (Thies, 2000): when agrobiodiversity training activities would be offered as extra courses, outside the official ones, teachers would resent the overload of work and they would be wary of new methodology not approved by supervisors. While integration in the mainstream of (re)training would profit from the motivation that teachers have to acquire a diploma or training certificate (because it is related with their formal job level and salary).

From an educational development point of view, the above-described contribution of the 'agrobiodiversity-programme' would have the following interesting characteristics:

- Support to and development of tools and pilot experiences in leading principles of the education reform such as parent and community participation and adaptation of curriculum to local conditions, contributing to reduction of the gap between the 'world of education' and the 'world of the community'.
- Introduction of the new theme of agrobiodiversity, preferably integrated into a wider subject, while adhering to national, general formats of teacher training, curriculum development, development of learning materials and teaching aids, etc.
- Exploration of the cultural aspect of community participation and local content within the framework curriculum. Local knowledge and practices of uses and conservation of agrobiodiversity are mostly integrated in local cultural norms and behaviour related to agricultural production, use of wild flora and fauna, etc. Thus, these norms, knowledge and skills have to be known, saved and built upon in order to find ways to foster a positive attitude to the conservation of agrobiodiversity and find new, sustainable ways of using it.

3. THE AGRICULTURAL KNOWLEDGE AND INFORMATION SYSTEM

3.1 Agricultural Research

Agricultural research is the backbone of the AKIS system. It is still seen as *the* generator of new knowledge. The messages produced by this system are not only disseminated through extension, but also included in curricula all over the educational system. Together with the generated knowledge, an attitude of superiority related to the bearer of that knowledge is also disseminated. For many researchers, but even more for their students trained in agriculture, it is evident that they have 'the knowledge' as they studied agriculture[4]. Farmers on the contrary

[4] A report on recent research in Morocco (Bauer and Kradi, 2001) states: "Critical reflection of the project experience suggests that the institutionalization of participatory research is mainly influenced by:
– the causal innovation theory to which researchers and decision makers adhere;
– the institute's strategy and the extent to which this strategy fits in with rural development policies;
– the management of change process by which staff relinquishes old ideas and assimilates new ones;"
The idea of the superiority of the knowledge of formal studies in relation to knowledge gained by experience and transmitted by tradition is certainly one of those "old ideas (… that should be…) relinquished".

(in their thinking), are ignorant and irrational as they just work out of tradition and they need to be taught the 'proper way' of farming.

In our opinion successful integration of agrobiodiversity can only be supported by those researchers and students who are open-minded, able and eager to experiment together with farmers (men and women!) in order to maintain/develop local varieties and species (see also conclusions of Almekinders, 2001).

Experiential learning is an educational principle that is already included in approaches such as Participatory Technology Development and Farmer's Field Schools, but it also should be included in the curricula of vocational schools, colleges and courses.

It is the combination of scientific knowledge and traditional knowledge that can progress agricultural development in situations where full control of the environment is not possible.

For farmers, sustaining agrobiodiversity has mainly an economic base: their survival and generation of income are based on the skilled handling of agrobiodiversity in a difficult environment.

In most cases where farmers managed to control their environment, they stopped being the sustainers of agrobiodiversity and focused on high productive varieties because of market pressure. [5]

One other aspect that research should not forget, is trying to prove the impact of the above mentioned approaches such as PTD and FFS. Defenders of those approaches claim that their practices are more successful and sustainable, but to convince other scientists, real proof is needed, but not yet available.

3.2 Vocational education and training

Agricultural vocational schools and colleges are training the future extension workers, farm managers, NGO staff, etc. working directly with farmers or producers. It is therefore very important that agrobiodiversity is treated properly in their curricula.
In order to stimulate these professionals' and technicians' ability and willingness to conserve and use agrobiodiversity in their future work, it is important to adapt the approach and content to the reality of this work (cf. concept of Competence-Based Education):

- How and where will they come across issues of agrobiodiversity?
- What actions can or must be executed by them in these cases?

It would probably be a good strategy, both for treating meaningful content development and for didactical purposes, to include investigation into the learning activities of these students. The habit of using both knowledge/principles from books, existing knowledge of the local population and one's own observations and experimentation, will be fostered by this approach.

[5] Zanderink (2001) researched the history of 70 animal landraces in the Netherlands. He found that these were not protected by the government, the farming community, or nature conservationists, but mainly by small groups of interested people. They take care of races that have been rejected by conventional farming and markets, but that have an emotional value to them.

When agricultural technicians learn this approach during their training, and see that good results are obtained, they will be motivated and able to use the same approach when they function in their future jobs.

Successful examples of the combination of local and scientific knowledge in research and extension do already exist in the field,[6] but the translation of this type of approach to curricula with which agricultural technicians are trained has hardly been undertaken as yet.

Probably in the longer run, an extra result may be expected from synergy between efforts directed to primary and to vocational education. This will be the case when in the field, at community or regional level, cooperation can be established between primary schools and for example an agricultural extension service or an agricultural school. When primary school teachers and agricultural extensionists or teachers work together with the same active, participatory approach to teaching and learning, their complementary knowledge and skills will improve the results.

3.3 Extension services and training of farmers

Since 1983, the World Bank has supported all over Africa the introduction of the Training and Visit extension system, based on the success of the Green Revolution in Asia (Venkatesan, 1995). This approach follows the traditional principles of extension: research develops packages of information, extension demonstrates the packages in the fields of demo farmers, and the farmers have to implement the given recommendations.

The results of this approach in Africa have been rather negative (Röling, 1995, Rees *et al*., 2000), amongst other factors because of the great variations in ecology in most African countries. For two decades participatory approaches have been introduced, initially by non-governmental organizations, but recently also by governmental extension services. These approaches build on active participation of farmers, improved experimentation of the farmers themselves, and support to them with information and research on problems they cannot solve themselves. PTD is the most widespread example of such an approach, while the Farmers Field School approach adopted from Asia is used specifically in the field of disease control (integrated pest management).

Although NGOs have been successful in developing the participatory methodologies, they have many more problems in involving research institutions in their work on a structural basis (collaboration between governmental and non-governmental organizations often meets hindrances), and in expanding their working area in a sustainable way (Griffith *et al*., 1999). Dependency on foreign contributions is continuously threatening their survival.

Sustainable agriculture is also a field in which NGOs have played, and are still, playing a role in trying out different methods and in providing training to farmers, but impact is still limited.

[6] A successful approach in this sense, although not directed to agrobiodiversity use and conservation, the examples of the Netherlands-funded ISCW-II programme described in “Clapping with two hands: bringing together local and outside knowledge for innovation in land husbandry in Tanzania and Ethiopia – a comparative study”, Kibwana *et al.* (2001).

The decentralization process in a number of countries also affects the government extension services. Tanzania is an example for that matter: until some years ago all agricultural staff belonged to the Ministry of Agriculture and, of course, it had its loyalty there. The T&V system as working model was implemented from the national level down to regions and districts. In specific cases it meant that T&V completely overruled more specific and effective extension methods developed at district level in collaboration with NGOs, just because T&V came from the Ministry. Now most of the staff working in the field have been transferred to the District Council, a change aiming to make them more accountable to their environment. This creates an opportunity for them to become more susceptible to their local situation, although the needed change in attitude as mentioned above must still begin for most of the staff. A national approach like T&V does not fit anymore and currently a kind of PTD approach is promoted at the district level with support from regional research institutes.

4. RECOMMENDED STRATEGIES TO STRENGTHEN AGROBIODIVERSITY THROUGH LEARNING

4.1 In education

In quite a number of SSA countries, educational reform is taking place. To name a few: Tanzania, Zambia, Uganda, Mozambique and Rwanda. This is an excellent opportunity to influence key stakeholders in favour of agrobiodiversity in formal education.

In general, primary education curricula are produced in a national centre. If the curriculum developers there can be influenced by linking them with NGOs working on agrobiodiversity and more generally in support of sustainable agriculture, then a change of direction could be realized in focusing curricula more on the value of local agricultural varieties and away from promoting the 'scientifically' developed 'modern' agriculture.

Secondly, a Teacher Training College could be selected as a pilot to develop an agrobiodiversity-oriented curriculum and a teachers' upgrading course in which teachers learn how to use community knowledge and the local environment in their lessons. If this curriculum is tried out as a pilot in an area where an extension service or an NGO is working with the PTD approach, then experience can be acquired with linking local schools, extension workers and farmers who are experimenting with local varieties.
The exchange of experiences between such local try-outs is very important to motivate, give new ideas and sustain efforts. One way to do this could be a simple magazine describing the different (successful) crops or races with improvements made by farmers.

The results of the pilot(s) will then to lead to the development of a module ready for integration in the national in-service and pre-service curricula of teacher training.

The motivation, learning and promotional effect of pilot projects would of course be even greater if pilots of this kind could be executed in several countries at the same time.

Thirdly, support is needed for innovation of the curriculum and teaching practice of agricultural schools in the direction of genuine experimentation with students' participation, oriented to the integration of regional agricultural knowledge with scientific knowledge and research methods and the development of an enquiring, problem solving attitude and skills in students.

Fourthly, agricultural schools that are part of the formal educational system in research and extension networks, which are developing and promoting agrobiodiversity-oriented approaches, should be involved.

4.2 In research and extension

As mentioned before, it is very important that research results become available on the impact of farmer experimental methods, such as PTD. Only this can convince more researchers to change their paradigm.

Cases of successful agrobiodiversity are important and need to be distributed for replication. But, screening is then necessary as well, to ensure that the described methods are valid under the mentioned conditions and to allow for adaptation. WWW.oneworld.net is doing this on its webpage Learningchannel.org for a number of topics including agrobiodiversity. Only a very limited number of cases has been included until now. Using the internet between scientists and NGOs can be a very powerful instrument. Once a success story is put on the website, then it is very easy for organizations to download it and reproduce it through photocopying. Regional networks would be required to search, assess and distribute real agrobiodiversity success stories.

Secondly, research centres that support farmers in their experiments and adaptation of local varieties, could be the physical and responsible entities for compiling and distributing the different experiences as mentioned under education.

Thirdly, NGOs working with agrobiodiversity-oriented approaches need to be made aware of (agricultural) schools as intermediaries for influence on wider segments of the population.

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RESEARCH FOR FARMERS AND WITH FARMERS: A KENYAN STORY OF TESTING TRADITIONAL METHODS FOR PEST AND DISEASE MANAGEMENT

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1. INTRODUCTION

Organic farming can be seen as the management of agrobiodiversity, based on understanding relationships between plants, the damaging and beneficial organisms around them and the interactions with the biophysical relationships. Thus, the basic feature of integrated pest management (IPM) is the conservation and use of agrobiodiversity in farmers' fields, resulting in the regulation of crop pests and disease populations by their natural enemies. The agrochemical-based technology that has been promoted over the last decades has not allowed the farmers to develop their knowledge to new crops, technology and conditions. Rather, their traditional knowledge was put aside, and replaced with blanket recommendations of extension-service people. 'Returning' to organic agriculture, thus, requires farmers to re-learn and develop their knowledge about relations between crops, insects and other plant-surrounding organisms. Farmer Field Schools (FFS) provide successful opportunities for farmers' learning. The FFS experiences in Kenya have, however, also shown that the role of extensionists and researchers is significantly different from that in the old models of Transfer of Technology. While their role can be described as that of facilitator and resource person, respectively, they also learn, together with the farmers.

2. HOW THE PROJECT STARTED

In the central highlands of East Africa, smallholder farmers grow many crops. Some of these, such as coffee, they sell for cash. Others, including a variety of cereals and vegetables, are grown for family consumption and for the local market. Many farmers in this area have become dependent on costly, synthetic pesticides to manage pests and diseases, and spray on a regular basis. They have found this to be expensive, eating into farm profits, and it can also affect the health of farm families, consumers and livestock. To make things worse, crop yields and quality have not improved as a result of increased pesticide use.

In 1996–97 Kenyan farmers, extension staff and researchers joined together to take part in a pilot integrated pest management (IPM[1]) training project. We wanted to see whether local low-cost, ecological methods for pest and disease management would work in our region. We used a training approach known as the Farmer Field School (FFS), in which specially trained

[1] IPM has been defined as "The careful integration of a number of available pest control techniques that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and safe for human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption of agroecosystems, thereby encouraging natural pest control mechanisms." *(Global IPM Facility Web site, www.fao.org)*

BOX 1. THE FARMER FIELD SCHOOL APPROACH

The success of the FFS approach lies in its focus on the farmer as the key decision-maker in pest **management**, and in the facilitation of a discovery-learning process using non-formal education methods. The field is the primary classroom, and the four major principles of the farmer's training:

- Grow a healthy crop
- Observe fields frequently
- Conserve natural enemies

Farmers understand agro-ecology, and become experts in their own fields

There are no standard recommendations or packages of technology offered. In the FFS, farmers collect data in their own fields and undertake action based on their findings. Farmers become active learners and independent decision-makers through learning by doing. They take responsibility for carrying out comparative experiments on small plots in their own fields and suggest topics for experimentation according to their particular needs.

Using the skills and knowledge acquired during the Farmer Field School, group members gain the confidence to select and adapt Integrated Pest Management (IPM) and Integrated Crop Management (ICM) options to suit their own farm needs. They may also undertake action research with the FFS trainers or in their own farmers' groups to experiment with other crop management practices, for instance, compost and mulching or the efficacy of botanical extracts as home-made pesticides.

The farmer field school approach differs from conventional agricultural extension in several ways, some of which are listed below.

Parameter	Traditional approach	Field school approach
Control Objectives	Predetermined and fixed	Variable and evolving
Aim of farmer training	To motivate farmers	To empower farmers
IPM methods	A package	A basket
What farmers do with IPM methods	Adopt or use as instructed	Experiment and adapt or modify
Knowledge hierarchy	Scientist, Extensionist, Farmer	None
Role of research	Develop pest management prescriptions	Develop pest management options
Role of extension	Deliver messages to farmers	Facilitate farmers
Extension methods	Dissemination	Participation
How farmers learn new knowledge	Instruction	Discovery

facilitators work with farmers to help them learn for themselves about the agroecology of their fields. The project aimed to empower farmers with the ability to experiment and adopt sustainable pest management methods or integrated pest management. In practice this means that the aim is for farmers to gain the skills, knowledge and confidence to make better decisions about crop management, recognize the problems of relying too much on pesticides, and appreciate the opportunities of using knowledge of crops and their associated organisms to

manage pests and diseases. This pilot project was one of the first to employ the FFS-approach in Eastern Africa. The overall goal of the project was to pilot test the farmer field school approach in Africa, under a more complex cropping system than the mono-crop rice system in which it had been first developed in Asia. The FFS approach, a discovery-based, group-learning model, is outlined in Box 1.

The project was a partnership of CAB International, the Kenya Institute of Organic Farming (KIOF), the Kenya Agricultural Research Institute (KARI), the Coffee Research Foundation (CRF) and the Ministry of Agriculture Livestock Development & Marketing (MOALD&M).

3. WHAT WE DID

During weekly FFS-meetings throughout the season, we observed insects and diseases in the field, and experimented with IPM methods, comparing these with farmers' current practice in the area. We studied the development of insects we collected and discovered what food they ate. As a result of these experiments we found that many of the insects in the field are, in fact, the farmers' friends, feeding on pests. We discovered how applying some insecticides can kill these friends, and that often farmers spray chemicals against insects that don't really damage the crop. We also tried out composting, mulching, and other organic methods to improve soil fertility and experimented with plant tonics (see Box 2), with encouraging results.

4. THE RESEARCH GROUP PARTNERS

The farmers: We belong to two FFS groups in the villages of Githunguri (Kiambu District) on the outskirts of Nairobi and Karigu-ini (Mur'anga District), about 80 km north of the capital. The Githunguri group are all women farmers who grow tomatoes and other vegetables for consumers in Nairobi. The Karigu-ini group is a mixed group (men and women), growing coffee and vegetables organically. Each FFS group has about 25 members.

The FFS facilitators: We work as government extension staff for the District Offices of the Ministry of Agriculture, Livestock Development & Marketing (MOALD&M), or as trainers with the Kenya Institute of Organic Farming (KIOF), a non- governmental organization. Most of us have worked with the groups since the FFS project started in 1996.

BOX 2. EXPERIMENTS

In 1998, two of the FFS groups got together to plan a set of experiments to test these methods in tomato and kale crops, using the field of one of the participating farmers at each site. This research would help us to answer questions like:

- Do these traditional methods really work?
- Are they any better than using agrochemicals?
- How do traditional methods compare to the use of chemicals in terms of cost and labour requirements?
- Can FFS farmers easily build these traditional methods into their farming practices?

In total, we carried out four experiments to answer four questions:

1. How effective are traditional methods for disinfecting soil in nursery beds?

Rootknot nematode worms (RKN) are tiny worm-like creatures that attack the roots of tomato seedlings, causing abnormal growths on the roots of the plant, which make the root knotted and swollen. The RKN control methods we tested were:

- trash burning
- application of hot water
- incorporation of fresh marigold plants into the soil
- incorporation of dry marigold plants into the soil
- Furadan soil pesticide
- control with no special treatment

2. Can applications of fresh milk help control tomato blight and bacterial wilt?

We had five treatments in this experiment. They were:

- milk (low concentration)
- milk (high concentration)
- milk (low concentration) alternating with Dithane M45 (a preventative fungicide)
- Dithane M45 and Ridomil (a curative fungicide)
- control, with no treatment against blight

3. Can pegging[2] and the application of ash prevent cutworm damage on kale?

Cutworms are caterpillar pests that attack the young seedlings of many crop plants.

We carried out these experiments to test two traditional methods for managing cutworms:

(a) Pegging; by tying a peg or thin wooden stick to the seedling we increased the girth of the stem, making it impossible for the cutworm to coil around the stem and bite through it.

(b) Application of ash: wood ash can repel and dry out the skin of soft-bodied insects like cutworms

4. Which plant-based preparations work best against diamond-back moth (DBM) and aphids on kale?

Farmers have been using homemade preparations of various plants for the control of insect pests for centuries and these botanical treatments are promoted by KIOF during its training projects. The evaluated treatments were:

- chilli (high concentration)
- chilli (low concentration)
- fermented marigold tea.
- karate
- control.

[2] Pegging involves tying a stick to the stem of a seedling. This increases the diameter of the stem sufficiently to stop cutworms wrapping themselves around the stem and cutting it off at soil level.

The researchers: We are pest and disease scientists from the Kenya Agricultural Research Institute (KARI) and from the CABI Bioscience Africa Regional Centre, an international organization.

The farmers participated at all stages of the experimental process. They discussed with the researchers and facilitators which of their pest problems they thought were the most serious and suggested many traditional management methods that could be tested. The facilitators guided the experimental design process and data-collection procedures and facilitated the group discussions after the regular data-collection sessions and at the end of the trials. The researchers also provided some technical background and support and carried out laboratory studies when and where this was necessary. We all worked together to prepare the trial sites and collect data and discussed the findings and drew conclusions during our group discussions.

5. ISSUES ARISING FROM THE FARMER FIELD SCHOOL

5.1 Design of the experiments

When we were testing different methods to manage pests and diseases in tomato nurseries, we mixed up seedlings from different methods when we transplanted them out to the field. Also we did not include any replicates in our experiments, so we could not be confident that the results we got were due to the treatments we were applying and not to something else. As a result of these and other experiences, we agreed to design the experiments according to normal scientific practice, and to include ‘control plots’, ‘replicates’ and comparisons with commonly used pesticides. These ideas were new to many of us so there was a great deal of discussion about them. We likened the need for good comparisons to the situation when a person becomes ill and tries out different cures. First, she may go to the drugstore and buy medicine; then she might consult the local healer or pray at church. Finally she may take a herbal remedy prepared by a neighbour. She does get better but how do we know which cure was the one that worked?

5.2 Data collection and insect classification

Each week we recorded the number of DBM larvae and aphids. For aphids we used a scoring system, because there were too many to count them individually. We therefore scored each plant as having ‘none’, ‘few’ or ‘many’ aphids.

There were some problems in introducing some of the IPM concepts, particularly as there are no names for some natural pests in the local language. However, through the field schools, farmers were introduced to the different organisms, and invented their own names for them (see Box 3). For example hover flies (Syrphidae, the larvae of which prey on aphids), were christened ‘helicopters’. This created ownership and confidence for conservation and use of the agrobiodiversity.

BOX 3. SOME KIKUYU NAMES GIVEN TO PESTS AND DISEASES BY FARMERS

'Elephantitis' for root knot nematode damage, because the roots reminded farmers of the symptoms of elephantits in humans.

'Polio' for bacterial wilt because this disease crippled the plant as polio cripples people

'Mbaa' for blight which means 'Cold diseases'

'*Kagunyu ka rurenda'* for diamondback moth caterpillars larvae which means 'caterpillar that dangles on a web string'

'*Murata wa murimi'* for ladybird beetles, which means 'friend of the farmer'.

'Gakui mirigo' for lacewing larvae which means 'that which carries a load on the back'

'*Helicopter insects'* for hoverflies because of the way they fly

'Ume muthece' for parasitized aphids, which means 'injected aphids'

6. INCENTIVES AND COMMON LEARNING POINTS

There are several potential incentives for farmers to adopt the *IPM approach*:

- reduced expenditure on pesticides and fertilizers;
- reduced health risks to the farmers and their families;
- reduced environmental damage;
- reduced risks to consumers.

Clearly the first two incentives are likely to be more compelling for smallholder farmers than the last two.

There are also important incentives related to the *FFS approach*. Everybody enjoyed the season's work and was more motivated to promote and experiment with organic options for pest and disease management in the future. (The kale leaf experiment was one of the most popular with the farmers and facilitators because after grading, the harvested leaves were shared among all present to take home for dinner!)

The farmers agreed they had gained a lot of useful knowledge and research skills by taking part in the experiments on an equal footing with researchers and facilitators. They were more confident in using traditional and organic methods on their farm and more inclined to keep farm records.

The facilitators also improved their research experience and are more confident in leading experiments with farmers. They played a crucial role in linking the farmers with the scientists. The researchers learnt about practical application of traditional methods and gained more respect for farmers' knowledge.

KIOF was happy because the results not only showed the usefulness of many organic methods which they had been promoting, but also staff gained valuable experience in carrying out careful research into these methods. KARI and the Ministry District offices were happy because their staff were involved in fieldwork which helped meet the real concerns about safe but profitable vegetable production voiced by smallholder farmers.

7. IMPACT AND STATUS OF THE ACTIVITY

An independent evaluation (Loevinsohn *et al.*, 1998) identified a number of areas in which the FFS had positive impacts. In relation to the incentives listed above, reduced expenditure on agrochemical use amounted to US$145 per year per household. Yields did not suffer so this represented a substantial incentive to the farmers to be aware of and conserve the agrobiodiversity in their farms. Farmers did not perceive any reduction in the number of days off sick due to pesticide poisoning, but no accurate assessment was undertaken. Farmer management capacity, assessed as the ability to make better decisions independently and under different conditions, was also positively affected by the FFS. Farmers used what they had learned in the field school on other crops, sometimes modifying practices to meet their needs. No environmental assessment was done, but farmers perceived soil productivity improvements. Another result was that women increased their role in managing coffee, which is generally controlled by men, but it is not clear whether women have a different view of the value of conserving agrobiodiversity from men in this context.

The pilot project was a short one-season activity. However, the FFS approach is now being tested over a much wider area under a regional project (funded by IFAD through FAO) involving several hundred field schools in Kenya, Tanzania and Uganda. The approach is also being adopted elsewhere in Africa.

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POSTGRADUATE TRAINING IN PLANT GENETIC RESOURCES IN THE SADC REGION: A CASE STUDY

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1. INTRODUCTION

There is no doubt that training is an important incentive for the use and conservation of agrobiodiversity: it acts as a motivating influence or stimulus for the use and conservation of agribiodiversity. In the Southern African Development Community (SADC[1]) region, the shortage of high-level trained manpower (MSc. and PhD) has been mentioned as a major constraint to increasing the levels of agricultural production and productivity and, hence, to the attainment of food security at family, national and regional levels (Wanchinga and Sebeela, 1991). The sustainable use and conservation of agrobiodiversity is an important element in achieving food security. In implementing the regional training approach, the provision of scholarships by national governments, regional and international organizations/institutions cannot be over emphasized.

FAO, in its Global Plan of Action (GPA, 1996) stressed the importance of training in achieving sustainable improvements in Plant Genetic Resources for Food and Agriculture (PGR for FA), and lists education and training as one of 20 priority areas for the conservation and sustainable utilization of PGR. CGIAR (1992) summarized the importance of training in PGR as follows:

- training adds value to PGR as skilled people increasingly become aware of the assets;
- skilled staff in a wide range of disciplines involved in PGR are needed to conserve, manage and make use of PGR;
- sustainable development requires technology transfer through training;
- research activities in PGR can only proceed if trained staff are involved.

Other authors have also stressed the importance of training in the use and conservation of agrobiodiversity (SRGB, 1990; IPGRI, 1993; Atlere, 1994; Putter, 1994).

In order to be more cost effective and relevant to the training needs, a regional approach is recommended (SRGB, 1990; Wanchinga and Sebeela, 1991; IPGRI, 1993; FAO, 1996). This is even more important in the current situation where resources, especially financial ones, are limited. A regional approach in addressing training needs entails the development of institutions and/or programmes in each region that are capable of providing the relevant advanced training in PGR and related fields which will contribute to the sustainable use and conservation of the PGR. This paper discusses the development and experiences of the

[1] SADC Member States: Angola, Botswana, Lesotho, Malawi, Mozambique, Mauritius, Namibia, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe.

SADC regional MSc programme in PGR at the University of Zambia, School of Agricultural Sciences in the Department of Crop Science.

2. CURRICULUM DEVELOPMENT PROCESS

2.1 The setting

In 1988–89, the Southern African Centre for Co-operation in Agricultural Research and Training (SACCAR) implemented four regional MSc Programmes in SADC with financial and technical support from the German Technical Cooperation – GTZ. Support from GTZ included full-scholarship packages. The initial M.Sc programmes included the following:

- MSc in Animal Science at Bunda College of Agriculture, University of Malawi;
- MSc in Agricultural Economics at the University of Zimbabwe;
- MSc in Land and Water Management at Sokoine University of Agriculture in Tanzania.
- MSc in Agronomy – Crop Science at the University of Zambia with 3 options, (i) plant breeding, (ii) crop production and (iii) crop protection.

At about the same time, two events provided the impetus for the development and implementation of the MSc in plant genetic resources management. The first was the establishment of the SADC Plant Genetic Resources Centre (SPGRC) in 1990 near Lusaka, about 14 kilometres from the University of Zambia. The SPGRC was originally called the SADC Regional Genebank (SRGB). The overall objective of SPGRC is "to provide service to the region through a system of National Plant Genetic Resources Centres (NPGRCs)". The SPGRC and NPGRCs are expected to contribute to the objective through training a cadre of highly skilled specialists in Plant Genetic Resources Management (PGRM) in the region. However, as was the case then and now, the SPGRC sends the NPGRC personnel to the University of Birmingham for MSc training in PGRM. The second event was the implementation of IPGRI's new strategy 'Diversity for Development' (IPGRI, 1993), which emphasized, among other things, the regional approach to training in PGR.

2.2 PGRM curriculum development

In developing the PGRM curriculum, the School of Agricultural Sciences in Zambia contacted collaborating partners, e.g. IPGRI and the University of Birmingham and some individual scientists in the area of PGR for materials dealing with PGRM. Subsequently, a draft document was prepared and circulated to various stakeholders, including IPGRI, University of Birmingham, SPGRC, the Zambian NPGRC and individual scientists. The revised draft curriculum was then approved at the school level and finally by the University of Zambia Senate.

Once approved by the Senate, the curriculum was presented to the Regional Programme Steering Committee (REPSCO) and finally by the Board of SACCAR as a requirement for the programme to qualify as a regional training programme. The PGR programme is now the fourth option within the regional MSc (Agronomy) Crop Science programme.

2.3 Programme structure

The MSc (Agronomy) Crop Science Programme is of 2-year duration. The first year is spent on coursework, while the second year is used for the research work, in the option area, i.e. crop production, plant breeding, crop production, plant genetic resources (Mbewe and Begemann, 1993). The course work is in two parts, i.e. compulsory or core, and optional

courses. There are four courses in each of the compulsory and option courses category (see Box 1) The successful completion of the coursework and the approved thesis proposal constitute Part I, while Part II consists of the research work.

2.4 Programme implementation

For the full implementation of the programme, four requisites needed to be in place. These were (i) adequate staffing; (ii) scholarships; (iii) availability of teaching materials; and (iv) field and other practical training facilities.

Adequate staffing: the Department of Crop Science has three core-staff members with experience in PGR and related fields including plant breeding, biostatistics, agronomy/crop physiology. In preparation for the implementation of the PGR programme, one staff member was attached to the genebank at the Institute of Plant Genetics and Crop Plant Research at Gatersleben, Germany, for a period of 10 months to get hands-on experience in genebank management. Another staff member was attached to the ILRI-genebank in Ethiopia and undertook hands-on experience with data management at the International Plant Genetic Resources Institutes sub-Saharan Office in Nairobi, Kenya. In addition, the expert on data management from the IPGRI sub-Saharan Office provided further hands-on experience to the staff member at the University of Zambia. Both activities were of one-week duration.

Apart from the core staff, the Department of Crop Science uses the services of two staff members from the Department of Biological Sciences and staff from the NPGRC and SPGRC. Staff from the IPGRI head office in Rome and the sub-Saharan Office are also available if need arises.

Scholarships: The availability of scholarships was one of the most critical pre-requisites for the implementation of the programme. The delay in the provision of scholarships was the main reason for the late start of the implementation process. So far, three partial scholarships have been provided by IPGRI through its sub-Saharan Office. Of the three students who enrolled, one had to withdraw because he was unable to get study-leave from his employers. Due to this crucial problem of scholarships, the first two students were enrolled in the year 2000 and are expected to complete their programme in May 2001. Their respective thesis topics are presented in Box 2.

Teaching materials: IPGRI provided books and other literature in support of the programme and continues to provide materials.

Field and other practical teaching facilities: The proximity of the SPGRC and its facilities provides ideal practical training opportunities. In addition, the field and laboratory facilities under the NPGRC supplement those of SPGRC.

2.5 Experiences and lessons learnt

The implementation of the MSc (Agronomy) Crop Science – PGRM programme has been very enlightening and enriching. It has made us, as University staff, appreciate more the need for training as a contributing factor in the sustainable use and conservation of agrobiodiversity.

BOX 1. COMPULSORY AND PGR OPTION COURSES FOR THE MSC (AGRONOMY) CROP SCIENCE PROGRAMME

Compulsory courses

- Seminar – not graded
- Agroclimatology and Physiology of Yield
- Biostatistics
- Plant nutrition
- Plant – Soil Water Relationships

PGR Option Courses

- Diversity of crop plants and forestry species.
- Conservation and collection of plant genetic resources
- Data management for plant genetic resources
- Genetic and Plant breeding for plant genetic resources.

MSc thesis topics for MSc (Agronomy) Crop Science – PGR Option Students

- Genetic characterization and preliminary evaluation of pigeon pea (*Cajanus cajan* (L.) Mill.) – (Syamuyoba, Phillip)
- Characterization and preliminary evaluation of local maize (*Zea mays* L.) landraces and determination of effective sample size to use in differentiating maize accessions – (Mufwaya, Millens)

One problem we faced was inadequate laboratory equipment for some of the hands-on techniques for molecular and biochemical characterization. This problem affected the execution of the laboratory component in the programme. Apart from laboratory equipment, inadequate computer facilities also affected teaching of the course dealing with data management. It is desirable to have sufficient computer facilities to facilitate the training process.

With regards to staff, the experience showed that it is important to have a core number of local staff to facilitate smooth training, and only involve staff from collaborating institutions for gap filling, i.e. for some specialized training topics.

The experience also showed the importance of having full scholarships for the students.

2.6 Future considerations

The programme should make concerted efforts to source funds for the student scholarships if it has to be sustained, among other requirements. Scholarship sources include national governments, relevant regional and international organizations/institutions. With respect to national governments, experience from the SADC region with the regional MSc programmes shows that the member states have not given scholarships to their respective students (Woodend, 1997). This means that SACCAR should make deliberate efforts to sensitize the various local/regional stakeholders on the need to sustain the programme.

Another consideration is establishment of link/collaboration activities with other institutions, e.g. the University of Birmingham and others that offer similar training programmes. This will enhance exchange (staff and student) programmes and joint research collaboration.

The programme will also promote the utilization of the relevant PGR specialists for short-term visits and/or thesis supervision.

3. CONCLUSION

The regional approach to training as a an incentive for the use and conservation of agrobiodiversity was successfully initiated at the University of Zambia to serve the SADC region. However, more still needs to be done to make it sustainable including, among other things, the provision of scholarships. The trained personnel will significantly contribute to the sustainable utilization and conservation of agrobiodiversity.

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PUBLIC AWARENESS AS AN INCENTIVE TO ENHANCE USE AND CONSERVATION OF AGROBIODIVERSITY

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1. INTRODUCTION

I feel honoured in being able to present some ideas on the challenges facing us in the conservation of agrobiodiversity in this part of the region. I am also fully aware that I may not cover all the ground and basis regarding interesting concepts and examples related to this issue. I merely wish to use this paper to stimulate discussion and debate. The challenge is also one of not only conserving agrobiodiversity, but also integrating its use in modern day agriculture, and livelihood strategies for poor farmers and families.

The most challenging aspect when dealing with agrobiodiversity is how to get experts, policy-makers and other external interventionists to focus on the larger picture. It is easy to lose perspective of the broader implications of agrobiodiversity if your focus is limited to the resource, but the cultural, historical and economic context in which we need to locate agrobiodiversity issues is overlooked. Agrobiodiversity, in a holistic sense, is a cross-cutting issue that touches on farming, marketing, training and education, all aimed at improving resource protection and use capabilities. Public awareness can be used not only to create greater awareness about agrobiodiversity issues, but also to become an incentive vehicle that imbibes pride in tradition, and creates avenues for the marketing of products.

2. THE CONTEXT IN WHICH AGROBIODIVERSITY IS USED

2.1 Agrobiodiversity and sustainable agricultural development

In our recent work on agrobiodiversity at IUCN South Africa, which was funded by the Heinrich Boll Foundation, we have been impressing upon others, mainly those in the research community, to consider agrobiodiversity in the more dynamic setting of rural development. More than 70% of the world's poorest of the poor (those who live on less than US$1 per day) live in rural areas. More interestingly, the poorest of the poor live in areas where the world's richest biodiversity is located, such as the tropics, and temperate grasslands. Therefore as population numbers grow in the next decades, so will the dependency in developing countries on agriculture as a support base, and safety net. In addition, these areas contain some of the major biodiversity hot-spot areas (McNeely and Scherr, 2001).

Three years ago I had the privilege of working on a project looking at sustainable agriculture in the smallholder sector for Southern Africa. Following numerous contributions by experts the work we did was compiled into a book by Martin Whiteside (1998) titled: "Living Farms: Encouraging Sustainable Smallholders in Southern Africa". A very useful definition for sustainable agriculture is contained in this document. The definition is as follows:

"Agriculture which meets today's livelihoods needs, without preventing the needs of neighbours or future generations from being met; this is achieved by the continuous efforts of men, women, and children to adapt complex rural livelihoods to a changing environment, so as to protect and enhance the stocks of natural, physical, human and social 'capital' available to themselves and to future generations".

What is useful about the definition is that it conveys an understanding that the notion of sustainable livelihoods encapsulates the objectives of poverty reduction, livelihood needs that go beyond food security, but also secures the entire functional capability of human beings through improvements in health and education. What is also important is that the notion of sustainable agriculture is dependent on the degree of integration and mutually reinforcing effects of local institutions, resource conserving technologies and enabling environments such as policies and services.

Some of the challenges we face in promoting sustainable livelihoods in Southern Africa include the recognition that in the region the population growth rate is approximately 3%, however, the impact of HIV/AIDS is likely to have a stabilizing effect on population growth. While growth rates are high, the number of deaths as result of AIDS will very likely erode the effects of this growth and the value of positive interventions. However, a more pernicious consequence of AIDS, highlighted by a recent paper by David Mullins (2001) is that AIDS is also likely to reverse the development gains made so far in the region.

2.2 Users of agrobiodiversity and other stakeholders

Poor people, like rich people, seek to find ways in which to mitigate their risk against adverse economic conditions. People who live in cash economies do it through savings and investments, while the poor, who are less integrated into the cash economy, rely on access to a range of different natural resources from which they can derive foods, material and health remedies. As the Latin American economist Hernando de Soto pointed out, the poor sit with assets, worth billions, but which they cannot use as collateral or forms of exchange because they are not recognized in formal market economies as assets. Therefore, exploitation and investments in resource use by social groups which are outside of formal cash economies can only be secured through proper tenure regimes, rights of access, and resource rejuvenation and management strategies. In developing countries, agriculture still remains an important bedrock and safety-net for many people. It is the single most important source of livelihoods for the poor in Africa, Asia and Latin America. And, during economic upheavals, for example in the Asia crises in 1997, many people reverted to agricultural activities to support themselves.

I raise the issue of the connectedness of agriculture because agrobiodiversity issues are tied to traditions which were once relatively isolated from other cultural, political, technological and economic influences. It is no idle truism to suggest that the degree of cultural adaptability also influences the degree to which agrobiodiversity continues to be the mainstay of different societies who are dependent on it as a resource.

When you widen the ambit of influence, and introduce new systems of economy, knowledge and technology, they either reinforce existing practices, or simply displace them. What use is it to be part of a mainstream tradition that becomes marginal, the activity of a few, or simply a

hobby,[1] at least in the context from which I come in South Africa? The effects of dispossession of land, the migratory labour system, and urbanization in South Africa have resulted in the fracturing of tradition, which has had negative impacts on the conservation of agrobiodiversity.

In addition, the dominance of modern agriculture has lowered the status of traditional knowledge and practices, and the resources that are derived from such practices. This is what I call the 'Cadillac' syndrome of modern agriculture: using hybrids and modern implements is seen to be more progressive and effective than using traditional instruments. Another important issue, which we also tend to ignore is the apparent dwindling interest in agriculture – not everybody wants to be a farmer. In many rural areas households tend to be dominated by older women, and so the focus seems to be concentrated on food gardens, where hybrid seeds are purchased from nurseries or donated by NGOs or seed companies.

The role of agrobiodiversity as an integral component of a strategy to diversifying livelihoods needs to be emphasized. National Agricultural Institutes and Systems (NARIS and NARS) tend to have a bias towards promoting crops that are attractive for the cash economies. There is, however, growing recognition (by the CGIAR institutes, such as IPGRI and ILRI) that agrobiodiversity, often in the form of minor-crops and livestock, do fill valuable niches, and in fact are part of the complex arrangement of diverse livelihood strategies that poor farmers pursue.

Nevertheless, the bias towards 'modern' agriculture still exists. As Whiteside (1998) notes: "Many agricultural programmes have not taken sufficient notice of the diversity among farmers. Worse still, agricultural policy, research and extension have often been directed at an unrepresentative sector of farmers – typically richer, male and less remote. Conditions in most experimental stations relate more closely to the conditions experienced by richer families; therefore, not surprisingly, the technology packages developed are often more suited to them". In addition, the bias towards non-favourable incentives for the use and conservation of agrobiodiversity still exists in other areas. In the rest of the paper I will highlight some thoughts as to how and why awareness can be raised to eliminate this bias.

3. PUBLIC AWARENESS STRATEGIES AND INCENTIVES

3.1 The power of public awareness

Public awareness, by its very definition, needs to be engaged at different levels. Therefore the strategy on public awareness must be defined according to the ability to exercise leverage within the ambit of policy, research, development grants assistance, within communities, consumers and linkages between agriculture and other sectors, such as tourism. In developing a public awareness strategy, you need to know who your audience is and what power they have to influence change. We often assume that public awareness is simply about information dissemination, when it should also be about creating the basis for change. As one works increasingly in the public sector and on public awareness issues, especially if you are also an amateur journalist, you need to learn to de-mystify words, as many of these have their

[1] The irony is that in some of the places I have visited like Kokstad in the E. Cape, white commercial farmers are increasingly dabbling in indigenous livestock and crop preservation. In fact there is a whole network of farmers involved in the rearing of indigenous livestock. There work is being facilitated by the Network for Early Domesticated Animals.

origins in technical fields. The word agrobiodiversity is meaningless to many people, both literate and illiterate. Perhaps words like traditional crops, traditional varieties, or cultural crops, may assist in conveying interest and understanding of the issues we as technical people are also trying to grapple with.

Certainly, experts are key people in the decision-making process, but the media and consumer groups, as we have seen in the debates around the high prices for pharmaceuticals and genetically engineered foods, have the greatest impact on the decisions of politicians and corporations. Consumer movements are using the very tactics employed by large corporations, such as branding and campaign advertising, to mount counter information campaigns and create a new consumer ethic. They invest a great deal, not in talking to politicians, but targeting shareholders of big corporations to ensure unethical practice is changed. Many of these consumer groups have to be creative with their campaigns as they lack the resources that large corporations have. One of the interesting phenomena, and a powerful tool at the disposal of consumer groups is the internet. What they lack in resources, they maximize on 'nested networks' and being able to connect ideas and issues across the globe at very low cost. This was clearly demonstrated in the way public opinion, events, and media was mobilized around the issue of genetically modified organisms, and some of the recent anti-globalization demonstrations.

Experience also shows that in developing consumer interest, or trying to influence decision-makers, the timing of public awareness campaigns is very important. The most effective campaigns are those where there is a heightened sensitivity and debate about controversial issues. It may not be the same issue, but as long as the issue provides a useful synergy. When the fracas over GE took place in Europe, we also saw the simultaneous rise in campaigns and marketing of organic foods as an alternative. There could not be a better opportunity for organic growers to launch a campaign for their produce, than at the height of the GE debate. Decision-makers and consumers were on high alert and looking for alternatives. For the good of all of us, organic farming received a tremendous boost, and the industry is growing rapidly.

Campaigns also need to be designed to take into account cultural sensitivities. This is well-illustrated with the birth control campaigns that have failed in places like Bangladesh and in some African countries where they were either directed at the wrong audience, or simply used wrong symbols and language that was culturally insensitive, thus distancing people and preventing them from identifying with the campaign.

3.2 Influencing decision-makers and the research fraternity

The greatest challenge, I believe, is to persuade the groups in our society that exercise the greatest influence over the public and more specialized constituencies through their opinions and programmes. For instance, the CGIAR and its network, which although only contributes 5% to the global agricultural research effort in financial terms, has far reaching influence on farmers, and national agricultural research institutions and policy agencies than the size of the combined national research budgets of different developing countries. Their influence is exercised politically in the way in which development assistance, and interventions in donor-dependent countries and through the framing and conceptualization of agricultural models and systems we pursue. The other strategy is to promote poor-farmer interest through the more inclusive forums such as the Global Forum on Agricultural Research (GFAR). GFAR

was initiated in 1996 by the CGIAR. Representatives from various stakeholders such as International Agricultural Research Centers, Advanced Research Institutes, National Agricultural Research Systems (NARS), donors, the private sector, NGOs and farmers groups are represented on the forum. However, one of the major criticisms of GFAR, coming from groups like RAFI, is that GFAR still lacks real representation from small-farmers and a distinct small-farmer orientation.[2]

Public awareness by changing the research bias of national and international agricultural research institutions can also be an important contribution to the use and conservation of agrobiodiversity. This change can be achieved by promoting research which focuses less on yields, and incorporates more attention on other trade-offs and risk aversion measures that poor farmers are seeking as part of their livelihoods strategies. Through more holistic approaches to research, greater recognition can be given to the fact that agrobiodiversity can significantly contribute to the welfare of households.

Even when there may be a focus on traditional crops and landraces, there could still be a bias towards particular crops and grains, not examining the potential of others. For instance in Africa there exists a bias towards maize. The focus on maize also extends to a bias in the production of inputs, and specialized knowledge services and technologies that only cater for these varieties. This bias is even extended to extension workers themselves: they may have knowledge only of certain crops,[3] and have little or no knowledge of how to deal with pests, and other problems of traditional crops. They can therefore hardly be of assistance to farmers who are seeking ways to manage traditional crop varieties. This points to the fact that in the training of agriculturists, institutions such as universities, technikons, colleges and other institutions need to be made aware of the importance of agrobiodiversity and traditional varieties to resource-poor households and farmers.

Certainly, nobody should miss the opportunity to create awareness amongst government extension officers, to generate interest amongst them and to promote greater awareness about agrobiodiversity issues. This interest amongst a very important group of public service providers and their link with the agricultural research community has not been sufficiently explored. Again, I believe the way to introduce such a topic, is through the notion of poverty reduction and sustainable livelihoods. In our own country there are a number of funds such as the poverty relief fund, funds for the promotion of indigenous technologies and knowledge through the National Research Foundation (NRF) that can be used to leverage interest amongst the research and extension community.

Earlier, I hinted at the importance of timing and linking into other debates. This is one of the reasons why there is a growing interest in traditional crops and livestock in South Africa, although it is not called agrobiodiversity. A key Ministry like that of Science and Technology, (which a few years back conducted a nation-wide review of science and technology in the country), and others, is interested in the revival of the use and awareness of traditional technologies to drive the excitement about African renewal and renaissance. The new political interest for African renewal and renaissance seems to provide a good opportunity to raise the

[2] Food for all – Farmers First in Research: International Workshop of Non-Government and Small Farmer organizations on Research for Poverty Alleviation, German NGO Forum on Environment and Development, Dresden Germany, 19–20 May 2000

profile and interest in agrobiodiversity issues, coupling it with African traditions and values in the mainstream. And, indeed, the State officials have therefore, been able to direct some state resources, (while perhaps not sufficient enough), towards research in this field. With the provision of research grant schemes, the public sector has created an enabling environment through which agrobiodiversity issues can infiltrate into the research establishment much more than it has previously.

3.3 Creating consciousness in schools

Respect for tradition and the importance of marginalized innovations are issues in which the youth have to show an interest. For when the old are no longer, the youth have to take care of the future. But, when they are not aware of their own inheritance, how can they take care of it? In many developing countries, fora for youth consciousness in schools, and youth clubs are an important avenue to raise consciousness about biodiversity in general, and about traditional crops and varieties in particular. The potential in targeting the interest of youth, by linking folklore, and experiencing life in rural areas goes without saying. Recently, the 15th International Youth Conference for Caretakers of the Environment was held in South Africa. This brought youth from all over the world, and one of the sessions dealt with biodiversity. It is only unfortunate that the focus was primarily on protected areas a much broader perspective on biodiversity use and conservation was not introduced into the agenda. It could have gone a long way in stimulating discussions in other areas of biodiversity.

In Southern Africa opportunity also prevails to introduce biodiversity in the curricula of secondary schools. Some schools already have agriculture as a subject, and the importance of agrobiodiversity can logically be introduced, and as such will contribute to widening the scope and network by which awareness about these issues can be generated.

Schools are fertile grounds to pursue these ideas, and one can create incentives such as school competitions and expeditions. In fact in one of our research proposals we suggested that we use school children from both the urban and rural sectors to conduct research and carry out interviews with poor farmers and older women and men in rural areas who still hold knowledge on the use and conservation of agrobiodiversity. This has the dual effect of creating understanding, inspiring interest, and perhaps influencing the career paths of potential future agriculturalists or farmers.

3.4 Tourism and cultural events as an avenue

Linking cultural tourism with agriculture offers challenging opportunities for impacting on the awareness of the value of agrobiodiversity. Two years ago my organization, in partnership with a consultancy firm called Mafisa, started working on a rural development project in the Madikwe game reserve area, which aimed at promoting cultural tourism. Given the focus of the project was on small-enterprise development, out of the initial evaluation, two main ideas were selected and pursued:

- The creation of cultural-tourism activity in the Molatedi area (one of the villages we were working with that would draw tourists from game lodges in the Madikwe reserve and would allow them to spend one or two nights in the Molatedi Village to experience local culture and cuisine. This has happened and is taking off.

[3] In fact often only hybrid varieties, given that many are trained in institutions in develop countries where agricultural models are based on the use of modern varieties.

- The development of agricultural activities, as the area had good soils and access to secure water.

Out of this interest arose the idea of linking the cultural tourism and agricultural activities. The older women expressed an interest in growing traditional crops, especially calabash, which used to be grown by the Tswana people many years ago, before the arrival of plastics. While calabash is difficult to grow, it nonetheless served multiple purposes, such as the use of the calabash husks as containers. Calabash is inter-cropped with other crops and adds diversity to the daily diet. The interest in agriculture was spurred on by the mutual link it had in developing traditional cuisine for foreign tourists who were prepared to pay premium prices for such dishes. This sparked a great deal of ethusiasm, and so it was arranged that the older women would teach younger people in the village how to cook traditional foods. This had the consequence of increased awareness of traditional crops, although it was primarily focused on the growing of calabash. IUCN South Africa performed a feasibility study and a whole development plan and activity was formulated. Unfortunately, when it came to securing funds from a suitable donor, in this case a private foundation, the chief of the village was less than cooperative and the whole project fell through. But, the important lesson here is that cultural tourism can be a useful vehicle not only for generating awareness amongst tourists about folklore and traditional practices, but it can also spawn renewed interest in agriculture, especially amongst unemployed youth. However, the key to its success was a linkage with large tourism activities, which are operated by the bigger tour operators.

Interesting approaches to creating greater awareness on the use and conservation of agrobiodiversity have been pioneered in countries such as Nepal, India and Bangladesh, which are now also used extensively in Latin American countries. These have the form of biodiversity fairs: farmers are to display the variety of crops and livestock, and the value of using and maintaining this diversity is encouraged through poetry readings, folklore or plays. The incentives are stronger when they are accompanied by the giving of awards and when leading community members become adjudicators. The events are normally organized as festivities and involve the whole community or village. (Rijal *et al*., 2000) However, what is lacking and where opportunities prevails, is in the linkage of these festivities with tourist activities. This not only expands markets for the farmers' agrobiodiversity products, but also enriches tourism experiences and contributes to the awareness of the domestic middle class and foreign tourist.

3.5 Targeting consumers

Networks and special interest groups and consumers that buy into fair trade products and organic farming are a constituency that one should target. These special interest groups generally tend to have political perspectives that seek to promote socially responsible activities and, as I mentioned earlier, their power is growing. Recent work we did shows that even local farmers have recognized the potential to target the organic-foods purchasers by beginning to grow and sell some types of traditional sweet potatoes, maize, beans and nuts. As these consumers are looking for 'variety', and animals and plants that have not been grown with artificial supplements there are valuable opportunities to promote traditional crops and livestock amongst this interest group. However, it would seem that a better understanding of this constituency, their eating habits, dietary preferences, and where they purchase their food are important elements in developing a targeted strategy. Where there is demand, there is also an interest of suppliers to listen. Many suppliers, such as retail supermarkets, cannot get enough of a supply to support growing demands from these consumers. These

consumers, we must remind ourselves, are in developed countries. Therefore, there needs to be an investment in building networks between consumers and local communities and farmers. Again, here the internet can be one mechanism, although not all people have access to this. However, agencies such as NGOs, government, or donors have access to this, and they can create centres where Internet access can be made available, for example at schools, churches, or community halls, or even rural shops.

4. CONCLUSION AND RECOMMENDATIONS

It is clear that public awareness is a cross-cutting issue, requiring a multi-faceted approach. For policy-makers, awareness should be targeted on the basis of the importance of agrobiodiversity to household food security, and diversifying of livelihoods, where products from agrobiodiversity have the potential to generate cash income from specific niche markets. Also in the areas of marketing and education the 'awareness' of the value of agrobiodiversity for food and culture plays a central role.

The climate of expanding international tourism, a great deal of which is aimed at experiencing alternative lifestyles and tastes, provides ample opportunities for creative campaigns, linkages, and the creation of new markets for traditional crops and livestock. The point is that where there are opportunities, linkages are often not being made because people who operate from different perspectives and disciplines do not communicate with each other, or simply do not undertake joint planning.

Some recommendations I would like to put forward are:

- When engaging in a public awareness campaign, is important to recognize constraints, and to find ways to develop linkages with others so that there is resource maximization. One area that is often lacking in many rural development initiatives is joint planning and development of strategies of different development assistance groups or agencies. Such joint planning helps to identify synergies and creative ways of bringing seemingly separate ideas together into one objective. This is especially relevant when addressing agrobiodiversity use and conservation, which so much depends on values and awareness.
- Targeting awareness of consumers requires that one has an understanding of their behaviour. Internationally, major food retailers and networks such as fair-trade initiatives, which are in touch with, and have insights about, consumers can assist in developing strategies for generating interest in agrobiodiversity-based products. Ecotourism is a tool for generating income from agrobiodiversity and creating awareness of (often distant) consumers.
- More creative thinking needs to go into how to link the cultural dimensions of agrobiodiversity so that it is firmly located within specific niche markets in the tourism sector. This is already being done for the promotion of wines, cheese, cherry picking in certain countries of Europe, where they are not only means to sell agricultural products, but also to promote local culture, cuisine and history. While marketing serves the end of commerce, it is also a valuable tool to link conservation awareness with other benefits that consumers derive from consuming the product(s).
- There are many international fora, like the Global Biodiversity Forum, meetings around the conservation of genetic resources and others which need to be listed, and ways

found to publicize local efforts in the protection agrobiodiversity. It does not mean necessarily that one has to be present their physically, as this is a cost, but if you establish good networks, one can work via these networks, which can act on your behalf.

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PUBLIC AWARENESS CREATION: AIDS EXPERIENCE IN KENYA

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1. INTRODUCTION

Why HIV/AIDS paper in a workshop on use and conservation of agrobiodiversity? Changing behaviour is fundamental in the strategy to reduce the spread of HIV/AIDs. Public awareness raising is an important tool in bringing about behavioural change. This paper presents methodologies and strategies used in raising public awareness for an HIV/AIDS project in Mwingi district and attempts to identify some of the key elements in successful strategies. Comparing HIV/AIDs and agrobiodiversity may produce some considerations that are relevant for raising public awareness on agrobiodiversity. In both cases, behavioural change is a crucial element in a successful fight.

2. HIV/AIDS AND BEHAVIOURAL CHANGE

The HIV/AIDS pandemic has posed one of the greatest challenges of public awareness creation in modern times. In communities such as in Africa, where taboos, cultural diversity and other traditional believes are very common, raising public awareness in the area of HIV/AIDS has been a major challenge.

Africans traditionally are very conservative in discussing issues of sexual nature across sex and age divides. Sex discussions across sex and age groups are considered taboo. Further, deaths across African societies have always been associated with evil spirits or punishments. Thus in many communities, cases of AIDS deaths have been associated with curse or witchcraft.

Among the Lou community in western Kenya, traditional believes of a curse *'chiira'* on those who have died of AIDS-related illnesses is very common (Rugalema *et al.*, 1999). This has made it difficult for the community to discard its long-standing tradition of wife inheritance: women whose husbands have died of HIV/AIDS-related illnesses are still inherited across the region. Among the Kamba community in which this case study project is located, belief in witchcraft is very common. There are also beliefs in *'jinis'*:[1] deaths do not just occur but are caused for one reason or the other by some evil spirits. Also, serious sicknesses that defy modern medicines, such as AIDS, are referred to traditional medicine men/women or sorcerers for curation. In other communities such as the Maasai, because of their 'closed' culture, the youth believe their girls are safe from HIV/AIDS and only other tribes carry the virus. Behaviour-change has therefore been difficult to achieve in this community which, in

addition, believes in sharing spouses. Even among the educated, denial of the existence of the pandemic has been overwhelming.

3. AGROBIODIVERSITY AND BEHAVIOURAL CHANGE

In the case of agrobiodiversity, incentives for use and conservation can be related to changes in people's eating habits in Africa. To a large extent most of the changes have been through the influence of western eating habits. Socioeconomic changes such as a modern way of life in which 'lunch at work', 'easy to cook foods' (less time and energy consuming) have also affected agrobiodiversity consumption. Rural urban migration is another factor because it contributes to changes in eating habits.

Getting people to go back to their traditional foods entails understanding the core issues contributing to the changes in eating habits. Since the most likely groups to have changed their eating habits are the educated and urbanized youth, giving information that shows nutritional values of the foods and also trying to diversify the nature of processed products from the crops may endear them to the crop again. An example from the Kenya experience may suffice here. Not too long ago sorghums and millets were important food crops to many Kenyan households, but their importance somehow declined in the past two decades. The government and donor agencies tried to promote the crop as drought resistant for the arid and semi-arid zones without much success and people would always go back to planting maize. The approach somehow changed and sorghum and millet are now promoted as weaning foods and also for those with diabetes complications. This has generated increased demand for the two crops and today leading supermarkets and retail outlets stock sorghum and millets flours. Commercial millers have also adopted them. This has generated renewed interest in the two crops and their prices are presently more attractive than that of maize.

4. STRATEGIC QUESTIONS IN CREATING PUBLIC AWARENESS ON HIV/AIDS

Traditional methods for addressing HIV/AIDS in the country are the use of a number of communication media. These include posters, billboards, calendars, radio and TV programmes, drama, music, public barazas[2] and peer-education programmes. Workshops, seminars, and training and counselling services have also been used as methods for creating public awareness.

How have these methods faired as means of raising public awareness? It is said that the level of HIV/AIDS-awareness in Kenya is quite high, especially in urban areas. Yet, behavioural change has not occurred among the majority of the population, leading to high HIV prevalence. This means that these methods of raising public awareness have not been effective.

What then is the problem? First, access to some of the media channels is expensive, such as TV, radio, seminars and workshops, and therefore cannot reach everybody. Posters,

[1] Some forces which can be acquired and that can transform one from rags to riches. These forces are said to feed on human blood which the owner must provide whenever required. Failure to adhere to the rules could result into great tragedy for the owner or very close members of the family leading to death.

[2] Meetings called and addressed by members of the government provincial administration. Most of the administrators lack any skills in reproductive health.

billboards etc. have limitations in areas in which illiteracy levels are high. Their distribution is also limited because of the poor infrastructure and the fact that their costs are also high.

The quality of the information given is also questionable. Mis-information has been counter-productive and has watered down the impact of public awareness creation on HIV/AIDS. In addition, statements like ‘HIV is in the condom’, traditional beliefs and taboos also make it difficult to achieve behaviour-change.

Behaviour-change has also been hampered by poverty levels among the vulnerable. Disadvantaged members of the population, e.g. orphaned girls, and those from poor family backgrounds with little or no education are forced to get into risk employment opportunities such as prostitution, barmaids or house-helps. Statements like 'I would rather die in the future of AIDS than die next week of hunger', are common among the unemployed youth.

Other factors that have hampered behaviour-change are: alcoholism, peer pressure, child abuse, rape, spouse separation, lack of recreational activities, denial, cultural beliefs, and living in highly vulnerable areas such as along trucking routes.

Public awareness creation for change must therefore be accompanied by means to address the underlying factors of why change may not occur even when awareness is abundantly available. This does not mean public awareness is entirely ineffective but rather reinforces the fact that target groups require exit-opportunities for behaviour-change.

5. STRATEGIES USED IN PUBLIC AWARENESS FOR HIV/AIDS PROJECT IN MWINGI.

At the request of a local NGO, FIBEC undertook a baseline survey to find out about the level of knowledge of HIV/AIDS and its transmission. Key-informant interviews and group discussions were used to get public and leaders perceptions of why the increase in deaths and orphans was occurring. Focusing on a small community (a division) within Mwingi district with a population of about 100,000 inhabitants, and using the existing grass-root structures (mwethya groups) and local leaders, the project was able to endear itself to the community and find out the key causes of increased deaths and orphans in the area.

5.1 Situation analysis

The community was reeling from an increasing number of HIV/AIDS orphans. The orphans were dropping out of school at an alarming rate and most would end up taking jobs that would expose them even more to HIV/ AIDS. Like in many parts of the country there was denial of the causes of the increasing number deaths in the area. This was complicated by the fact that doctors are not allowed to disclose the HIV status of people who have died of AIDS related illnesses. Thus death certificates only show causes of death as pneumonia, TB, etc., but will not disclose whether the victim was HIV positive or not. The local community-leaders were however convinced that HIV/AIDS was a major cause of the increasing number of deaths in the area. It emerged that although there was private denial, the general public was of the opinion that AIDS was already with them and hence the high rates of deaths. First, however, we had to comprehend the fact that this community is highly superstitious. They have strong beliefs in witchcraft and this, of course, complicated matters.

5.2 Trying to understand miscommunication

The project took a different step of finding out the level of knowledge of HIV/AIDS and its transmission. It emerged that most people had already heard of HIV/AIDS and how it is transmitted. But had there been behaviour-change? The answer was no. Why? People thought that it was only affecting people living outside the local community e.g. local people who were working in urban areas or those engaged in immoral activities such as prostitution. This meant that the HIV virus was only affecting other people but not those living among them. By extension, they also did not see themselves as vulnerable. Sure enough, the majority of those who were dying were people working in main towns (Nairobi, Mombasa etc.) and would come to live in the rural areas when they were already in an advanced stage of HIV/AIDS.

Most people had heard about HIV/AIDS through radio, public meetings, friends and some through the print media and posters in local dispensaries. Through the survey it was found out that the transmitted information had not been adequate and was also being communicated without openness. There was a feeling that methods used implied that the disease was elsewhere and not among the local community. Most of the information was also targeted at the women, mainly those attending antenatal clinics, and failed to appreciate that women did not have adequate bargaining power when it comes to negotiating sex especially with their husbands or male friends. The youth did not also get adequate information because traditionally they are not expected to have sex before marriage. Religious workers did not want to be seen as being at high-risk as they were “not engaging in sex”. Some of the people advocating abstinence were also known by the locals to be of ‘questionable behaviour’.

5.3 Identifying alternatives

The other challenging factor limiting behaviour-change was poverty in the area. Local leaders and the community were convinced that there could not be sexual behaviour-change without addressing the underlying factors of poverty among the youth and women. Leaders were of the opinion that as long as people were impoverished and without means of income, women and young girls would be tempted to give sexual favours for money and this will expose them to the pandemic.

The secrecy within which sex is culturally held in the community prevents open discussions of risk sexual behaviours between the young and old and men and women. This advances the stigma of the disease among the people. Thus a common ground in which the youth, women and men can discuss HIV was necessary in order to reach everybody and demystify the disease.

Since poverty came out as the most important factor hindering behaviour change, it was decided that a suitable income generating opportunity that uses local resources needed be identified, developed and promoted. This activity should also form a forum through which reproductive matters including HIV/AIDS will be discussed.

Bee-keeping was a possible solution, but technologies that were also suitable for women needed to be found. Bee-keeping could serve a twin purpose: it could address poverty and unemployment across the gender divide and also create a neutral forum through which youth, women and men could discuss both development and HIV/AIDS. Bee-keeping is a traditional industry among the community, but it is exclusively a male domain for a number of reasons: traditional taboos, the methods used in siting the hives and in harvesting the honey.

5.4 Implementing an alternative

To ensure that women participated in the bee-keeping, new and gender-friendly bee-keeping technologies were introduced coupled with training activities to change cultural believes in bee-keeping. Using respected community and group leaders and traditional bee-keepers, the project managed to get a core group of converted believers in bee keeping that could be used to reach out to the wider community.

BOX 1. STRATEGIES IN HIV/AIDS CAMPAIGNING IN MWINGI

Step 1: Baseline survey

- To find out the level of knowledge of HIV/AIDS and its transmission among the community. Basic points in this step were:
- To find out if people in the area believed HIV/AIDS to be a threat and how it had affected them.
- To establish whether there had been any behavioural change as a result of existing knowledge.
- If change had not occurred to find out why and how can change can be achieved effectively.
- Using the existing structures and resources design a programme that would address the key issues predisposing the community to HIV/AIDS infections, etc.

Step 2: The alternative: bee-keeping

Bee-keeping was identified as a key entry point in addressing poverty and unemployment in the community, as it is already a traditional activity among them. Basic points in this step were:

- Women and youth integrated into bee-keeping through introduction of appropriate technologies and training.
- Linkages made with commercial outlets to assure market for processed honey.
- Bee-keeping field days used as fora for HIV/AIDS message delivery.
- HIV/AIDS message-delivery has been incorporated in all the other activities of the NGO.

It was ideally an incentive aimed at ensuring those at risk because of poverty, an alternative source of income. The community was able to engage in income generating activities using local resources and improve their general welfare. This in itself was an exit-opening for those likely to enter the trap of getting into risk employment opportunities. Bee-keeping field days were used as fora in which women, men and youth could jointly benefit from information on HIV/AIDS. The joint meetings are important strategies for getting the women, men and youth to start discussing HIV/AIDS together. This created openness in discussions and reduces the stigma associated with HIV/AIDS. It served the twin purpose of ‘destigmatizing’ the pandemic and also creating a livelihood for the people.

6. PUBLIC AWARENESS RAISING IN HIV VS AGROBIODIVERSITY

Common issues include the objective of bringing about behavioural change of the target group. This entails understanding the target groups' social-cultural and power structures. Once these structures are understood, communicating to the target group becomes essentially easy and it becomes easier to link the problem with the communities aspirations, believes and attitudes. This will make it possible to design interventions in a way that they will be acceptable and convincing.

Questions to ponder in defining a strategy:

- What does the target group know about the task at hand (HIV/AIDS – Agrobiodiversity)?
- Is this knowledge sufficient/distorted etc.?
- Has the community changed as a result?
- What has hindered the community's change?
- What methods have been used to communicate the existing information?
- Are they defective?
- What approaches work in this community?

While the target group in the case of agrobiodiversity includes consumers, farmers, agriculturists, and politicians, for the farmers' level it is important to consider that it is necessary *to give the community alternative choices so as to achieve change*. The community may have problems, which hinder them from achieving change or changing behaviour. It is important to understand these factors and design approaches that would enable the community to embrace change. For example, in the HIV project one of the problems was poverty. This was driving the youth and single mothers to high-risk jobs such as commercial sex. The project had to identify local resources that could boost income for the local people and hence reduce the risk of people joining risk jobs.

It is also important to realize that problems can be external. Identify whether the failure to adopt or change is caused by external factors e.g. national policies, change in peoples culture/attitudes as a result of external influence.

7. CONCLUSIONS

In the case of agrobiodiversity, one of our messages is getting people to return to traditional foods. In aiming to bring about this change we need to be able to give them an answer to the question 'why?'. We need to come up with convincing messages as to why the threatened agrobiodiversity is important to the community. Why is it in their interest to conserve it? The importance attached here could be cultural preservation. Here we need to demonstrate that every community has a cultural tradition including the crops and the foods that they traditionally grew and cooked. We need to show the importance of conserving this cultural attribute.

We also need to appreciate the fact that due to socioeconomic changes in society, most rural households would prefer to cultivate crops or keep animals for which there is market for surplus. Issues of marketing the threatened agrobiodiversity therefore need to be considered as part of incentive measures. Technological innovations which diversify the forms in which the crops are utilized would also improve their attractiveness to the community. The example given for sorghums and millets above could be a starting point.

In most cases these crops or animals happen to be the most suited to the relevant agro-zones and therefore could play important roles in fighting food insecurity. Here the message could be to try to get people to grow these crops because they are well suited to the local conditions.

Raising awareness in the case of agrobiodiversity must take a system approach in which all actors from production to utilization including policy-makers, advocators and technology developers are involved. As stated in the case of sorghums and millets; technology policy and

marketing aspects were all considered. This was in turn complemented with marketing and an information campaign.

7.1 Difficulty areas for public awareness in agrobiodiversity

If people have already changed their eating habits and, therefore, tastes, getting them to go back to their traditional foods may take considerable campaigning. Here one will have to deal with twin problems of: first, getting people to return to their traditional crop, and secondly, if it is already endangered, making the produce or planting material available.

In cases where a crop is already endangered, the genetic diversity of the material may also be scarce. Getting it to the people may then be difficult especially because of the poor infrastructure in many third-world countries.

If the crop/animal cannot be easily marketed it also becomes difficult to sell/conserve it as the majority of farmers would prefer crops for which a market for the surplus exists. In that case, the agrobiodiversity to be conserved for the benefit of mankind (and thus a public good) would be loaded on the shoulders of the rural poor. This is when there is a clear distinction between HIV/AIDS and agrobiodiversity. With HIV/AIDS there a strong personal involvement and incentive. Few incentives are available for conserving agrobiodiversity for the benefit of others.

7.2 Raising public awareness for agrobiodiversity may be easy!

This may particularly be true in more highly conservative communities than in others, because of the pride in which these communities hold their culture. If the threatened agrobiodiversity products can be transformed into products that conform to changes in society tastes, and therefore be marketable. Technological research in such changes may yield interesting alternatives.

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CREATIVITY, CONSERVATION AND COMPENSATION: THE HONEY BEE NETWORK APPROACH TO PROVIDING INCENTIVES FOR SUSTAINABLY UTILIZING BIODIVERSITY

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1. INTRODUCTION

1.1 Scope of the paper

After notes on the threats for agrobiodiversity, this paper presents several cases of farmers' innovativeness in augmenting the value of agrobiodiversity. It also elaborates the many biases and barriers that form disincentives for farmer-inventors and shares the experiences of the Honey Bee Network to provide incentives through recognition and economic stimulus.

1.2 Major threats to agrobiodiversity

Before we describe the incentives that are needed to encourage farmer-breeders to conserve as well as develop new varieties themselves through their own selection and crossing, with or without outside help, it is useful to appreciate the major threats to agrobiodiversity:

- Much of the decline in agrobiodiversity took place during past three decades or more through the diffusion of high-yielding varieties (HYV) as well as hybrids developed by public sector research institutions. The private sector had negligible role in this in the Asian region. The reasons are obvious.
- The consumer preference for local varieties and so-called inferior millets, sorghum, etc., has waned due to a kind of 'sanskritization' effect. That is the lower income classes, who consume these grains, tend to emulate the behaviour of higher income classes (who consume rice/wheat) in order to aspire to better social status.
- The cheap subsidized grains such as rice and wheat distributed through public distribution system, as well as through the food-for-work programme, further depressed the demand for local grains and varieties.
- The lack of price and procurement support for the local varieties reduces incentives for growing them for market.
- The allocation of better land and plots for high-yielding varieties, which responded to external inputs, eventually meant that only marginal land and plots were left for local varieties. Environmental risks affect the productivity of these crops, though farmers still grow these crops in the niches where 'better' alternatives do not exist.

There are many other factors including socioeconomic and cultural changes which influence the decision of farmers to grow local varieties. Given these pressures, it is useful to understand how farmers' innovations provide hope for not only conserving but also

augmenting the agrobiodiversity by improving productivity and/or reducing costs through complementary innovations.

2. SUPPORTING FARMERS INNOVATIONS TO AUGMENT AND CONSERVE AGROBIODIVERSITY

Farmers have always been known to make selections in the available diversity that is created through natural mutations, mixtures or outcrossing. Sometimes they are supported by natural stresses which generate selection pressure. This provides opportunity for some less common characters to be manifested. For instance, if a few rice plants survive in a flooded field, then farmers may select these plants and accordingly develop a flood-tolerant variety. In Bangladesh, Dr Nurul Alam observed a practice of farmers in which such plants were uprooted and then cut, like sugarcane sets, with each piece having one or two nodes. These were transplanted for vegetative propagation of rice plants. In this case, a stress created a selection pressure which, when complemented with a management innovation, generated scope for a new variety development.

The Honey Bee network has documented a large number of such examples over the past 12 years. In each case, farmers' ability to observe and select a unique variety has brought out the potential of farmers' innovation for augmentation (see Box 1) There are several other examples of this kind of breeding by farmers in the Honey Bee database. The question that arises is why the modern agricultural research system nationally or internationally does not focus its efforts on augmenting the efforts of such farmers? Why is it that millions of dollars continue to be spent in the Consultative Group on International Agricultural Research (CGIAR) whereas not even half a million dollars is spent for augmenting the pursuits of farmer plant breeders. There have been countless discussions in FAO on the farmers' rights. All the consultations must have cost millions of dollars. Why couldn't even five such farmer-breeders been invited once to FAO to advise how farmers' rights should be exercised? Mr Sundaram had represented SRISTI as a keynote speaker in an international consultation on traditional knowledge and intellectual property protection organized by WIPO two years ago in Geneva. There are a large number of programmes on the so-called participation around the world, but somehow, whenever I have asked the international community to share examples of varieties developed by farmers, I have never found many responses. That does not indicate that there are not enough farmer breeders in the world, it only indicates that these innovative farmer-breeders are not the main focus of researchers engaged in so-called participatory breeding. Similarly, there is little attention for farmers' conservation of agrobiodiversity (Box 2)

Obviously, the *in situ* conservation of local landraces cannot take place by just letting farmers know that biotechnology industry as well as the seed industry might need these landraces for future breeding. Thus, it would be in the interest of local farmers to conserve these races. Studies show that the maximum gain from new high-yielding varieties was in places which are not rich in local landraces. Regions which are rain-fed and suffer greater fluctuations in production also have lower productivity, and thus lower income levels. However, apart from heterogeneous ecological conditions they also have higher agrobiodiversity. But, we have no policy framework to address anxieties, and aspirations of local communities concerning agrobiodiversity.

How do we change this situation? The story of Honey Bee Network provides some lessons. The Honey Bee network philosophy also offers some lessons for the accountability of formal research system towards the people whose knowledge we often use for improving our own work, without any acknowledgement, reciprocity or sharing of benefits. I am not suggesting that Honey Bee network is necessarily the best way or the only way through which we can scout, spawn, support and sustain grassroots innovators who are solving local problems through their own genius without outside support. I am certainly intrigued by the fact that there are not many such networks around which build upon a resource in which poor people are rich i.e. their knowledge, creative spirit and values.

BOX 1.: FARMERS' SELECTIONS: AN EYE FOR DETAIL, DIVERSITY AND DEVIANCE – ILLUSTRATIONS OF INNOVATIONS

A groundnut variety with drought resistance and a stronger peg. Thakershibhai Savalia, a 70-year-old farmer from Pankhan village in Saurashtra, the dry part of Gujarat, had a very keen eye for variation in the field. During 1987, there was a severe drought, said to be the worst in the last 100 years. Most of the crops of groundnut had withered. However, there were two plants which he found that were not only green but also seemed healthy and different from the rest. He marked those two plants and started observing their growth every day. He multiplied the seed of these plants and within five years through recurrent selection, he developed a variety which he initially named as Morla (peacock) – the pod of this variety had a peacock's beak kind of curvature on one hand. Apart from having very good oil content, it had two unique characteristics: (a) the lack of ridges on the pod and (b) the strong peg. Further, the variety also had better than average disease and pest resistance. Through word of mouth, the variety has spread to more than 40 villages in the last few years. It was also more tolerant to drought than other varieties and the taste was extremely good. While the variety was rejected in the All India Coordinated Research trials conducted by ICAR (Indian Council of Agricultural Research), the farmers in the region continue to grow it. Thakershibhai is very keen to get varietal protection for his selection. The stronger peg and lesser ridges render it easier to dig out the groundnuts after maturity more easily. Harvesting groundnut usually involves heavy cost because some of the pods are left in the soil, requiring second or third digging. In addition, in Morla, not much soil attaches to the pod due to the near absence of ridges.

A pigeon pea variety with pink flowers. Dhudabhai Punjabhai Patel of Gadha village, Sabarkantha district, Gujarat, found in his field of pigeon peas a few odd plants which were neither affected by pest or disease nor seemed to have the flowers or pod- bearing pattern of the other plants. These plants had pink flowers. Most varieties of pigeon pea have yellow flowers which attract insect pests. In addition, the new type had a higher number of pods, five to six seeds per pod and most of the pod bearing was on the upper part of the plant making it easier for women to harvest. The green pods were very good to cook and the yield was satisfactory (25–30 quintals per hectare) even when a low level of fertilizer was provided. It was also resistant to wilt and matured early. The cooking time for the dried pulse was reduced. The grain was bolder and it was found highly suitable for certain specific recipes. The farmer named the variety 'Gadha Dudhabhai Punjabhai-1' (GDP-1).

In 1994 a selection led to development of this farmer bred variety which has been registered with National Bureau of Plant Genetic Resources. Mansukhbhai Ramjibhai Murani also made a selection of pigeon pea mutant from BDN-2 variety. This had bigger leaves, four to five seeds per pod, equal pod bearing on each branch, requires less water, seems resistant to sucking pests, the flowers are red from the outside and yellow from inside and yields well.

New sesamum varieties. Laljibhai Ramjibhai, made a selection of sesamum variety which had higher yield and larger number of grains per pod. In 1994, he sprayed an insecticide which was time barred and apparently caused mutation in the field. He observed erratic pod bearing behaviour in the crop. He selected some plants which had up to eight rows of grains as against two to four in the normal varieties. There were pods with two halves/rows, as well as four and eight halves/rows of grains. This variety was found to be resistant to pests and diseases besides yielding 50% higher than Gujarat Ses-1, the official release

varieties. A shortcoming of the new variety developed by Laljibhai is that its pods have two rows as well as up to eight rows in the same plant. He has named it as Adarsh-8 (Agricultural Development and Research Superhouse Seed Farm-8).

Sundaram is one of the most enterprising young breeder-experimenters that the Honey Bee Network has found recently. He has developed a very innovative agroforestry system in arid parts of Rajasthan that have a rainfall of less than 20 inches per year. In addition, he has developed a large number of varieties of vegetables as well as pulses and spices through selection in farmers' fields. One of his first outstanding selections was a variety of chilli that had three times more colour value than the best variety in the country, 50% higher yield than the popular improved variety and about twice the market value of other varieties.

Among his notable selections, there are two varieties of garlic which have earlier maturity than others, and one which has better yield than all the improved varieties released by the formal research system. In onion, he had six varieties which recorded higher productivity than the improved released varieties. In cluster bean, he had four varieties which were free from powdery and two from leaf curl disease. In sesamum, he had a selection which was resistant to drought and free from red rot disease. In greengram, fenugreek, chickpea and cumin, he found many disease and pest-resistant varieties. In coriander, he found 13 varieties which were resistant to both blight and wilt. In several varieties, he observed synchronous maturity. In pearl millet, he found 22 varieties which were free from black smut and 19 which were free from downey mildew. For one farmer to have made so much improvement single-handedly is a unique contribution. Support from SRISTI and a small grant from the using diversity project supported by IDRC and administered by SRISTI have made a small contribution to his research. He also received a national award from the Indian Council of Agricultural Research. He has maintained complete details of each farmer from whose field he has made these selections so that part of the benefit should go to the original conserver of the germplasm, in case these become commercially successful. At this point he has no external support to continue his research, although SRISTI and the National Innovation Foundation are trying to provide some.

In West Bengal, a farmer Dholaram Mondal had grown two types of broad bean variety alongside in his field. Three years ago, he noticed a plant with odd pods. He grew these seeds separately and found that new variety had a higher number of pods, larger number of grains per pod and thicker skin. He thought that the new variety was developed by natural crossing between two of the local broad bean varieties.

Jita Bhai of Wetla village, Wadali taluka, Sabarkantha district in Gujarat presented his selection of a new bean variety at a recent meeting of Shodh Sankal held at Modasa in North Gujarat. He had procured fodder during the drought of 1987 and found mature beans mixed with the dry fodder. He grew these separately and found that some of the plants were very vigorous in growth and yield. He kept seeds of those plants separately and eventually a new variety was developed; it has become quite popular in the local region.

BOX 2: CONSERVATION OF LOCAL VARIETIES THROUGH CULTIVATION

In 1989–90 I coordinated a study in collaboration with Dr Maurya of ND University of Agri-Technology, Faizabad, on strengthening the on-farm research processes. As a part of this, plot-wise cultivation of farmers' varieties as well as improved varieties in three seasons in five villages was mapped. The same villages were revisited recently after 10 years to see the changes in proportion of area and plots with local varieties and for what reasons. While the study is still in process, initial results indicate some very interesting findings. There has been decline in almost all crops in area and number of plots under local varieties, ranging from 16% in some villages and crops to almost 100% (that is, those varieties have disappeared from these villages all together). Except for cauliflower, in which area under local varieties had increased, most local varieties had lost acreage. The decline for millets and other minor crops was, of course, much less than for rice. Among different land holding classes, the larger farmers had made the most changes at aggregate level though the pattern was different at village level (Gupta *et al.,* 2001).

2. HONEY BEE NETWORK[1]

The Honey Bee Network evolved 12 years ago in response to a personal crisis. While I had grown in my career, received awards[2], recognition and remuneration for writing about knowledge of innovators and other knowledge experts at grassroots, very little of this gain had actually been shared with the providers of knowledge in concrete terms. Much of my work was written in English language and although I had tried to share the findings of my research with others, it had not been institutionalized in local languages. Likewise, I had tried to acknowledge the knowledge providers, but they still remained, broadly speaking, anonymous. It was obvious that my conduct was not very different from the conduct of other exploiters in society. They exploited land, labour or capital markets. I exploited the poor in the knowledge market. At this stage a realization dawned that something had to be done to overcome this ethical dilemma. The Honey Bee as a metaphor came to my rescue one day. The honey bee does what we, intellectuals, don't do. It pollinates the flowers and takes away the nectar of flowers without impoverishing them. The challenge was, to define the terms of discourse with the people in a way that they will not complain when we document their knowledge, have the opportunity to learn from each other through local language translations, not be anonymous and get a share in any wealth that we may accumulate through value addition or otherwise. The Honey Bee Network has brought lots of volunteers together who share this philosophy partly or completely and who want to link up with an immense source of energy and inspiration available with the grassroots innovators.[3]

The relative weight which contemporary society places on this resource of grassroots innovations and informal knowledge vis-à-vis formal knowledge and technologies in devising developmental options almost always is skewed in favour of formal science, technology and other linked knowledge systems.

[1] This section draws upon a recent paper by Gupta (2001).

[2] The Honey Bee network has also received many awards and recognition. Apart from the Pew Conservation Scholar award to Prof Gupta in 1993, the Far Eastern Economic Review chose SRISTI and the Honey Bee network for the Asian Innovation Gold Award in 2000 (9 Oct 26, 2000).

[3] The Honey Bee Network was founded with the help of Professor Vijay Sherry Chand, Jyoti Capoor, and many other friends. Later Kirit Patel joined and made an immense contribution. Kapil Shah, Rakesh Basant, Amrut Bhai Agrawat, Chiman Parmar, Praveen, Mahesh Parmar, Hema Patel, Shailesh Shukla, T N Prakash, P Vivekanandan,, Sudhirender Sharma and many others have contributed to the growth of the Honey Bee Network.

3. BARRIERS FOR LOCAL INNOVATIONS AND INCENTIVES PROVIDED THROUGH THE HONEY BEE NETWORK

I will present some evidence of the biases, barriers and lessons of the Honey Bee Network.

3.1 Poverty because of generosity, and consequent knowledge erosion

Unethical exploitation of the local knowledge for centuries leading to capital accumulation in the formal sector without any reciprocity cannot continue for ever. Since many of the grassroots innovators conserve biodiversity despite remaining poor themselves, share their knowledge with outsiders generously and do not assert their rights, an anomaly has emerged. The youth in the same societies do not want to emulate in the footsteps of their elders. They do not want to be penalized because of superior ethics of their elders who shared their knowledge and remained poor. If something was given, it was accepted but a payment for services was not demanded. There are several consequences. One, the erosion of knowledge is taking place at a very rapid rate. For example, the building blocks of healing and herbal tradition are getting lost. Many plants are becoming weeds. Just as one cannot locate a book in a library if the catalogue is lost or misplaced, likewise, if the knowledge about the plants, their place in nature and uses are lost. As a consequence, one cannot accord them the value they may deserve. There are several other forces accentuating the knowledge erosion such as loosening links between the grandparent and the grandchild generation. But the crucial issue is the loss of respect for this rich source of traditional knowledge. It is taking place precisely because younger generation, exposed as it is to media and every day news of upward mobility of some ordinary people, does perhaps not want to remain poor because of their superior ethics.

3.2 Articulation of social versus ethical capital

The question then arises, how do we harness this ethical capital for social transformation? I differentiate ethical capital from social capital because trust and goodwill also exist among members of a mafia. The debate on the subject has included this divergence but the resolution has so far been eluded. My contention is that trust accompanied with reciprocities in a social network bound by pursuit of a common good in the larger social interest does constitute social capital. However, when this good is pursued through ethical means and for non-sectarian interests, one could argue that it constitutes ethical capital. There are many other sources of ethical capital such as the norms of ecological ethics, social and professional ethics, and eventually individual ethics, which permeates all kinds of organizations whether formal or informal and political, public or private, or civil society organizations.

The Honey Bee Network is an attempt to articulate the ethical capital of our society, guided as it is, by the spirit of innovation, sharing and networking for generating eco-compatible technological and institutional solutions for natural resource management problems.

3.3 Ecological ethics

There are several ways in which ecological ethics has been articulated in the Honey Bee Network constituting ethical capital. Our first encounter with this phenomenon took place seven years ago when we were making a small film on grassroots innovations and outstanding traditional knowledge with the help of the Indian Space Research Organization. The photographer and the director of the film, Jayantibhai had accompanied us to a village in north Gujarat to meet a herbal healer namely, Karimbhai. He was extremely poor economically but was very rich in his knowledge and ethical values. When Jayantibhai

plucked a particular plant on the roadside growing abundantly and asked Karim Bhai to hold it in his hand facing the camera, Karimbhai suddenly became upset. He asked why this plant was plucked when there was no immediate need for using it. He could have shown the plant without damaging it. We realized the importance of the notion that even a roadside plant (which was not endangered or scarce) should not have been plucked unless there was a need for it. This was a value unknown to us till that time. Likewise, we have had many examples of ethical capital manifested in our network. In drought-prone regions, a large number of villages have institutions to collect greens from every household to feed the birds. Despite the fact that birds attack the crops and cause loss, I have never come across farmers killing the birds by poisonous baits or shooting. On the contrary they would rather sit on a raised platform under the scorching sun and scare the birds to save their crops. A variety of bird-scaring devices has been developed by farmers, but the taboo on killing birds is widely prevalent, though there are other tribal communities which kill and eat the birds.

There are fishing communities which have common property institutions to ensure that nobody would use a gillnet of mesh size smaller than four inches, preventing small fish and fry from being caught. All these examples indicate that institutional innovations help in articulating ethical values and accumulating ethical capital in societies trying to live in harmony with nature. It is obvious that this capital base is narrow. But, so long as there is living wisdom, one is challenged to explore opportunities for expanding such capital base.

3.4 Barriers for innovators

The Honey Bee Network has documented more than 10 000 innovations either of contemporary origin or based on outstanding traditional knowledge primarily from India but also from all parts of the world. Many of these innovations are extremely simple and can improve the efficiency of farm workers, women, small farmers, artisans and others a great deal. However, the diffusions of these innovations across language and regional boundaries has been extremely slow despite the fact that the Honey Bee Newsletter has been coming out in six languages for a decade or more. There are many barriers to the evolution and diffusion of these innovations.

1. A lot of people have learnt to adapt and adjust to a constraint rather than transcend it. In case of women based technological problems, this constraint has been a consequence of cultural institutions, which prevented them from acquiring blacksmithy or carpentry tools. Women are very creative in coping with the constraints and sometimes transcending them. However, relatively speaking, except in health, childcare and animal-care, innovations by men have out-numbered the ones by women in our limited sample. We have to look deeper to understand the dynamics of such engendering of a particular kind of creative capacities.
2. There is contempt in society for someone who breaks out of the mould. Despite an up-surge of entrepreneurial spirit in different parts of the country in recent times, by and large, a social deviant who is trying to do something new is often the butt of ridicule. Only those innovators who can sometimes withstand the indifference, and occasionally the hostility, of their peers can succeed in developing lasting solutions.
3. The lack of social networking among innovators has prevented them from faster collaborative learning or from provision of moral support in times of crisis or failure.

4. Lack of access to formal scientific institutions accompanied by lack of general responsiveness on the part of scientists has also prevented grassroots innovators from optimizing their solutions and in some cases even pursuing their innovations to logical conclusion.
5. Formal scientific institutions at national and international level have failed to build upon grassroots innovations thereby weakening the momentum for even articulating the innovations.
6. The educational systems at different level, ranging from primary to higher education, have ignored this subject and have almost never included profiles of grassroots innovators in the curriculum or pedagogy. The result is that young people of ten grow up ith assumption that technological solutions to their problems would come from outside and generally from the West rather than evolving from within. The defeatist mentality and pervasive cynicism add to the problem.
7. The lack of micro-venture capital prevents transition of small innovations into enterprises. The incentives therefore, remain limited for those who innovate. While micro-finance facilities are now available around the world, micro-venture finance for small innovations has almost been totally absent. This institutional gap shows the lack of appreciation by the global as well as national public policy institutions of the potential that grassroots innovations have for generating employment and overcoming poverty.
8. The lack of intellectual property protection through specific instruments and legal frameworks designed for helping small innovators may also inhibit the articulation or sharing of innovations.

Despite all these reasons, innovations have indeed been scouted, documented and disseminated by Honey Bee Network and SRISTI (www.sristi.org) over the past 12 years. Innovations such as a modified pulley to draw water, a gum scraper to enable women to gum from thorny bushes or trees, or a large number of small machines, herbal pesticides, veterinary medicines, new plant varieties, agronomic practices or other products have been developed by the unsung heroes of our society without any outside help (www.sristi.org).

3.5 Linking innovation, investment and enterprise: micro venture promotion fund

As a follow-up of the first International Conference on Creativity and Innovations at Grassroots held in January 1997 at IIMA, a regional fund was created in collaboration with Gujarat state government to convert innovations from the Honey Bee database into enterprises. GIAN (Gujarat Grassroots Innovation Augmentation Network, www.gian.org) was set up in 1997 to link innovations, investment and enterprise. The idea is that innovators sometimes may not want to become entrepreneurs themselves. And even if they want to become entrepreneurs they may not have access to risk capital, technical know-how or design-input for making their innovations into a product, which can be commercialized or diffused through non-commercial channels. GIAN has filed patents on behalf of grassroots innovators, incubated several innovations into products, and licensed some of the innovations to entrepreneurs on a district-wide basis with the license fee going to the innovator (even when patents for the licensed innovation have only been filed and not granted). Why are there not many GIANs within the country or around the world? A possible reason could be that the development planners and international aid and investment

agencies have failed to see the potential of a knowledge-intensive approach to development.

It is useful to summarize some of the lessons of the incubation process of innovations. Often, innovators don't prove to be good entrepreneurs. They seldom realize that by constantly improving their design and not making any two machines or products alike, they generate a doubt in the mind of the customers that some other people get more features than they do. Likewise, there are innovators who don't think they can learn very much from other experts particularly from formal sector. Very often, experts in the formal sector also fail to see the merit of the local innovations. The lack of incubators, laboratories and other science and technology institutions that can add value to local innovations make the tasks of these innovators even more difficult. The lack of venture promotion capital and R&D funds constrain the pace and scale of technology upgrade of the innovation. The lack of mentors affects the morale of budding entrepreneurs who often need 'a shoulder to cry on'. The lack of certification facilities at concessional rates for the products based on local innovations delays and sometimes inhibits the diffusion of innovation. Finally, the lack of media support prevents horizontal networking among the innovators and generation of the demand for their products.

While the Honey Bee Network is experimenting with the use of information technology through multimedia multi-language databases accessible through touchscreen kiosks, we are conscious of the limitation information technology has at the current level of infrastructure in making major impact on society.

3.6 National and International Register for Innovations and a clearinghouse for horizontal networking and innovation market

The transaction costs for innovators around the world to learn from each other and thereby improve the livelihood options, are very high. The popular media and other channels of communication do not pay attention to this source of creativity. Unless we have a clearinghouse in multiple languages and easily accessible in remote areas through the Internet as well as radio, it will be very difficult to create horizontal networks of grassroots innovators. A step in this direction was taken in India recently. The National Innovation Foundation (NIF, www.nifindia.org) was set up in March 2000 with a corpus of US$5 million by the Indian Department of Science and Technology at Ahmedabad, essentially to scale-up the Honey Bee model all over the country. NIF will develop a national register of inventions and innovations, link innovation, investment and enterprise, connect excellence in formal and informal sciences, set up incubators and help in changing the mindset of society to ensure respect, recognition and reward for the grassroots innovators. SRISTI has moved a proposal for Global Innovation Foundation primarily to create multi-language multi-level clearing-houses for networking innovators.

One of the remaining problems is the protection of intellectual property rights. It will be impossible for traditional knowledge experts and contemporary innovators to pursue standard patent protection where the average cost is about US$15–20 000 per international patent. The cost of validating the patent in each country every year is extra. There is a provision in the TRIPs as a part of WTO that an international negotiation be initiated to develop a global registry of wines. Obviously, it was done to persuade France to the sign the GATT treaty. There is no obvious reason as to why international registry should be restricted only to wines. It should be considered possible to develop a two-track system of intellectual property

protection. Under this, any inventor from any part of the world should be able to register their own innovation or traditional knowledge and get at least 8–10 years protection for 3–5 claims at a very nominal cost to be paid in national currency at the national IP office. This registry will provide incentives to the millions of knowledge-rich, economically poor people to disclose their innovations and at the same time explore the possibility that investors or entrepreneurs from a part of the world will join hands with them to set up an enterprise in their country or elsewhere. Thus, the grassroots creativity can harness global capital and entrepreneurial support for decentralized development. This is the perhaps one of the ways I can imagine, in which forces of globalization can be mobilized in support of autonomous development at grassroots level.

4. POLICY MEASURES FOR AUGMENTING AGROBIODIVERSITY AND BENEFIT SHARING WITH CONSERVERS OF DIVERSITY

Conserving agrobiodiversity poses many challenges. A key challenge is to provide incentives that local communities need to have for growing local varieties. These incentives (see also of Gupta, 1989, 1995, 1998, 2000) are summarized below:

4.1 Material incentives

1. Increased demand for local landraces through development of niche markets.
2. Compensation to a certain percentage of farmers in each region for growing low return landraces based on the difference in productivity and price product of high yielding varieties and local landraces.
3. Support to local farmer breeders as well as communities in participatory breeding with or without involvement of outside scientists so as to improve the land races and make them viable in the market place through increased productivity.
4. Link the conservation of agrobiodiversity with development of organic agriculture and provide institutional support for certification of output, development of market channel for marketing, generation of consumer demand and other post harvest processing and branding.
5. Provision of non-chemical inputs such as herbal pesticides, beneficial insects, technologies for enriching farm yard manure, etc., so as to make the cultivation of local landraces more economical.
6. The provision in national plant variety acts for a ‘Gene Fund’ as attempted in the Indian Plant Variety and Farmers’ Rights Bill for sharing benefits with local conservers of agrobiodiversity whenever they are used for breeding of varieties by public or private sector within the country or externally.

4.2 Non-material incentives

1. Awards and honour to the communities/individuals who are conserving the rare or endangered agrobiodiversity.
2. Policy measures aimed at procurement of local landraces as a priority while designing food security programmes and buffer stock.
3. Curriculum and pedagogy at primary and higher level of schooling to include lessons and references about the contribution specific communities make for conservation of specific agrobiodiversity.

4. Acknowledgement of the indigenous knowledge provided by the farmer-conservers in the passport datasheets of germplasm in genebanks. This has not been the practice, unfortunately, anywhere so far.
5. Development of an international registration system (such as INSTAR proposed by SRISTI in 1993) as mentioned in Section 2 for providing quick IP protection to conserving communities as well as individual breeders.
6. National authorities to take responsibility for generating data required for plant variety protection since farmers on their own cannot generate all the formalities involved in the matter. NGOs supporting the local conservers in the matter also need to be supported for the purpose.
7. A risk fund for encouraging local communities and innovators to take up test marketing, value addition and to seek outside help.

There may be various other ways in which this issue can be taken forward. The gene fund set up by UC Davis at the initiative of Dr Pamela Ronald unfortunately never worked and no amount ever accrued in it. So much so that UC Davis also did not agree to mainstream this initiative. Biopiracy continues at the international level. But can we stop exploitation and erosion of agrobiodiversity at a national level? This paper is a small response to that.

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SECTION 2: WORKSHOP RESULTS

1. SYNTHESIS OF PRESENTATIONS AND DISCUSSIONS: 'STATE OF THE ART' OF INCENTIVE MEASURES TO ENHANCE AGROBIODIVERSITY

The papers in the foregoing sections were presented on the first two days of the workshop in Lusaka. According to the reporters, from the total of the presentations there emerged a richness of experience. Many of the activities reported were not initiated with the prior objective of enhancing the use or conservation of agrobiodiversity. However, reflection on the experiences shows significant contribution to it, and/or do provide important lessons concerning incentives and disincentives.

It also became clear from discussion related to the papers that the various key areas as addressed in the workshop (activities at farmer level, policy, marketing, education and public awareness) are closely related and represent strongly interacting factors. For example, the incentives and disincentives at farmer level cannot be brought about without changing the policy environment. Marketing incentives can be strongly influenced through education and awareness. Bringing agrobiodiversity-awareness into education needs attention to educational policies. One important key observation was the need for the region to 'think outside the box' and look for innovative ways to marry the formal laws and legislation with the informal customary laws in order to give incentives and rewards to the wider population who are the custodians of the agrobiodiversity. Two main priorities for attention stand out:

- The need to interpret appropriately the various articles in international undertakings in order to develop legislation that produces a favourable policy environment. In addition, innovative and practicable monitoring and enforcement channels need to be developed in order to protect the rights of the owners of the agrobiodiversity.
- Development of new markets (niche markets within the region and internationally) for the more exotic indigenous products through strengthening regional markets and educating consumers.

2. CLARIFICATION: INCENTIVES FOR WHAT?

After the first day of presentations in the workshop, before proceeding, there was an obvious need for a basic discussion on what exactly should be the target of incentives in agrobiodiversity. Could incentives in agrobiodiversity also address the use of modern varieties if farmers where preferring or needing these. Or, should incentives target the use of local varieties only. Discussion on this question was centered around two statements:

- Incentives are for sustainable utilization of species of *local varieties.*
- Incentives for utilization of *a portfolio of varieties that can include modern varieties*?

A controversial discussion began; some argued that incentives should be for the use of local varieties.

> *"Because, why give incentives for the use of modern varieties? We already have modern varieties everywhere! Processing of products of modern varieties is already in place. Traditional knowledge is disappearing and that is our concern! Incentives thus have to target local varieties and breeds."*

In contrast, the overall goal is sustainable development – "We have to be interested in the farmers' interests as well as in conserving diversity! What is the farmers' view? We have to give farmers the opportunity to choose one variety or the other! There is a bias in defining what is modern and what is not modern. Farmers' preference will depend on how much they have been exposed to modern varieties and on the resources they have for needed inputs. That is why the second option is the better one."

A third option was suggested that combines aspects of the two. This includes the conservation objective, but emphasizes that the main focus lies on sustainable utilization, whatever the varieties are! A consensus was reached among all participants, thus agreeing on:

- Incentives for conservation and sustainable utilization of a portfolio of varieties and species that can include modern varieties.

3. IDENTIFICATION OF INCENTIVES AND CHALLENGES

A framework for analysing keynotes and case presentations

The preparatory group felt it necessary to provide an analytical framework to guide the discussions of the workshop. Andrew Mushita on behalf of the group presented the frame.

Definition of 'incentives' by the CBD

'Specific inducements designed and implemented to influence stakeholders to conserve biological diversity or to use its components in a sustainable manner.'

The following matrix provided clarity about the types of incentive. The cases in the boxes are merely examples and were not to be taken as the incentives to be discussed or to limit people's minds!!

Types of incentive	Positive incentive 'measure designed to encourage beneficial activities' economic legal or institutional	Negative incentive 'measure that induce unsustainable behaviour that reduces agrobiodiversity'
Direct incentive 'directly encourages a stakeholder to use and conserve agrobiodiversity'	• direct payments for growing local varieties • rewards for maintaining diversity • improved access to good quality seed of local varieties • access to credit for growing local varieties	• illegal status of marketing seeds of local/non registered varieties • non acceptance of local varieties by buyers/ • processors because of heterogeneity and small volumes/quantities
Indirect incentive 'induces changes in the agroecological or socioeconomical or political environment of a stakeholder which affects use and conservation of agrobiodiversity'	• legislation that allows farmers to exchange and market seeds of local varieties • development of food chains for diversity product * processing * labelling * collective marketing	• Subsidies for modern varieties • extension messages promoting mono-culture and high-input agriculture • promotion of export/cash crops at the expense of food crops • access to credit linked to use of modern varieties

Another differentiation of types of incentives is related to different stakeholder groups:

- farmers
- consumers
- support system
  - policy
  - extension
  - research
- NGOs
- seed companies, etc.

After each keynote and case presentation, participants sitting together on a table 'buzzed' for a couple of minutes and identified:

- which incentives were recognized in the presented keynote paper or case presentation;
- the key challenges to strengthen incentives or to overcome negative incentives.

These incentives and challenges were written on cards, collected and put up on boards. At the end of all the presentations they were clustered by the facilitator and a small team. They ended up being grouped into five themes, each theme forming the issue for the work of one group for the following session. The themes were fed back to the plenary where the clustering was endorsed. The five themes to work on were:

- (Group 1) Enhancing farmers skills and capacities
- (Group 2) Enhancing public awareness and education
- (Group 3) Enhancing incentives at policy level
- (Group 4) Enhancing access to seeds
- (Group 5) Enhancing marketing and value adding/Enhancing production and ABD

The overview of incentives and challenges identified in each of the themes is presented in the following boxes:

Group 1: Enhancing farmers' skills and capacities

Incentives	Challenges
• Access to training/information • Access to information • Information and knowledge • Learning as incentive (2x) _ for other stakeholders = support system _ in a participatory way _ by doing and discovering • Participatory learning including different stakeholders • Recognition of farmers' knowledge systems • Recognition of traditional in enhancing agrobiodiversity • Putting values on farmers knowledge and culture • Conservation of agrobiodiversity and environment using Farmer Field Schools • Exchange visits promote agrobiodiversity through knowledge varieties • Appreciation and empowerment of indigenous knowledge (positive/direct) • Farmers knowledge experiences and innovations are recognized	• Gender access and control • Create and exchange knowledge and information • How to implement community registries • Scaling-up • Scaling-up and costiveness of FFS • Promotion of Farmers Field Schools as a cost-effective concept • How to prevent over use of genetic resources • Getting farmers perspectives and trust • Implement Farmer Field Schools for agrobiodiversity issues • Form research and extension programmes: (i) approach more participatory – (ii) content relevant to farmers. • Getting research and extension to recognize the local landraces and indigenous knowledge • Increase resource allocation for participation of researchers and extension workers in Farmer Field Schools • Cultural awareness • Socio-cultural beliefs • Translate national obligation (CBD) to

• Training adds value to PGR • Seed fairs (direct) • Animal and seed diversity fairs (positive, direct) • The possibility to demonstrate the valuable of crops and animals one owns (indirect incentives) • Community registry • Clear issue gaps identified • Including non –market incentives • Exposure of farmers to diversity (positive, direct) • Increased number of options to cultivate diversity positive, direct • Recognition of 0 + 0 farmers' knowledge Participatory (positive, direct) • Approach ethnic communities with products from their home • External support (funding) • Create awareness of the valuable characteristics, and encourage use of underutilized crops and locally adapted breeds • Gender issues addressed	communities • Links to support institutions • Sustainability of farmers' initiatives to maintain agrobiodiversity • Test local level initiatives

Group 2: Enhancing public awareness and education

Incentives	Challenges
Education	
• Including agrobiodiversity in the curriculum positive/direct • Incorporation of agrobiodiversity into curricula • A binding action plan for inclusion of biodiversity in curricula	• Attracting scholarships and funding for learning • Association with poverty
Public awareness	
• Customer and producer awareness • Public awareness FFS/others • Massive publication via all media massive campaigning	• Association with poverty

Group 3: Enhancing conducive polices and legislation

Incentives	Challenges
• CBD, TRIPS, IU, OAU Model • Links to support institutions • Translate national obligations (CDB etc.) to communities • Harmonized regional access legislation • Integration of IKS into policies • Capacity building • Appropriate seed legislation that promotes local varieties • OAU model law on access to GR and associated IK	• Awareness creation for all stakeholders → policy makers • Influence policy • Recognition and protection of the rights of custodians of ABD and IK and benefit sharing → empowerment • African customary law • Review of international laws such as CBD, TRIPS, IU • ABD more visible in the CBD process

Group 4: Enhancing access to seeds

Incentives	Challenges
• Harmonized regional access legislation	• How to implement community registries
• Animal and seed diversity fairs	• Promote use of IKS and technologies
• Regulated, improved, facilitated community access to GR	• Change variety release requirements to accommodate local varieties
• Privatization policies	
• Promote seed supply systems that give farmers broader choice	
• Change of variety release arrangements to accommodate local varieties	
• Broaden exemptions to plant breeders' rights	
• Availability of a wide range of genetic material and international and national genebanks	
• Seed list, compulsory certification	
• Community seed banks	
• Small scale seed production in seed gardens	

Group 5: Enhancing markets and value adding/Enhancing production in agrobiodiversity

Incentives	Challenges
• Master Farmer Scheme	• Changing of status and preferences
• Development of niche markets (indirect)	• Value adding
• Development of niche markets positive, direct	• Value adding to indigenous products
• Develop markets	• Identification of products
• Developing niche markets (positive, direct)	• Establish marketing information system to inform of new opportunities for markets
• Certification labelling/standardization for niche market	• To develop more fair-share market
• Facilitation of Access to markets (infrastructure/information – positive, indirect)	• Creating awareness of value-added end product.
• Non market incentives e.g. cultural preferences	• How to improve the agronomic traits of local varieties
• Market information	• Meeting market requirements
• Adding value on farm (positive, direct)	• (*Gnetum* as example) Produce big quantities without destroying the agrobiodiversity
• Developing appropriate product development technologies	• Sustainability of market/product information supply
• Protecting wild and semi-cultivated species (recognizing as food sources)	• To have reliable, readily available products for the market
• 'Bigger is better' parading market preferences against local crops/animals negative, direct	• How to arrange domains of market preferences
• Local preference for local/indigenous breeds and vegetables	• Linking community directly to markets – cut out middle man
• High prices lead to over-exploitation (negative incentive for sustainable use)	• Make information and knowledge availability to the needy
• Market path dependence syndrome (negative, direct)	• Increase production and improved management of local/indigenous breeds
• High demand/or organic products	• Producing enough quantities, quality, delivering, etc
• Aggressive marketing strategies (positive, indirect)	• To increase the quantity of diverse products (e.g. local seeds produced to satisfy customer demands)
• Create new product for a new market inside and outside Africa	• Maintenance of sustainability of the system of seed banks
• Product development (cataloguing shows)	• How to match production with population growth
• Market incentives	• Sustaining the whole process to satisfy the niche
• Strong markets local/export	

	market • Farmers' involvement in discussion making (clearance of vegetation without consultation)

4. WORKING GROUPS ON INCENTIVE MEASURES

Participants joined the groups they had main interest in and were given three working sessions of time to discuss the issues in 'their theme'. An innput to the discussions were the clustered cards with the (i) incentives and (ii) challenges. The working groups were given the following guiding questions:

1. What are the realistic promising incentive measures for your topic, their opportunities and constraints?
2. How can these incentives measure be operationalized in practice?
   - ♦ What are possible strategies and steps to put them in practice?
   - ♦ Who should then do what in this scenario, what are the roles and functions of different actors and possible institutional arrangements?
   - ♦ What are possible incentives for the service providers to change their roles?

In the following the reports from these five working groups are presented. The reports are based on the presentation of the rapporteurs in the plenary (see workshop report on www.gtz.de/agrobiodiv/).

WORKING GROUP 1: ENHANCING FARMERS SKILLS AND CAPACITIES

Report on the group discussions by Kudakwashe Murwira

Enhancing farmers' skills and capacities means the facilitation of a number of things. It involves facilitation of farmers' access to information and technology, sharing of information on agrobiodiversity and implementation of the Participatory Technology Development (PTD) process. Successful implementation of PTD requires recognizing and rewarding the conservation and use of IKS in agrobiodiversity. Further, access to resources is needed for adequate implementation of PTD.

Opportunities and constraints to enhance farmers' skills were discussed by the group. This led to the conclusion that there are a number of *opportunities* to be tapped to ensure successful farmer-competency development. These include:

- *Access to information and technology:* the presence of the extension system, leaflets being produced currently by the extensionists and researchers that can be shared with farmers; existence of radio communication programmes that can be used to impart new information to the farmers; making use of such avenues as the Internet to disseminate new information and technologies.
- *Farmer to farmer sharing of agrobiodiversity information*: general acceptance of farmers knowledge by researchers and extensionists; a culture of sharing which exists among farmers; some farmers are still practising agrobiodiversity-friendly practices.
- *PTD process*: both indigenous and scientific knowledge are available and, to a certain point, in use; participatory approaches have been in existence for awhile.

Major constraints to enhancing farmers skills and capacities were discussed and resulted in the following observations:

- Information communication channels are not so easy to use.
- Resources needed to translate information into local languages to make it user-friendly are not readily available.
- Some farmers are not willing to share their knowledge with neighbours and outsiders.
- Lack of enabling environment.
- Poor linkages between farmers and researchers.
- Unfavourable policies e.g. land tenure system.
- Channels for resource flow may be not so good.

Strategies to overcome the constraints

The strategy to overcome the constraints in *access to information and technology* involves the facilitation of events such as seed fairs to inventory the knowledge of farmers as well as workshops; production leaflets in local language to share information with farmers and documentation of farmers' knowledge and skills for wider sharing. In addition, identifying information and knowledge gaps for farmers as well as sources for that information and including agrobiodiversity in the curriculum of training extension staff are elements of a strategy to overcome constraints in accessing information and technology.

As *sharing information* on agrobiodiversity was identified as a specific constraint, strategies to overcome this constraint were discussed. A number of suggestions emerged:

- to facilitate events such as agricultural shows and field days to enable farmers to share
- to strengthen farmer networks through exposure-visits
- to facilitate establishment of community genebanks

To facilitate the *implementation of the PTD process,* the strategy could contain the following elements:

- identification of sites for establishing PTD cases;
- introduction of the Farmer Field School concept within the PTD cases;
- initiation of the participatory variety selection or the participatory plant breeding processes in partnership with farmers;
- establishment of communal plots based on the traditional system.

Conservation and use of IKS were identified as important issues where recognition and rewards are needed. For incentives to promote this recognition the following strategy elements were mentioned:

- enactment of laws to reinforce the conservation and sustainable utilization of agrobiodiversity and protection of IKS;
- identification, documentation and sharing of IKS through seminars and workshops;
- inclusion of IKS in the education curriculum;
- facilitation of competitions for sharing.

Facilitating access to resources was considered an important condition and supports use and conservation of agrobiodiversity. Various strategies to improve access to resources were considered and discussed:

- review of the land tenure system to promote a sense of ownership and control by both individuals and communities;
- development of mechanisms for access to funding for conservation and use of agrobiodiversity;
- facilitation of farmer organization for lobbying.

The overall strategy in Enhancing Farmers' Skills and Capacities is to ensure that both men and women, young and old, rich and poor are participating actively in these processes. A range of key stakeholders will need to play different roles in this process, but in a much more coordinated way. Although the role can change from one situation to another, in general the different stakeholders have the following roles are:

- ***Farmers***: they are planners, implementers, monitors and evaluators; providers, influencers of policy-makers, partners.
- **NGOs:** their role is that of facilitator, trainer, extensionist, lobbying on behalf of farmers, disseminator, source of information
- ***Researchers****:* they are recipients, generators and disseminators.
- ***Extensionists*****:** in the process they have the role of facilitator, disseminator, recipient, linker, etc.
- ***Funders*****:** they are the sources of funding, influencers of policy, creators of accountability within funded institutions, evaluators.

WORKING GROUP 2: ENHANCING PUBLIC AWARENESS AND EDUCATION

Report on the group discussions by Tommy Mumba and Conny Almekinders

The working group dealt with Public Awareness and Education separately. For each area they defined: (1) incentives; (2) strategies; and (3) steps – who should do what.

In **formal education** the group made a general distinction between:

- Primary, secondary and vocational training.
- Academic level (MSc and PhD).

As a general strategy in education it was felt that integrating agrobiodiversity issues in existing curricula offers more opportunities than developing new curricula, since the last one requires important changes at the ministerial level. It was also generally recognized that incorporating agrobiodiversity issues in lower-level education offers a very important opportunity as it reaches so many – all who later will be consumers, or otherwise may have an influence. In specific, the group discussed the importance of incorporating agrobiodiversity issues in curricula of household economics and in that of those who are likely to be future policy-makers.

An important constraint is the need for approval at ministerial level for changes in the curricula. However, one can think of range of activities outside the curricula that can have important impacts, such as school-gardens, visiting farmers' communities, cooking contests, etc. This was defined as **informal education and training** activities and further dealt with under public awareness raising. The formation of a group that includes the various stakeholders and that can have impact on lobbying at ministerial level, i.e. where changes in curricula are brought about, was seen as the first essential step.

Thereafter, constraints were defined. Following, the target groups/organization (other stakeholders) to whom the lobbying should be directed were identified ('who'). Under 'how' to bring about the implementation, we defined the incentives that were there for the stakeholders to participate in the implementation, the activities and conditions.

In **public awareness** the group followed a similar path. The target groups (other stakeholders) that actually offer opportunities for impact. Particularly the informal activities around formal training and education programmes were felt as powerful. Constraints were formulated and it was understood that although these constraints are different for each of the identified target groups, they could be labelled under the same keywords. Different types of activity were discussed, addressing different levels of the strategies. Associated with the activities were different stakeholders should be addressed and the incentives that the public awareness raising activities would bring about.

WORKING GROUP 3: ENHANCING CONDUCIVE POLICES AND LEGISLATION

Report on the group discussions by Baitsi Podisi

The group defined major policy issues, thereafter they identified incentives and constraints to shaping a conducive environment. The **five major policy issues** concerning the legislative framework on genetic resources were identified:

- Recognition and protection of the rights of custodians of agrobiodiversity and indigenous knowledge as well as ensuring benefit-sharing and curbing biopiracy e.g. developing *sui generis* legislation frameworks e.g. OAU model.
- Facilitate community access to genetic resources.
- Broaden the intellectual property rights and access issues to animal genetic resources.
- Harmonize national legislation with the International Undertaking.
- Harmonization of policy/legislation at regional level.

In a following step of the group work, major **incentives** were identified that contribute to a conducive legal and policy environment on genetic resources. They include:

- Empowering the custodians of genetic resources and indigenous knowledge through recognizing and protecting the rights of custodians of genetic resources and indigenous knowledge.
- Ensuring that custodians of genetic resources participate in sharing the benefits accruing from accessing the genetic resources and the indigenous knowledge.
- The need to have improved facilitated community access to genetic resources.

Constraints to shaping a conducive environment include:

- Lack of relevant policies and legislation at national level on access and benefit sharing with respect to genetic resources.
- Insufficient capacity at national level to develop effective legislation on genetic resources.
- Lack of experience on how customary law could be incorporated into national law as recommended by the OAU model law. (The inclusion of African customary law would include the interests of local communities to protect them as custodians of agrodiversity and indigenous knowledge.)

Other constraints that affect the access of genetic resources by local communities include the lack of seed lists and compulsory certification, which disqualifies and exclude the farmers' landraces that do not meet the set standards. This in turn leads to reduced availability of such material for distribution. Patents of plants or animals and parts thereof were also viewed as a potential constraint, which would stifle access to future development and access to germplasm.

The coming into effect of the Convention on Biological Diversity (CBD) which advocates for the protection of genetic resources creates **opportunities** for countries to develop and invoke relevant polices and legislation. Other complimentary developments, which deal with genetic resources legislation like the OAU model and the International undertaking, provide important opportunities for countries to review their policies and legislation. Technologies like GURT (genetic utilization restruction technologies) pose a great hindrance to access to genetic resources by farmers.

Policy strategies on legislation, awareness raising and stakeholder involvement

The working group recognized that SADC countries are at different stages of implementing various biodiversity-related policies and legislation. Countries that do not yet have any legislation on access to genetic resources and indigenous knowledge would have to address this in a number of ways. Those countries that have made much progress should go ahead and enact legislation of choice, which may include using any suitable *sui generis* systems. However such legislation needs to take into account existing international multilateral agreements like the International Undertaking etc. This situation logically calls for a reviewing of progress made so far at national level in implementing the international law such as CBD, TRIPS and IU.

Incorporation of African Customary law into National Law to accommodate the interests of local communities has been suggested as another issue that has to be explored to protect custodians of ABD, IK and ensure benefit sharing. This is recommended by the OAU Model Framework, but no experience exists on how this can be done. Therefore some studies on how customary law can be incorporated into national law need to be carried out.

It is important to **raise the awareness** of communities and policy-makers of the value of developing legislation on access to genetic resources and indigenous knowledge. This sensitizing process needs to involve all stakeholders.

All relevant **stakeholders** need to be consulted and have to participate at all levels of developing policy and legislation. Stakeholders should include all those who have to deal with agrobiodiversity issues such as government agencies (legal, agriculture, environment, trade, local government), the private sector, NGOs, CBOs, private companies and local communities.

In the discussions on the strategies, a range of **elements for policy strategies** emerged addressing seed and variety legislation, community-level intervention and agricultural research and extension that contribute to improved community access to genetic resources. At the seed policy level it was felt that seed policies, which promote diversity and seed supply systems, that give the farmer a broad choice of seeds are still not in place. The national variety legislation should broaden the exemption to plant breeder's rights and accommodate local varieties. But legislation should be against the use of GURTs, and against patents on plants, animals and parts thereof. At the regional level it was felt extremely important to harmonize regional access legislation and to allow agreed exchange of genetic resources at regional level. In addition, mechanisms should be developed to refuse or cancel access where the resource is significantly being depleted. Strategies that address the community level could aim to promote local seed multiplication by local farmers as seed producers, participatory plant breeding, community seed banks and stimulation of germplasm exchange between farmers and local, national, regional genebanks, and NARs and NGOs. **Opportunities** were identified as elements of a policy strategy for agricultural research and extension that would support use of agrobiodiversity. This included: seed fairs and animal shows as elements in the national policies; policy to mainstream agrobiodiversity in all levels of curricula; promotion of production practices that encourage agrobiodiversity e.g. mixed farming and mixed cropping;, adaptation of research extension policies to facilitate use of participatory approaches which involve farmers/communities; and facilitation of the development on National Legislation.

Countries should be assisted to develop legislation at national level through:

- developing the necessary capacity at national level;
- securing funding to support the law development process;
- bringing in the necessary expertise from outside the country where necessary.

WORKING GROUP 4: ENHANCING ACCESS TO SEEDS

Report on the group discussions by Regassa Feyissa

The task of the working group was to look into opportunities to develop mechanisms for enhancing access to seeds. The working group considered issues that emerged during the plenary session regarding the enhancement of access to seeds. This was done by organizing issues into constraints; opportunities to tackle the problems; and possible strategies that could be used. Issues were organized according the guidelines for the working process: (i) constraints, (ii) opportunities, (iii) strategies (steps to take, roles of stakeholders, and incentives for those stakeholders)

As a major **constraint** the group identified the fact that local varieties are not recognized in the National Seed Legislation. Variety release systems do not accommodate farmers' varieties; farmers' varieties are not included in the QDS system (as functional in Zambia).
Given the constraints, **opportunities** were seen in the creation of mechanisms for access to resources (use of seed gardens to include farmers' varieties) and in seed policy and regulations that support local seed system development. This last policy area can include provisions to decentralization of seed services and to improve farmers' seed production skills.

Discussion on **strategies** resulted in a number of points that would contribute to overcoming the constraints. Creating access to good-quality seeds of various varieties of local farmers' interest should be central in such a strategy. Elements improving the access are (i) the use of a QDS system to increase the range of diversity of improved varieties thereby contributing to agrobiodiversity; (ii) establishment of community seed banks; (iii) development of local seed production and marketing systems; and (iv) promotion of niche markets for seeds.

Consequently, corresponding **promising incentives** were identified: development of policy and regulations to recognize farmers' varieties/breeds; development of harmonized Regional Seed Regulations for both farmers' and improved varieties; formulation of a QDS system that takes cognisance of policy measures and harmonized seed regulations at sub-regional level; decentralization of seed service facilities such as seed certification, inspection etc.; establishment of community seed banks; development of small-scale seed enterprises that promote seed marketing.

The working group saw important **challenges** ahead in operationalization of the strategy. These included:

- arrangement of committed institutions to lobby for policy and regulations;
- lack of political will and commitments;
- lack of resources for SADC structures to push for regional harmonization of seed regulations;
- lack of funds for seed service facilities, community seed banks and for the establishment of small-scale seed enterprises.

The working group defined first steps to operationalize the earlier defined strategies. These steps could be important **starting points for a process** to improve farmers' access to seed in the region:

- identify a focal-point spearheading the development and implementation of policies in an inclusive way for policy, harmonization and QDS systems;
- assign a SADC-structure to coordinate the harmonization and QDS systems;

- training and decentralization of seed inspectors and establishing satellite laboratories for the purpose of decentralization;
- assessment of the existing seed bank structures and recommendation for appropriate and area specific seed bank facilities;
- capacity building which includes linking to or establishing revolving loan-fund facilities for small-scale seed enterprise development, training etc.

Major **roles** in the process to improve farmers' access to seed were seen for the Ministries of Agriculture (dealing with policy, regulations, development promotion etc.). The Ministries of Agriculture with FANR and the Development Unit are the principal actors responsible for the harmonization of policy and regulations and the formulation of a QDS; The MoAs, NGOs and CBOs should jointly work on the establishment of community seed banks. These same actors plus the private sector should work on seed service facilities adequate to the decentralization and on the development of seed marketing mechanisms.

Incentives for service providers ask in the first place for an enabling environment. An enabling environment re-enforces information and experience exchange; increased networking at local and regional levels; institutional strengthening and resource availability.

WORKING GROUP 5: ENHANCING MARKETS AND VALUE ADDING/ENHANCING PRODUCTION IN AGROBIODIVERSITY

Report on the group discussions by Siboniso Moyo

A very large number of cards had been written during the keynote and case presentations with market-related incentives and constraints (see section 3, this chapter). The group started with brainstorming in order to clarify issues and end up with a common understanding of the goal ahead. Through discussions and clustering of cards with defined incentives and challenges, the group identified the areas of incentives that thereafter the working group addressed. The defined areas were:

- existence of niche markets;
- access to markets;
- adding value on-farm;
- public recognition;
- stability of production.

The following represents a synthesis of the working group discussions per area of incentives.

Existence of niche markets provides an opportunity to have a wider range of products available to consumers. However, constraints include risk of changing preferences of consumers and potential negative impact of commercialization on biodiversity. The question was how do we balance access to more markets with maintaining agrobiodiversity? A variety (diversity) of markets is perceived to be good since it allows marketing of different products through a number of channels thus promoting production of agrobiodiversity. Some of the strategies include creating awareness on the new products developing products, creating demand and changing consumer preferences.

Access to markets. Again there was a concern that marketing demands might lead farmers to shift towards improved varieties and breeders to the detriment of local/indigenous varieties which might not

meet the market standards. How best can we involve resource-poor farmers? Key strategies include provision of market information and credit for market involvement and infrastructure development.
Adding value on farm offers an opportunity to generate income for farmers and create employment for community members. Some of the constraints include lack of technologies and knowledge, and lack of investments (shortage of funds) to support the initiative. Strategies meant to address appropriate technologies are needed. Farm employment.

Public recognition. System becomes more open on who has done what. Ownership is promoted. Recognition of knowledge on applied developing traditional methods curriculum. Farmers will play part in the policy framework. Producers (master farmer). Integrate informal union with recognized unions for small-scale sector.

Stability of production. This was defined as a non-market incentive. It addresses positive characteristics of production from varieties, i.e. characteristics that are favourable for, or favoured by, farmers (e.g. taste, traditional chicken, cooking quality nutritional value, storage quality etc.). Difficulty of obtaining inputs such as seeds and bulls are an important constraint. Production of non-commercial varieties may reduce income. Strategies to favour stable production include secure land tenure, delivery of appropriate extension messages and providing a range of seeds and breeding (male) animals.

Who are the players and what are their roles and functions? In designing strategies it is important to know who are the main players. Marketing and adding value has a host of players involved in the operationalization of incentives measures. These are mainly farmers, researchers, extension agents, consumers, media donors, farmer-associations, women's groups, non-governmental organizations, savings groups, policy-makers, educators, the private and public sector, traditional leaders. During the discussions it was emphasized that these groups need to network better and share experiences and ideas for the sustainable use and conservation of ABD.

Roles and functions of the players are different. Consequently, incentives vary.

- Researchers – new funding source
- Extension agents – modified reward system
- Policy-makers – re-election, enhanced prestige, international recognition
- Donors – tax payer pressure and accountability
- Private sector – image, profit

5. TYING LOOSE ENDS TOGETHER: NEW INSIGHTS AND COMMON ISSUES FROM THE DISCUSSIONS

The outputs of the working groups were impressive with regard to their depth and also their concrete suggestions on what could be done to enhance the different incentive measures. They were, however, at a general level and the next step in the workshop was to break them down into the reality of the different participants and their situation. Before that step, a synthesis of the essential overall outcome of the work so far was carried out through table-group discussions. This resulted in a accumulated listing of the main 'new insights' and common issues in the discussions so far. The activity brought out the really new aspects and pulled together the essence of the whole discussion.

New insights?/Common issues	
• Recognition of small farmers as custodians of ABD	• Decentralization of seed services
• Recognition of need to maintain ABD across sectors (e.g. education)	• Small-scale entrepreneurs → seeds
• Integration of animal biodiversity as part of ABD	• Curriculum development at all levels
• Paradigm shift: away from 'Cadillac'	• Effective participation still a challenge
• Strike balance shift: away from modernized to alternative systems	• Need for attitude change of researchers, policy, extension
• Need to develop legislation for ABS	• Need for two-way flow of information
• Need for *sui generis* system for protection of rights (OAU Model) → regional approach	• Need for coordination among service providers and donors
• Recognition of informal seed sector and its support	• Need to facilitate seed movement among farmers
• Need for integration of farmer knowledge in research and extension	• Need for broadening the range of species
• Value-adding to increase utilization and returns	• Draw from existing lessons, exchange of experiences needed
• QDS as a means to promote farmer seed systems	• Need for collaboration of private sector and other stakeholders → review institutional arrangements
• Community seed banks as a means to promote farmer seed systems	• Need for capacity building in ABD-related legislation

6. COUNTRY GROUPS AND PLANS OF ACTION

After the outcomes of the working groups had been discussed in the plenary, the facilitator suggested projecting the outcomes to a concrete working situation. As strong groups of stakeholders were present from one country each (e.g. Zambia, Zimbabwe, Tanzania), it was suggested that these groups sit together and discuss how to take forward ABD in their countries, reflecting on what they can do as individuals. After discussing this set-up, participants agreed to group themselves. The goal of following working sessions was the elaboration of a plan of action that would follow-up this workshop and lead to concrete action in the different countries/the region. The results of the country groups (in alphabetical order) are given below as reports, elaborated by one of the members of the respective group. The guiding questions for the working sessions were:

- What are the gaps and opportunities you see in your situation?
- How can these be addressed most effectively?
- What networks/partners are required?
- What concrete actions do you commit yourselves to (the next steps…): what, who, when?

Another group used the working time to prepare a final statement, based on the new insights explored in the plenary (see foregoing chapter).

ACTION PLAN FOR CAMEROON (MANFRED BESONG)

There was only one participant from Cameroon. He defined an individual action plan based on the guiding questions.

What I can do tomorrow, on my own?

- Present outcome of workshop (report) to my institution
- Discuss relevant aspects with my colleagues
- Distribute results of the Workshop to some relevant government and conservation services
- Discuss information with stakeholders (farmers, seed companies, NGOs, policy-makers)

What I can do to get support?

- Formal stakeholder identification and analysis
- Develop proposals and activities on ABD including public awareness and capacity building
- Solicit diplomatic missions support (financial)

- What I can do to contribute to policy changes?
- Get the agricultural Research Institute in Cameroon to identify possible areas of funding
- Get policy-makers participate in workshops and discussions

Time Frame:

- October to December: discussions and soliciting financial support
- January 2002: field activities on agrobiodiversity

ACTION PLAN FOR CANADA (SHERI ARNOTT)

The only Canadian participant defined and individual action plan.

Things I can do:

- Liase with local environment/food safety/farmers' groups in Canada do tell them more about movements in other countries and our programme.
- Prepare a presentation for my kids' day-care plus classroom.
- Inform myself more about agricultural policy in Canada and look for ways do support lower input agriculture.
- Contact other interested donors to talk about coordination.
- Ask my grocery store for local/organic/fair trade products.
- Designate workshop proceedings.
- Write a letter to my Prime Minister and schedule a visit to discuss importance of farm- and agro-biodiversity

ACTION PLAN FOR TANZANIA

The participants from Tanzania agreed to take the lead in working towards the implementation of a programme on agrobiodiversity enhancement, conservation, management and use. They analysed what gaps exist, with whom they should link up and what action or partners were needed.

As a response to the question of what needs to be addressed (gaps) in the Tanzanian context, the Tanzania participants felt they could contribute by using the fora of which they are members (STOAS, CCT, PLEC) to introduce the topic of ABD. In addition, they recognized the importance of ABD awareness in ongoing food security programmes (the same can be done in other countries, e.g. Cameroon), and the inclusion of livestock in researching existing ABD research groups. They could lobby for that on a personal basis. In addition, they recognized the importance of linking up with other networks on ABD.
They felt that support is needed to:

- establish a network between relevant institutions in agrobiodiversity related activities e.g. universities, zonal research centres, non-governmental organizations, National Environmental Management Council (NEMC);.
- make contacts with interested funding agencies;

They decided they should work on a number of points to contribute to the need for policy changes:

- invitation of policy-makers to visit project sites and project beneficiaries of on-going agrobiodiversity projects;
- mobilization of funds to organize workshops for policy-makers on agrobiodiversity;
- lobbying and dialogue with NEMC and Vice Presidents to include agrobiodiversity as a priority for improvement of smallholder livelihoods.

They agreed that there are several things that could be done in their individual capacity. They can and will introduce agrobiodiversity awareness in on-going food security programmes and fora, of which they are members, e.g. STOAS, FAO Task Force, PLEC, CCT. They see that linking up with agrobiodiversity research working groups within the Department of Research and Development of the Ministry of Agriculture can be useful to include livestock diversity in rural research systems. The group will reconvene by mid-October 2001 in Dar Es Salaam where most headquarters for stakeholders in agrobiodiversity-related programmes are based. The objective of the initiative will be to identify, list and visit various stakeholders, and interact with them to find out what they are doing and where. Also they

will try to define the areas of interest and funding of these additional partners. Based on the results, a proposal will be written capturing the stakeholders' interests and SPRC-recommendations relevant for Tanzania. They aim at a start of project implementation in January 2002 with stakeholders support.

ACTION PLAN FOR ZAMBIA

Overview of fields of activity, steps to take and conditions/needs of the action plan defined by the Zambia participant group

Fields of activity and objectives	Steps to take	Conditions/needs
• Access to market	• Provide market information	• Market studies (need for financial support)
• Existence of niche market	• Need for market policy	• Financial support for policy development
• Facilitating participatory technology development • Facilitating access to information and technology	• Scale up workable participatory technology development activities • FFS • Seed gardens • PPB	• Need support for scaling up
• Information and education • Public awareness	• Establish a national focal point • Collaborate with the MENR-coordinator of ABD	
• Development of policy and regulations to recognize farmers' varieties/breeds	• Study of customary laws of Zambia in respect to ABD • Develop a policy for regulation of farmers' varieties/breeds	• Need financial assistance for study
• Development of harmonized seed regulations for both farmers' and improved varieties / animal breeds regulations	• Reviewing QDS • Including local land raves • Reviewing standards • Decentralization of seed services – ongoing inspection and testing • NPGRC to be represented on the Seed Implementation Committee • Establish seed banks and animal genebanks	

The Zambia group focused on fields of activities that the workshop had recognized most relevant for incentive measures. For each of these fields of activities the next steps to take were outlined (see table below). It was recognized that particularly in the policy field (market policy and regulatory framework for use of genetic resources) further study is needed (market studies, QDS system and regional harmonization of seed laws) before further policies can be defined. Such studies need to be commissioned and funds for it need to be mobilized. For technology-related fields the upscaling of successful approaches is most relevant. Upscaling also needs support.

ACTION PLAN FOR ZIMBABWE

The action plan that the Zimbabwe Working Group defined had three main points around which the activities would be arranged:

1. strengthening the process of national GR policy and legislation formulation
2. Setting up a network on agrobiodiversity with a national focal point
3. Scaling-up on-farm conservation programmes

To strengthen and continue the process of the formulation of the national policy and legislation on access to genetic resources, benefit sharing, and protection of farmers and communities rights, a number of enforcing activities were defined:

- mobilization of funds by the existing national task force to prepare a project document to sell the ideas to a wider audience (Mr Mafa);
- development of a national strategy and action plan on agrobiodiversity (does not exist at present);
- revisiting the Strategy and Action Plan on Biodiversity (in the Ministry of Environment) and highlight priority needs to develop anaction plan – National Genetic Resources Committee will play a key role (Dr Mlambo);
- work on institutional arrangement for implementation of the Agrobiodiversity Policy Legislation and Action Plan is needed.

To scale-up on-farm conservation programmes it is important to use lessons learnt from on-farm projects involving seed fairs, community seed banks, participatory plant breeding and participatory variety selection, and Farmer Field Schools. In this up-scaling the National Genetic Resources Committee Project Committee and key stakeholders should be involved.

ACTION PLAN FOR SADC

The participants of the SADC Action-plan group came together in the recognition that an important number of issues need to be dealt with at the regional level – and not at the national level only. The group first specified these issues. The absence and differences of legislation was the most salient issue at the regional level that needs to be dealt with. In close relation is the limited legal expertise in policy research. In addition, there is limited financial capacity to deal with the issues at hand. The lack in human capacity is important as well: there is a lack of training and education in agrobiodiversity to build a regional human capacity.

Based on these identified gaps and bottleneck, the group defined the required actions. The following actions and associated needs were formulated:

- a review of genetic resources legislation – which would be the first step to the next point;
- harmonization of regional genetic resources legislation;
- need for expertise – in order to bring about the former point;
- need for donor support;
- need for countries to work together;
- identification of institutions and curriculum development (to contribute to the building of human capacity);
- SADC: to lobby for training in agrobiodiversity.

A number of institutions and institutional networks have to be involved in the realization of these actions, with specific responsibilities on the different action-fields: donor agencies, NGOs, the private sector, research, SPGRC, SSSN, etc.

The concrete next steps that the group formulated were:

- Transmitting the recommendations of the Workshop to the SADC-level (SPGRC).
- Analysis of the current policy situation (wide consultation)
- November, i.e. the end of 2001, was defined as the date for implementation of the next steps.

7. CONCLUSIONS

The outcomes were discussed critically in the plenary. It was stressed that in action planning it is important to be as specific as possible on who is going to do what. Some groups were slightly reluctant to put timeframes on their activities as too many unclear institutional variables were still involved. However, there was great enthusiasm among many participants to commit themselves to concrete actions

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