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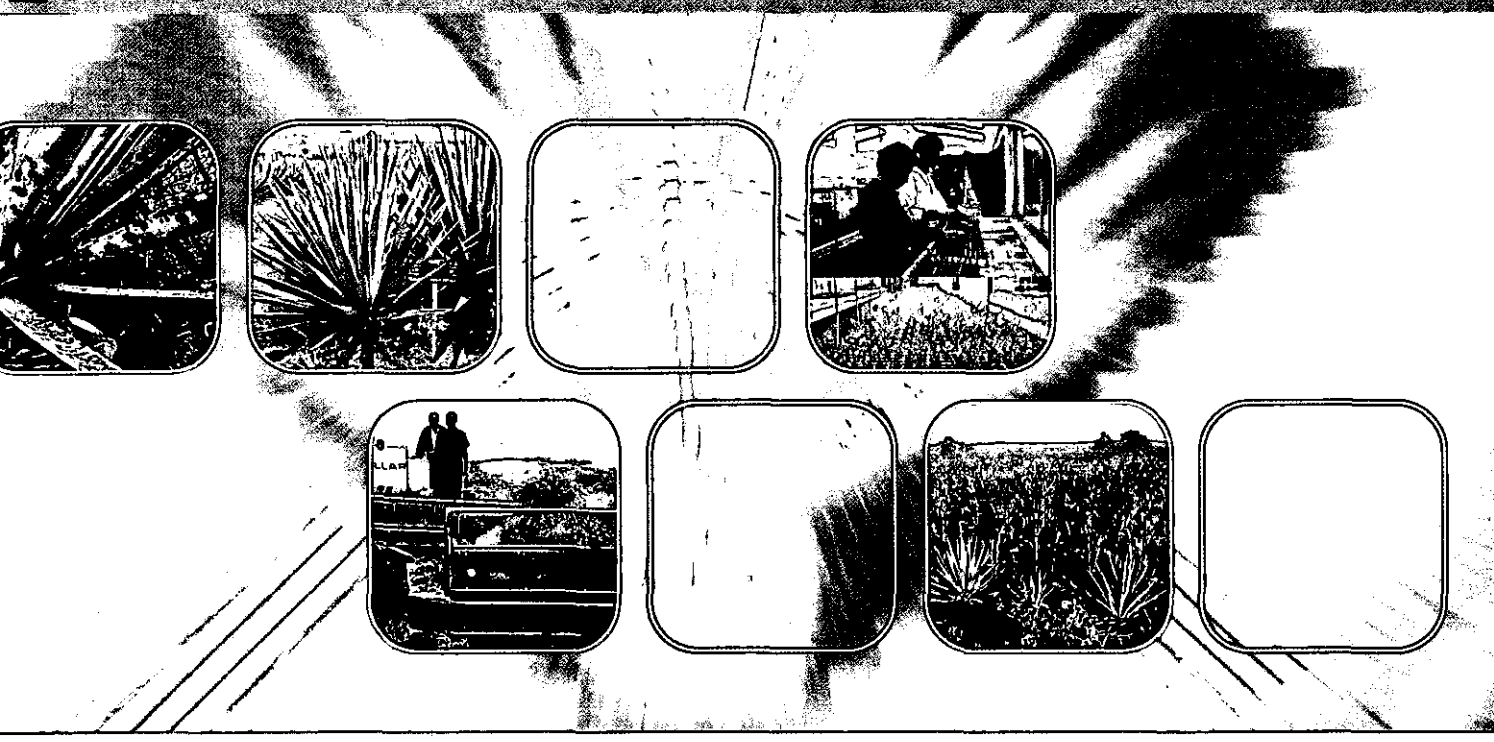
COMMON FUND FOR COMMODITIES
Project CFC/FIGHF/07

Product and market development of sisal and henequen



Dissemination Workshop

Project completion report/Addendum F.2

Tanzania, November 2004

UNIDO

KENYA SISAL BOARD

COMMON FUND FOR COMMODITIES

Product and market development of sisal and henequen

Project completion report, Addendum F.2

Dissemination Workshop

Tanzania
November 2004

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna, 2006

Project Completion Report preparation: National and international experts and consultants involved with the project, with contributions and support from the national teams.
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The opinions, figures and estimates reflected in the Report and its Addenda are the responsibility of the authors and should not be necessarily be considered as reflecting the views or carrying the endorsement of the CFC or UNIDO.
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Project Completion Report

Sub-component F.2
"Dissemination Workshop"

CONTENTS

Abbreviations and acronyms

ARI	Agricultural Research Institution
CELESA	Celulosa de Levante, S.A.
CFC	Common Fund for Commodities
EBDA	Empresa Baiana de Desenvolvimento Agricola S.A.
FAO	Food and Agriculture Organization
IFAD	International Fund for Agricultural Development
MTC	Meristematic Tissue Culture
PEA	Project Executing Agency
R&D	Research and development
SAT	Sisal Association of Tanzania
SINDIFIBRAS	Sindicato das Industrias de Fibras Vegetais da Bahia
UNIDO	United Nations Industrial Development Organization
UNIDO/PTC/ECB	Energy and Cleaner Production Branch, Programme Development and Technical Cooperation Division

I. Project sub-component summary

1. Title: Dissemination Workshop

2. Location: Tanzania

3. Starting Date: November 2004

4. Completion Date: November 2004

5. Sub-component external financing – excluding counterpart contributions

Total sub component cost:	U$ 68,094
Of which:	
CFC Financing:	U$ 68,094

II. Background and context in which the sub-component was conceived

The scope of sub-component F.2 was to disseminate as widely as possible the results achieved by the project, and to exchange experiences with representatives of other countries were sisal is produced. A first workshop was held in Tanga in February 2003.

III. Implementation and results achieved

The workshop was organized in Tanga, Tanzania, at the Mkonge Hotel from 16 to 19 November 2004. An organizing committee, with seven sub-committees) was formed to organize the event.

The countries represented included: Brazil, Cuba, China, Kenya, Mexico, and South Africa. The event was officially opened by the Vice President of the United Republic of Tanzania, H.E. Dr. Ali M. Shein and blessed by the presence of representatives from the Government and from international organizations. In particular the following guests participated:

Dr. A. Rwendeire (UNIDO Divisional Managing Director)
H.E. Ambassador A. Mchumo (CFC Managing Director)
Hon. Capt. (Rtd.) J. Mwambi, (Tanga Regional Commissioner)
Hon. Mr. M. Mwandoro (MP), (Chairman Tanzania Sisal Board)
Mr. J. Cheluget, (Kenya Ministry of Agriculture, Head of Kenya Delegation)
Mr. S. Mbabaali (FAO)
Hon. Dr. J. Ngasongwa (MP), (Minister for Industries and Trade)
Mr. D.D. Ruhinda, (Chairman Sisal Association of Tanzania).

On the first day, participants had the opportunity to visit the project sites: from the Agricultural Research Institution (ARI), at Mlingano to the demonstration areas of the smallholder scheme agricultural trials at Hale. The foundation stone of the biogas project was laid during a formal ceremony and the prototype hammer mill was formally inaugurated. The programme of the workshop is included in Annex 1.

On the second day the meeting was officially opened and speeches and statements delivered. On the third day the presentation of the project main features started and continued on the next and last day. The different sessions covered the following topics: "Enhancing and Improving Sisal Production", "Alternative Uses and Markets for Sisal", "Market Demand for Sisal", "Industrialization of Sisal, Way Forward". The presenters were the project national and international experts.

During the second session (Market demand for sisal), the experiences of participants from Brazil, China, Cuba, Mexico and South Africa were presented and a contribution to the discussion was given by Mrs. P. Brazier (from Wigglesworth, UK) on the demand for sisal products in Europe, North America and Asia.

It should be noted that all the presentations were followed by active participation in the discussion sessions. Criticisms were raised on the demand projections produced as part of the market study. As specified in the report for sub-component D.1, the study was carried out at the end of the 1990s and there were no additional funds in the project to bring it up-to-date. Therefore the results of the market study should be evaluated cautiously.

The presentations given at the workshop are included in Annex 3. Obviously the content of the presentations reflect the views of the presenters, and not of the PEA, the donor or of the organizers of the event.

IV. Lessons learned

The workshop was well attended and participants provided enthusiastic comments. The spirit of the workshop was very positive and the views of the participants and of the guests on the sisal industry highly optimistic. The workshop raised a lot of interest in the country. The overall goal of disseminating the project results was therefore met.

The participants underlined that dissemination should have been done more homogeneously throughout the implementation of the project and noted as being rather poor especially during the first years of project implementation. After the first workshop (February 2003) more efforts were made to communicate the project activities to a wider audience.

V. Conclusions and recommendations

In the future more attention should be given to disseminate the project from the beginning and to facilitate a more participatory approach. This applies to both smallholder growers and to sisal estates. The role of the Tanzania Sisal Board should be instrumental in reaching all the sisal industry.

The participants showed a lot of interest, in particular for the Meristematic Tissue Culture (MTC) activities initiated at ARI Mlingano. Action should be taken to make the laboratory more efficient and ensure delivery. The future of the sisal industry seems very promising and there is a need to prove the efficiency of biogas generation from decortication waste and the opportunities of alternative markets (pulp and paper, composite materials).

Annex 1. Proceedings of the Dissemination Workshop

PROCEEDINGS OF THE INTERNATIONAL DISSEMINATION WORKSHOP HELD AT MKONGE HOTEL TANGA, TANZANIA FROM 16TH TO 19TH NOVEMBER 2004

1.0 Background

The Project Dissemination Workshop was structured and planned with the purpose of disseminating the project results and promoting a follow-on investment programme. It was intended to:

- Bring together sisal producing countries to participate in the terminal workshop;
- Review results achieved from 1997 to 2004;
- Share experiences on new developments in sisal utilization and technology development;
- Take advantage of the results achieved by the project in Tanzania and Kenya in developing investment programmes in the sisal industry;

The discussions dwelled on how the project has contributed to the achievement of the United Nations Millennium Declaration goals, specifically to Goal 1, *Eradicate extreme poverty and hunger,* Goal 7, *Ensure environmental sustainability,* and Goal 8, *Develop a global partnership for development.*

1.1 Dissemination Workshop objectives

The main topics discussed during the workshop focused on the various aspects of the project implemented during the period 1997 to 2004, which are:

- Sisal production systems aimed at increased productivity per hectare and reducing the cost of production for the fibre;
- Smallholder and outgrower sisal farming systems;
- Meristematic tissue culture techniques for mass propagation and development of new clones which are more homogenous;
- Fibre extraction technologies, flume tow recovery systems and biogas production using the 98% and recovering most fibre for increased productivity and reduced fibre cost;
- Sisal fibre pulping trials and market analysis for pulping fibre and pulp;
- Utilization of sisal waste for animal feed;
- Economic and financial evaluation for a pilot scale fibre extraction project for pulpable fibre for the pulp and paper market;
- Demand for sisal products in Europe, North America and Asia;
- Experiences from Brazil, Mexico, China, South Africa and Cuba;
- Follow-on investment promotion through a paper on the industrialization of sisal;
- Achievements and the way forward.

Experiences from other countries included topics of interest such as the development of sisal composites and development of alcohol from sisal. The Workshop strongly relied on discussions and contributions from participants. The outputs of the eight-year work were shared and discussed during the workshop.

1.2 Workshop Programme and Agenda

The workshop itself lasted three working days from Wednesday, 17th November to Friday, 19th November 2004. The workshop was preceded by visits to project sites on 16th November 2004. These included tour of the gene bank and MTC Laboratory at ARI Mlingano, tour of Mwelya Estate smallholder farms, tour of fertilizer trial at Gomba Estate and tour of variety and CEPS trials at Hale Estate in the morning.

In the afternoon, Ambassador Ali Mchumo the CFC Managing Director and Dr. A. J. J. Rwendeire the UNIDO Divisional Managing Director laid the foundation stone for the sisal biogas plant and observed demonstrations on the flume tow recovery system built by the project. They also inaugurated the prototype hammer mill and viewed demonstrations of the hammer mill operations at Hale Estate.

1.3 Participants:

Participants were drawn from all sisal estates in Tanzania and all institutions involved in the project in Tanzania and Kenya.

- Invitation to participate in the Terminal Dissemination Workshop was extended also to:
- Donor countries;
- Counterpart institutions;
- Institutions from sisal producing countries involved in the development of other products from sisal;
- Financial institutions and Government Departments working closely with the sisal industry in Tanzania;
- Institutions involved in sisal marketing and utilization outside Tanzania and Kenya;
- Representatives from University of Dar-es-Salaam and Sokoine University of
- Agriculture;
- Suppliers and agents to the sisal industry in Tanzania

1.4 Financial and administrative arrangements

To cover the cost of attendance of those participants invited and approved by UNIDO, the following financial and administrative arrangements were made in line with UNIDO rules and regulations:

UNIDO provided:

a) Round-trip air economy transportation, by the shortest, most direct route and least costly fare, between the airport of departure in the participant's home country and Tanzania.
b) Arranged board and lodging at Mkonge Hotel and other Hotels in Tanga for the duration of the meeting.
c) Provided a reduced subsistence allowance for foreign participants for the period of attendance at the meeting and allowances toward the expenses incidental to travel abroad.

1.5 Visas

Before leaving their home country, participants were asked to approach the respective Tanzanian Embassies and complete all formalities regarding entry and transit visas, required for travel to Tanzania or send passport details three weeks before arrival for visas on arrival at the Dar-es-Salaam International Airport.

1.6 Arrival times

prior to travel to Tanga the next day. Foreign articipants arrived in Dar-es-Salaam on Monday, 15 November 2004. After arrival they were taken to Peacock Hotel and Royal Palm and traveled to Tanga on Tuesday, 16 November 2004 in time to participate in the afternoon activities on that day.

Participants from Tanzania and Kenya arrived in Tanga on Monday, 15 November 2004 and participated in visits to project sites on the morning of 16th November 2004 and to the afternoon session at Kwaraguru and Hale Estates.

2.0 Official opening: Wednesday 17TH November 2004

2.1 Briefing on the opening ceremony and programme

Mr. S. Shamte, Chairman, Project Coordinating Committee

Mr. Shamte welcomed all participants to the project dissemination workshop. He briefed the participants regarding the programme and stressed all to participate in the discussions. He asked all participants to welcome the Vice President of Tanzania at Tanga airport.

Before the start of the opening ceremony he asked participants to be seated, rise when the Vice President arrive and sit down when the Guest of Honour has sat. He explained that proceedings would be in English. He asked all foreign participants, High Court Judges, Members of Parliament, District Commissioners, Regional Departmental Heads and Religious Leaders to move to front seats.

Upon arrival of the Vice President Mr. Shamte welcomed the Guest of Honour and asked TOT to sing one song. The TOT song urged sisal stakeholders to revive sisal, increase efforts in research on sisal and markets. It called on the participants to work together in this era of globalization. Sisal stakeholders in Tanzania were asked to work towards achieving the goals set in the election manifesto for the third Government. It commended efforts by CFC, UNIDO and the sisal industry to revive sisal and asked for continued cooperation.

Mr. Shamte thereafter asked Capt. (Rtd) Jaka Mwambi, the Tanga Regional Commissioner to make welcoming remarks and continued to act as the master of ceremony during the opening session calling upon the various speakers scheduled for the occasion.

2.2 Welcoming remarks

Captain (Rtd) Jaka Mwambi, Tanga Regional Commissioner

The Regional Commissioner warmly welcomed all participants to Tanga. He said the people of Tanga felt honoured and proud to host the international meeting. He informed the Guest of Honour and the participants that sisal was once the mainstay of the economy of Tanzania. In 1951 for example, it made the biggest contribution to the national economy of 60.2% of the National Income of Tanganyika then. Sisal was the leading crop in Tanga Region. Tanga Region was the main producer in the country producing around 70% of sisal fibre and sisal products. He affirmed his desire to follow closely the deliberations of the Workshop because of the implications to the economy of Tanga and Tanzania and to poverty alleviation. Poverty, illiteracy and disease afflicted most of the people in Tanzania and the revival of sisal could help alleviate these problems. He hoped that fruitful discussions and constructive deliberations would be made by the Workshop for the benefit of all sisal growers, product manufacturers and consumers in the world.

2.3 Introduction of key guests and foreign participants

Hon. Mbaruk K. Mwandoro (MP), Chairman, Tanzania Sisal Board

Hon. Mwandoro thanked the Guest of Honour for accepting to grace the occasion despite his tight official schedule and assured the Vice President that investors and stakeholders would take seriously his guidance and directives on the development of the Sisal Industry in Tanzania and the world as a whole. He explained that the introduction of heavily subsidized synthetic substitutes, coupled with change in the technology of hay and straw baling had mainly contributed to the decline of the Sisal Industry. He said that the project started in 1997 aimed at addressing problems facing the Sisal Industry. He requested the Vice President to convey the industry's gratitude to CFC, UNIDO, IFAD, FAO, Belgian, Kenyan and Tanzanian Governments, who financed the activities of the Project from 1997 to 2004. He introduced key guests and foreign participants present. He congratulated Ambassador Ali Mchumo on his appointment to the post of CFC Managing Director.

2.4 Statement From Kenya

Mr. J. K. A. Cheluget, Head of Kenyan Delegation

Mrs. Mary Githaiga, the Assistant Director of Agriculture in the Kenya Ministry of Agriculture read the Director's statement. The Republic of Kenya felt greatly honoured to be associated with the very successful story of reviving the Sisal Industry, which was the engine of economic growth for East Africa in the 1960's.

The Kenya Government recognized the role played by Tanzania in co-implementing the Project, hosting previous workshops and the current Dissemination Workshop. The statement highly commended the role played by various farmers, international experts, Katani Limited, Tanzania Sisal Board, ARI Mlingano, Kenya Sisal Board, Kenya Plant Health Inspectorate Service, Kenya Agricultural Research Institute and sisal estates in both countries.

The findings and technologies developed in the project were considered of great importance to the revival and stimulation of growth in the sisal industry worldwide. The Kenyan Government expressed its commitment to creation of employment, poverty reduction, self-sufficiency in food production and sustainable environmental conservation.

The statement recounted how in the 1960's Kenya and Tanzania around 300,000 metric tons of the world's 800,000 tons and acknowledged how the achievements made by the project since initiation in 1997 helped arrest the declining trend in sisal production in the world. Six outcomes of the project were acknowledged. The first was collection, reviewing, assembling and publishing of all research findings prior to mid -1970s. The second was production of extension manuals and brochures for application of developed technologies. The third was improvement of sisal production systems, agronomic through meristematic tissue culture, improved agronomic practices and varieties, capacity building and technology transfer. The fourth was enhanced utilization of the sisal plant. The fifth was development of new fibre extraction technologies using the hammer mill and the sixth was utilization of sisal waste to produce products of economic value and reduce environmental pollution. The statement concluded by challenging the developing countries to implement the results of the project and urged development partners to be willing to assist as and when necessary.

2.5 Statement from FAO

Mr. Shakib Mbabaali, Commodity Specialist FAO, Rome

On behalf of FAO he thanked the Vice President, Ministers and other distinguished guests for agreeing to officiate and attend the official opening ceremony of the Workshop. He thanked the workshop organizers, CFC, UNIDO and the national project staff in Kenya and Tanzania for undertaking the project activities. He assured the workshop that the project objectives were consistent with elements of the Commodity Development Strategy of the Intergovernmental Group on Hard Fibres to

expand markets and improve returns to stakeholders, improve production and processing technologies to reduce cost, and improve and maintain social and environmental standards.

He reminded the participants that many families particularly in Africa, Asia, Central and South America depended on sisal production and trade as a source of income and for food security. He cited the loss of market share to synthetic fibres, change in technologies for haymaking, poor marketing arrangements, barriers to free trade, low utilization of the sisal plant and inadequate research and development efforts as contributing to the decline. He emphasized the serious economic consequences on the economies of Kenya and Tanzania who in the 1970s produced 30 percent of 800,000 tons produced worldwide but declined to only 17 percent of the 249,000 tons produced worldwide in 2003. He recounted how sisal stakeholders had come to the conclusion that the way out of the predicament was through diversification, reduction of production costs, and expansion of demand through increased utilization of sisal.

He commended the involvement of the private sector in the entire process and concluded by expressing his organization's preparedness in its capacity as the Secretariat for the Inter-Governmental Group on Hard Fibres, to continue working with all those concerned in improving the livelihoods of those involved along the supply chain.

2.6 Statement from UNIDO

Mr. Abel J. J. Rwendeire, Managing Director, UNIDO

Mr. Rwendeire conveyed fraternal greetings from the UNIDO Director General, Mr. Carlos Magariños and entire UNIDO staff on workshop. He expressed great honour and privilege to participate in a dissemination workshop presided over by His Excellency Dr. Ali Mohamed Shein, the Vice President of the United Republic of Tanzania and other distinguished guests.

UNIDO viewed the project as one of its major undertakings the design and implementation of programs and projects on poverty alleviation through job and wealth creation. As a specialized agency geared at enhancing productive capacities of developing countries and sustainable industrial development, it provides technical cooperation services that enhance skills, technology diffusion and capacity building for market access. To this end the sisal project had endeavoured to combine the best elements of UNIDO services in technical cooperation assistance.

UNIDO's activities in Tanzania were initiated many years ago targeting development partnership in industrialization. Current projects included a US$ 7 million integrated programme for capacity building in food processing, quality control, bio-safety, women entrepreneurship development, utilization of information technology for promotion of small and medium scale enterprises.

He extolled the establishment of the pilot biogas plant as a start in product diversification and urged the building of more biogas plants in order to produce up to 40 MW of electricity.

He challenged sisal industry stakeholders to develop other useful products such as pharmaceutical products, inulin, citric acid, alcohol and composites for added value to the sisal plant.

He congratulated ARI Mlingano and KEPHIS for their resilience, persistence and cooperation in technology diffusion especially relating to tissue culture. He commended TATC and Katani Limited for pioneering in technological innovation.

He encouraged TATC and other private sector players to extend the technological innovation to other commodities like coconuts, cassava and cashew nuts. He reiterated the need for continued value addition and manufacturing in order to eradicate poverty and usher in sustainable development. He called upon all development partners to support the expansion of the pilot projects.

He thanked CFC for its contribution in the project and many others and for its cooperation with UNIDO. He thanked the Kenyan and Tanzanian Governments, the various private sector stakeholders involved in the project and the Sisal Association members from Kenya and Tanzania for their contributions. He closed by thanking all participants for finding time to attend the workshop and share experiences.

2.7 Statement from the Common Fund for Commodities

Ambassador Ali Mchumo, Managing Director, CFC

Ambassador Mchumo expressed pleasure for the Vice President's acceptance to officiate the opening of the workshop and the attendance of very senior Government and private sector officials from Tanzania and Kenya as well as other member countries of the Fund. He highlighted activities of the Fund and reasons for providing the main financing of the project.

The Common Fund for Commodities being an autonomous intergovernmental financial body within the United Nations umbrella had partnership with 106 member States and three institutional members (the African Union, the Common Market for Eastern and Southern Africa and the European Union). The CFC mandate is to enhance commodity producers' socio-economic development by assisting in strengthening and diversification of commodities, which provide livelihood to around 1 billion people. The fund focuses on commodities rather than the traditional country focus. The activities of the Fund include research and development, productivity and quality improvement, technology transfer, diversification and processing and improvement of marketing and market access. The Fund's concentration is on low cost and high impact projects. By the time of the workshop the Fund had approved 130 regular projects and 50 small-scale projects covering 45% of the US$ 350 million involved in 35 commodities. Project proposals are submitted to the Fund through 24 designated International Commodity Bodies.

CFC-funded projects focus on the poor, small producers and exporters, smallholders and small and medium sized enterprises. Poverty alleviation is the overriding goal and thus 85% of the financing is in grants. As a consequence of the commodity focus,

CFC-funded projects target on common problems as perceived by commodity producing countries. To ensure all member countries benefit from the limited projects, large emphasis is put on wide dissemination of the results hence the reason for holding the workshop. Ambassador Mchumo recalled the long history of the project dating back to early nineties, which had to go through several rounds of revision before approval.

He acknowledged contributions from UNIDO, IFAD, the Government of Belgium, as well as Tanzania and Kenya. The Fund had financed the major part and provided for US$ 1.25 million as a loan for a pilot sisal fibre extraction project producing leaf at around US$ 100 per ton to be able to compete with softwood. The main features of the project were cited as being increased productivity, effective use of by-products, increased fibre extraction efficiency, and low cost production of fibre and market development. Due to various factors impacting on the project it took 8 instead of 5 years to implement the project. He urged the presenters to give the achievements and setbacks as part of the learning process. He urged investors to select results to be commercialized after the presentations.

He promised support in financing the commercial fibre extraction facility earlier envisaged in the project. In recognition of the importance of sisal the CFC had committed itself in 4 projects including the biogas project, the sisal cement composite project and studies on alternative applications for sisal and henequen whose dissemination had already been published in CFC Technical Paper No.14. CFC involvement in Tanzania stood at 18 approved projects with CFC contribution of US$ 35 million. He hoped the activities supported by CFC in Tanzania and elsewhere will directly or indirectly contribute to the achievement of the objectives of the Common Fund.

2.8 Invitation of the guest of honour to open the Workshop

Hon. Dr. Juma Ngasongwa (MP), Minister for Industries and Trade

Hon. Dr. Juma Ngasongwa (MP) Minister for Industries and Trade thanked the various financiers of the Project and commended Katani Ltd and Kenya Sisal Board for successfully implementing the Project. The Minister then invited the Vice-President of Tanzania, His Excellency Dr. Ali Mohamed Shein to give the official opening speech.

2.9 Official opening statement

H.E. Dr. Ali Mohamed Shein
Vice-President of the United Republic of Tanzania

The Vice-President thanked the organizers for inviting him as the Guest of Honour to officiate the opening of the Workshop. He commended the initiative to hold the Workshop in Tanzania especially in Tanga, which used to be referred to as the "Sisal Capital of the World" during the heydays of the sisal industry in the 60's. He therefore extended a warm welcome to Tanzania to all participants of the Workshop.

He reminded the participants that some 40 years ago, Tanzania and Kenya were the leading sisal producing countries in the world with Tanzania producing over 200,000 tons of sisal fibre per year at its peak, which declined to around 25,000 tons per year by 2004. The decline in production caused by synthetic substitutes depressed the living standards resulting in widespread poverty. He expressed happiness at the arrest of the decline and the realization by people all over the world that synthetic products cannot replace natural products due to their hazardous and detrimental effects to the environment.

He commended CFC, UNIDO, FAO, IFAD, the Belgian Government and the sisal industries in Tanzania and Kenya, for conceiving and financing a Project, whose objectives centered on poverty eradication, economic development and environmental conservation. The Vice President reminded participants that the sisal industry stakeholders expected guidance on the prospects in store for the revival of their industry. He expected the Project results to be made available to producers, consumers and all interested parties in all sisal-producing countries.

He noted that the sisal industry had good prospects and a bright future due to enhanced quality, pricing and lower production costs for various products identified from all the parts of the sisal plant, among which were cordage, woven products, pulp and paper products making them more competitive to substitutes. He urged sisal producing countries to diversify into other products like composites for automotive and other industries, energy, animal feed, building and roofing materials and pharmaceuticals through industrialization of sisal as a way forward to full development of the sisal industry. He asked participants to make research and development, product and market development, part and parcel of the permanent sisal industry initiatives and assured them that collaboration among producers and other stakeholders would sustain the industry beyond the life span of the Project. He urged CFC, UNIDO, IFAD and FAO to continue supporting the industry through publishing of results, initiation of pilot plants and project profiles to attract investors and financiers.

On the smallholder sisal farming schemes, he felt satisfied with the scheme assessment proving its viability and expected it to contribute positively towards eradication of poverty among the rural poor. He emphasized the need to adopt smallholder and outgrower schemes in order to widen ownership and transform smallholders into commercial farmers linked to the market system. He commended the initiative to utilize the sisal waste to produce products of economic value and reduce environmental pollution. He emphasized the importance of the revival of the sisal industry and its potential to contribute to poverty alleviation, employment creation and to economic growth and development in general. The key to successful revival of the sisal industry was the support and partnership of public and private sectors.

He pledged the Tanzania Government's full support in the revival of the sisal industry and thereafter declared the Workshop officially opened.

2.10 Vote of thanks

Mr. D. D. Ruhinda, Chairman, Sisal Association of Tanzania

Mr. Ruhinda started by recalling the history of the Sisal Industry in Tanzania. The Industry was exactly 112 years since 62 plantlets arrived in the then Tanganyika from the Yucatan Peninsula of Mexico. The workshop was therefore a reincarnation of the Tanzanian Sisal Industry and a challenge to Tanzanians to revamp the industry with determination, vigour, hope and vision of reclaiming the number one position in the world as used to be in the 1960's. During the three days participants were urged to share with scientists useful findings collected from the eight years of research.

He thanked Dr. Ali Mohamed Shein, the Vice President of United Republic of Tanzania for using his precious time to grace the Workshop and for his words of wisdom and encouragement. He recalled how H. E. President Benjamin Mkapa had also honoured the industry by chairing a meeting of sisal stakeholders for a whole day in August 2001. He assured the Vice President that his guidance would be followed.

He thanked H. E. Ambassador Ali Mchumo as without his great intervention and that of CFC this Project would not have been implemented. He thanked Dr. A. J. J. Rwendeire for UNIDO's most valued contribution in implementing the Project with total commitment. He thanked Hon. Dr. Juma Ngasongwa, the Minister for Industries and Trade as counterpart for UNIDO for his valuable guidance and participation. He thanked Hon. Charles Keenja the Minister for Agriculture and Food Security for guidance. He recognized the presence of other Ministers and their support at different levels of decision-making.

He commended Hon. Capt. Jaka Mwambi, the host Regional Commissioner for recognizing, accepting and pushing for growth and sustainability in the sisal industry. He thanked all the Regional Commissioners, Members of Parliament, and the Mayor of the Tanga Municipality, District Commissioners, Municipal and District Directors for their unfailing support and guidance. He recognized the contributions from CFC, UNIDO, IFAD, Belgium, Tanzania and Kenya Governments and appealed to them to continue supporting the industry.

The Sisal Association of Tanzania thanked the Government of the United Republic of Tanzania for creating a conducive environment, for recognizing the sisal industry and streamlining taxes. He however agitated for a smart public and private partnership. SAT called upon the Government to abolish land rent and tax on tools of production. Taxes on farm fuel, oils and lubricants and electricity tariffs should be reduced and the transfer of titles to those who acquired sisal estates after privatization seven years ago should be finalized.

After the vote of thanks, group pictures were taken with the Guest of Honour and other dignitaries and the workshop made a break for tea while the Vice President was being escorted to the airport. In the evening all participants were invited to dinner and a cultural evening.

3.0 Introduction of presenters for the morning session
Mr. S. Shamte, Chairman, Project Coordinating Committee

Mr. Shamte as Chairman introduced the programme for the day and the presenters who were to present papers. The programme was to start with Project Rationale and Highlights by Sietse van der Werff the Senior Project Manager in CFC, followed by Mrs. Mayra Sanchez Osuna the Deputy to the Director Energy and Cleaner Production Branch, Programme Development and Technical Cooperation Division. A presentation on New Production Systems, Variety and Fertilizer Trials by Dr. Walid Khayrallah of Mkonge Resource Development Corporation in Canada as the International Consultant was to follow. Discussions were then to be held on the presentations and responses made. The workshop was after that to break for tea. After tea break Mr. Gideon Seng'enge an Agronomist in the Project was to make a presentation on Smallholder Sisal Farming followed by discussions and responses. Before breaking for lunch Dr. Manuel Robert from CICY in Mexico as the International Consultant for the sub-component was to make a presentation on Sisal Multiplication by Meristematic Tissue Culture followed by discussions and responses.

4.0 Project rationale and highlights

4.1 Mr. Sietse Van Der Werff, Senior Project Manager, CFC

Mr. van der Werff explained the need for holding the dissemination workshop in order to exchange results and information. Prior to the final dissemination workshop results and information about the project was disseminated at a workshop were held in 1998, newsletters, national coordinating and project coordinating meetings and stakeholder meetings.
Technical reports on individual components and proceedings of the workshop would be disseminated to all countries dealing with sisal and to interested parties.

The main objective of the project was to make sisal production more productive and more rewarding leading to expanded production and descent income for the rural population contributing to poverty reduction. The focus was on fibre for pulping as this was considered as the best approach at inception. Sisal has however, a lot of applications and there is still a lot to be discovered. One can argue whether the initial focus was the best approach.

He assured all participants that they stood to benefit from the presentations and should recommend alternative development areas. He urged all participants to give views on possible improvements and possible alternatives. Sisal is not the easiest plant to work with as it takes many years. Participants were asked to give recommendations on how to improve sisal productivity. He hoped the workshop would provide a forum for productive exchange of information and deliberations.

4.2 Mrs. Mayra Sanchez Osuna, Deputy to the Director, UNIDO

Mrs. Sanchez promised to give a general view of the Project leaving the details on the specific components to the international and local consultants. She recognized the excellent work done by her predecessor Mrs. Rosely Viegas Assumpçao. The project started in 1997 with UNIDO as the Project Executing Agency (PEA) working with staff from Kenya and Tanzania on the project.

The main objective was to produce fibre that could compete with fibre from other crops. To do so the project had to establish the techno-economic feasibility of using sisal for various grades of fibre and the utilization of different parts of the plant. The project was planned to last 5 years but took 8 years. The results were to be disseminated to Brazil, Mexico, Haiti, Madagascar, Philippines and China. Due to language problems Haiti was unable to send a representative as no participant conversant in English was available and the project could not afford expensive translators. Neither was Philippines and Madagascar.

The design of the project took into account many factors. The major ones were low sisal prices in the market, loss of market share to synthetics, environmental concerns on its production process and its obligation to contribute to social and economic aspects of job creation and improvement of the living standards of the local population. The industry in Kenya and Tanzania was and still uses only 2 percent throwing away 98 percent. Low profitability and high capitalization characterized the industry making it unable to sustain itself and compete in the global market. It was unable to fully meet global conditions for export. She presented a chart showing the industry was using 2-4 percent of the leaves with 96-98 percent going into liquid waste disposed in ponds, fields and rivers causing high oxygen demand depletion. Poles, roots and boles not used for construction and cooking were burnt in the field causing air pollution or left in the field to be harbours for weevils.

The international community highly valued the project and made the following contributions:

Source	**Amount in US$**
CFC	2,248,957
Belgian Government	365,276
UNIDO	585,104
TOTAL	3,199,337

Mrs. Sanchez briefed the participants on the different project sub-components objectives and about the resources needed and utilized for the implementation of the sub-components' related activities.

5.0 New production systems, variety and fertilizer trials
Dr. Walid Khayrallah, International Expert from Canada

Dr. Khayrallah first thanked Mr. Gideon Seng'enge, the Project Agronomist and Mr. Akonaay, the Agricultural Officer at Hale Estate for assisting him in all field activities

and close follow up during implementation since the inception of the trials in 1999 to 2004. The main objective of the trials was to revive the Sisal Industry by helping it to become more competitive and by opening a large new market for pulping fibre and pulps. In order to penetrate the new fibre and pulp markets, the raw material cost had to be drastically reduced, the fibre must be of uniform quality and raw material availability had to be assured.

He summarized the critical component of this as to treat the *Agave* plant as an agricultural crop by improving systems of producing planting materials, increasing field plant density and introducing cost - effective field and crop management operations.

He listed the agro R & D activities as enhancement of nursery production trials, CEPS confirmation trials, ultra high-density trials, use of new mechanical aids for enhancement of productivity and application of fertilizers and sisal wastes in the sisal trials.

In the enhanced nurseries, intensive field management was adopted to increase productivity and cut down cost. The plant density in the nursery was increased from 80,000 to 100,000 plants per hectare. After 6 months, the seedlings had attained a weight of 250 gm each and were about 25 cm long. The cost per seedling was TShs. 4 resulting in reduced field establishment costs.

The Consultant gave figures of potential fresh whole plant biomass per hectare for the four varieties (hybrid 11648, *Agave sisalana*, Hildana and Mlola 487) at 6400 and 8,000 plants/ha and at four different ages. Data on leaf fibre yields and whole plant fibre production potential was presented.

On selective leaf harvesting results, he concluded that higher yields and lower mortality was achieved when 10 or 15 leaves were left on the plant during each defoliation. Hybrid 11648 produced more leaf biomass than the other three varieties. Total defoliation of hybrid and Mlola 487 caused more losses due to weevils than in *Agave sisalana* and *Hildana*. He discouraged higher levels of defoliation if the crop is kept for more than 4 years in the field.

He presented costs involved in raising seedlings from nurseries, costs of field establishment and maintenance and cost of fibre production per ton of air-dried metric ton of fibre.

In the intensive field production systems (CEPS), the plant density was increased by 50% resulting in increased fibre production. Yields of the four varieties tried (H. 11648, *Agave sisalana*, *Hildana* and Mlola 487) at different densities and harvesting periods were given. Likewise costs of production of an air-dried metric ton (ADMI) were given.

The consultant recommended continued gathering of data from CEPS I and CEPS II plots, analysis of soil fertility at the end of each cycle particularly levels of calcium and organic matter and evaluation of requirements for correction for long term sustainability of productive soils. He suggested use of cheap lime and other inputs

and to employ more effective leaf gathering systems like those adopted in South Africa for further cost reduction.

Discussion

Mr. G. O. Seng'enge
He recommended to the participants to adopt selective lifting of seedlings from the nurseries so that at the end one is left with a sisal field at the old nursery site. He reported that Mnazi Estate on the foot of the Usambaras had adopted the farming system and had 10 hectares of sisal ready for harvesting. The system had cut down the cost of establishment by more than Tshs.100, 000 per hectare. In areas with bimodal pattern of rainfall, farmers were encouraged to establish sisal fields directly from selected medium to large sisal bulbils. Mkumbara sisal estate situated about 150 km north from Tanga had adopted this system successfully.

Comments from other participants:
It seemed possible to have differences in terms of fibre quantity and quality between plants established directly from the bulbils and those planted from the seedlings raised from a nursery. This needs to be investigated further.

On application of organic and inorganic fertilizers it was considered important to confirm if the benefits of such an application outweigh the costs.

On the Korogwe Leaf Spot disease (KLS), the problem was initially thought to be due to mineral deficiency in the soils but when soil amendments were applied the problem persisted. A new project to address KLS was recommended.

6.0 Evaluation of smallholder farming systems
Mr. Gideon O. Seng'enge, Project Agronomist, Tanzania

Mr. Seng'enge recalled the historical background of the smallholders scheme since 1994 when the then Tanzania Sisal Authority initiated a smallholders pilot scheme at Kimamba Fibres in Morogoro Region in which by the end of 1998, 109 farmers were allocated 720 hectares of which 236 hectares were planted sisal. In 1997 IFAD began funding a similar sisal scheme in Mara Region.

He recounted how farmers in the Lake Victoria Regions of Mwanza, Shinyanga, Mara and Tabora had grown sisal around their farms and homesteads as hedges for years. The fibre extracted manually was used for ropes, bag making, building, fishing and other uses. He informed the delegates of the study done by Mara-FIP on sisal in the Mara Region. The main objective was to evaluate farming systems suitable for sisal farmers to optimize returns, improve production practices especially technologies for fibre extraction and provide an alternative cash crop for poverty alleviation. This study in the Mara Region targeted farmers in dry areas, companies processing sisal fibre into products, local government and other stakeholders.

By the end of the Mara-FIP Project in December 2002, each of the four Districts had planted one hectare of sisal nursery, which provided planting material for 48 hectares. One project agronomist, extension staff and farmers were trained on sisal husbandry.

In the sisal schemes involving farmers and workers in sisal estates, the Project reviewed the farming systems in Tanzania since 1967 by collecting data from Kwaraguru, tea and sugar outgrowers. From this review it was recommended to allocate a minimum area of 6 hectares per family. The study recommended subsidization of sisal establishment and maintenance costs by the Government, development of mini-decorticators for farmers living far from estates and encouraged farmers to adopt mixed crop farming to maximize land use and provide food and cash. Tanzania Sisal Board was to assist all sisal smallholders especially those in Mara Region in finding markets for their fibre.

He reported that prior to implementation of the smallholder/outgrower scheme in Katani Limited the Private Sector Initiative of Dar es Salaam and ACDI-VOCA of USA undertook additional studies and farmers were sensitized and trained. Officers were sent on study tours to China, Brazil and Mexico where valuable information on land ownership, fibre extraction methods, marketing of fibre and products was collected. By September 2004 Katani Limited had allocated 21,591 hectares to 2,121 farmers who had planted 1,912 hectares. The remaining area was in different stages of preparation. He reported that sisal farmers at Mwelya had sold 5,573 meters of sisal leaves earning Tanzania shillings 22.1 million. The farmers in Katani Limited estates had organized themselves in 43 groups and had formed five cooperative societies.

Newsletters, workshops, national coordinating committee, project coordinating committee, annual sisal stakeholders meetings were used to disseminate the results. It was learned that capacity building through participatory approaches and training were necessary for success. Other lessons were that commitment and cooperation of politicians was required for smooth implementation, sisal ownership and land had to be assured right from inception. Sisal was a crop, which even under adverse weather conditions, farmers survived from sisal proceeds.

He recommended grants and soft loans for farmers to cover sisal establishment and maintenance. Soft loans were also recommended for spinners, weavers and other processors. Savings and credit societies leading to formation of a Sisal Bank needed to be put in place. He further recommended that farmers near sisal estates, schools, national service camps and prisons be encouraged to grow sisal. Cooperative groups needed strengthening, groups needed more education on participatory planning, monitoring, evaluation and organization.

Discussion

Mr. O. O. Wilson, Director General, Tanzania Sisal Board
He started with a quotation from a "monthly letter" from the then Ministry of Agriculture, Forestry and Wildlife reporting the Newsletter of TSGA of 9/2/1965. It highlighted sisal planting progress in Morogoro, Tanga and Shinyanga Regions. In Morogoro, he said sisal planting by smallholder farmers was started in 1957 by H. Maliaga who had 70 acres and by 1963 had produced 4 tons of fibre. In Tanga

Region there was a good response from all Districts to plant sisal and in Shinyanga enthusiasm for growing sisal especially in Maswa, Shinyanga and Kahama Districts was growing. It was therefore clear that involvement of smallholders in sisal production started many years ago and the Government and the sisal companies like the Amboni Limited encouraged it. In the Lake Victoria Regions sisal was grown predominantly in hedges. Production of sisal by the smallholders declined from 1976 after the collapse of the cooperative movement in Tanzania. The farmers in the Lake Regions are still growing sisal in hedges around their farms and homesteads.

Recent developments included the involvement of the Government and IFAD to promote sisal production in the Mara Region through Mara-FIP with financial assistance from IFAD. The latest development was the initiative of Katani Limited in promoting smallholder production in its estates coupled by the Government initiative to undertake a feasibility study on production and processing of sisal in the Lake Regions after securing funds from BADEA. Tanzania Sisal Board in collaboration with Local Governments in the Districts has worked out a development program for areas without a reliable cash crop, especially dry areas.

He cited the major constraints facing the sisal smallholder and outgrower development in the country. These were lack of capital for sisal establishment and maintenance and wrong perception of some politicians and Government officials who do not believe that sisal can be grown profitably by small-scale farmers. Other constraints included inadequate training and extension services and inadequate availability of processing machinery mainly decorticators, brushing and baling facilities for the farmers especially those in the Lake Regions.

In concluding he recommended the way forward be to encourage farmers to form cooperatives, issue land titles to farmers to be used as collateral for loans, establishing processing facilities and educating stakeholders like Government officials, politicians and policy makers that sisal can be grown and developed by smallholders.

Dr. N. Subbiah Director Mohamed Enterprise, Tanzania
He told the participants that Mohammed Enterprises would continue to grow sisal as a company but would allocate some area to farmers for sisal growing and assist them. He however wanted to know why the land allocated to farmers was reported to be 21,591 hectares while only 1,921 hectares were planted sisal by end of September 2004.

Mr. Frederick Malika, sisal smallholder farmer from Mwelya, Tanzania
He thanked the management of Katani Limited for providing land and expertise for sisal production to farmers living around sisal estates. The Scheme had addressed the problem of land shortage for food crops production and provided reliable income to farmers through sales of sisal leaves and excess food crops harvested.

He wondered why the Government favoured farmers in Mara Region by providing them with loans for land preparation, establishment and maintenance but did not extend the same treatment to farmers in estates.

Mr. Samuel Sassi, Regional Agricultural Adviser Mara Region, Tanzania
He responded to Mr. Malika that it was not true that the Government favoured the farmers in the Mara Region. He clarified that the Government and IFAD financially supported the Project in Mara Region and that the results obtained were to be used to establish similar schemes in other parts of Tanzania.

Fibre prices realized by farmers in Mara Region were however not sufficiently remunerative for the sisal farmers. The farmers were being paid only TShs. 140 per kilogramme of fibre while the world price was around TShs. 650 per kg.

Mara Region was working on ways to cut down costs so as to increase farmers' profit. This included cutting down fibre transport cost by brushing and baling the fibre before selling to fibre merchants. Plans were under way to establish rural cottage industries for processing the fibre into handicrafts like ropes, bags, mats etc.

Dr. Ali Majani, Livestock Manager, Katani Ltd Tanzania
He particularly wanted to be informed of the reason for registering only one cooperative society out of the five cooperative societies formed by the farmers.

Mrs. Mary Githaiga of Kenya
Smallholder farmers have grown sisal for years in Kenya in hedges around their farms and homesteads to protect fields, livestock and crops from wild animals, especially at night. In the early 1960's annual production from smallholders averaged 15,000 tons of fibre. Sisal fibre from the smallholders has created cottage industries in rural areas dealing mainly with processing the fibre into various products, including the now famous kiondo bags, which have found good markets in Europe and elsewhere in the world. Women and youth groups operate many of these industries. A good example was the Yatta South Women's Group (YSWG) formed in 1986 by merging 31 women groups. It had 2,030 women members. Among other activities the Group dealt with income generation activities like making sisal fibre based products, samples of which were displayed in the Kenyan stall at Mkonge Hotel.

Hon. Shaweji Abdallah (Member of Parliament, Kilosa, Tanzania)
He thanked the presenter of the paper and suggested that the Government, the Sisal Industry and all the sisal stakeholders direct more effort and resources on research and development. The aim should be to commercially exploit about 75% of the *Agave* plant from the current situation in which 2% only of the plant is utilized and the remaining 98% is thrown away as waste to the detriment of the fragile environment.

Many sisal estates are dying and reverting to bush due to inadequate sisal planting and maintenance for many years. Sisal husbandry requires among other things to rotate annually 10% of the sisal estate area. He called on the sisal plantations to include sisal smallholders in their planting programmes so as to efficiently utilize the land designated for sisal.

He was particularly concerned with the performance of the Agricultural Research Institute at Mlingano. He suggested that there was a need to make a follow up and review their problems, including the frequent power interruptions, in order to get a solution.

Mr. Shariff of Tanga, Tanzania
He sought a clarification on weather the term "smallholder", was based on the hectarage one has or on the financial standing of an individual. He called on the Government to reduce bureaucracy in registering sisal smallholder's cooperative societies.

Response by the presenter Mr. Gideon Seng'enge
He thanked the contributors for their valuable comments and suggestions. He specially thanked the Director General of Tanzania Sisal Board, on behalf of the Government, for including the sisal smallholder Scheme in the Government strategic plan promoting sisal production by farmers in arid areas of Tanzania. He also thanked Hon. Abdallah Shaweji (MP) for his good comments.

On Dr. Subbiah's question concerning the small area planted sisal compared with the hectarage allocated, he reported that the remaining area of 9,670 hectares included areas in different stages of preparations for sisal planting and areas under seasonal food crops. The Agreement entered between Katani Limited and the farmers required each farmer to plant annually 25% of the total area allocated to him.

On Mr. Sassi's comments regarding the low sisal prices paid to the farmers per kilogramme he answered that it was due to the transport cost involved in carrying the bulky, loose and unbrushed fibre to the processing mills in Tanga, a distance of almost 1000 kilometres away. He recommended that the Region should rehabilitate the brushing and pressing facilities in Musoma and educate the farmers to avoid packing their sisal with foreign objects like stones etc. in order to increase the weight.

On Dr. Majani's question concerning registration of farmers' cooperative societies, he reported that bureaucratic actions of some Government officials had been the cause.

Mr. Seng'enge defined the term "smallholder" as a farmer having up to 6 hectares and basically using own or family labour, while an "outgrower" is a farmer with areas ranging from 20 to 200 hectares employing other people to work on his farm.

7.0 Sisal multiplication by meristematic tissue culture
Dr. Manuel Robert, International Expert, CICY Mexico

The International Expert in outlining the stages involved in plant multiplication by MTC said that the first and crucial activity was the selection of the plant material on the basis of its genotypic and phenotypic properties. The plant is then cut and all its leaves removed. Then the meristem is cut into small pieces followed with induction, growth and multiplication phases. The plantlets are transferred to the greenhouse before finally planting them in the open nursery prior to transplanting in the field. Therefore, from one piece of the meristem, many shoots can be produced for multiplication to thousands of genetically homogenous clones with the desirable characteristics and which are eventually planted in the field. The selection in traditional nurseries is done in the field, when collecting bulbils and finally in the nursery during transplanting. The selection for MTC material is done in the field from

the mother plants with desirable characters. In addition the Participants were briefed on the MTC activities being done in Mexico involving the *Agave tequilana.*

He informed the Participants that the main objective of MTC is to cut down time and cost of producing seedlings for propagation to the field and at the same time obtain genetically and metabolically uniform and of high quality plant material with desirable characters.

The International Expert was also the Consultant of MTC activities in Kenya and Tanzania. He said that the MTC laboratory at ARI Mlingano was renovated and refurbished from an old building while the one in Kenya was from an existing agricultural laboratory and it was doing an excellent job. Both MTC laboratories have well trained personnel and facilities for production of several thousand plantlets per year. He emphasized the need to have germ plasma collection for future breeding and research work. He recommended that plants with desirable characters be continuously selected in the field before taking them to the laboratory for plant multiplication by meristematic tissue technique.

Discussion

Mr. Philip Njoroge, (KARI) Kenya
He confirmed that MTC was beneficial both to the plant breeders and to the farmers for the present and future applications. Farmers using suckers to establish sisal fields have observed tremendous variations in fields in terms of plant size, early poling and leaf unfurling. The material produced in MTC laboratories is uniform genetically and in size. He however observed that the plant genetic base in East Africa is very narrow, tissue culture can therefore be a solution to this. He suggested that the participation of growers including sisal smallholders is a vital ingredient of success. Regarding the technology of the bioreactors mentioned by Dr. Robert, he recommended the two Governments of Kenya and Tanzania provide funds for adopting this new technology in research.

Mr. Ndekirwa Nnyari (Mohamed Enterprise Ltd) Tanzania
When he visited ARI Mlingano he observed that the Institute could not transfer the plant material to the open nursery, although it was ready, due to the dry weather. His company raises planting material first in a primary nursery at an ultra high density followed with a secondary nursery. The former needs to be irrigated to cut down mortality rate and to speed up growth. He suggested that the MTC open nursery should be irrigated especially during prolonged drought, but costs involved should be taken into consideration. He however, wanted to know the reason for evaluating hybrid 11648, which had already been evaluated before release to growers many years ago and farmers know its field performance.

Mr. Damien D. Ruhinda, Chairman Sisal Association of Tanzania and sisal grower
He said that since the MTC sisal material from ARI Mlingano had been released to Rudewa estate in Kilosa District, he wanted to be assured of its superiority and the field lifetime vis-à-vis other sisal cultivars before he could be convinced to accept the material. Secondly, he wanted to get the opinion of experts on the genetically modified plants as in maize, wheat and other crops on their genetic degeneration and

yields. He suggested that in order for the material from the MTC laboratories to be useful to the farmers, the yields must exceed those of other materials raised from the traditional nurseries and the period taken to pole must also be longer. If farmers adopt the sisal MTC material, the chances of planting undesirable material, as was once the case with the 'kaptura' will be avoided.

Hon. Musa Lupatu (MP)
He shared Mr. Ruhinda's concern on the effects of GM crops. He reminded the Participants that Tanzania has had a bad experience by growing coconuts, oranges and tea varieties, raised by MTC methods and then introduced in the country about twenty years ago. In the first two years they performed well but thereafter their performance declined due to their sensitivity to weather changes. He wanted to be assured that the sisal planting material raised in MTC laboratories would perform better despite variations in the weather. He was interested to know if there was some literature to support Dr. Robert's observations and recommendations.

Response by Dr. Manuel Robert, the Presenter
He pointed out that the use of secondary nurseries by Mohamed Enterprise increases cost of planting materials. Secondly, he assured those worried with genetically modified plant material that the seedlings from MTC laboratories are clones and therefore free from genetic transformation. Thirdly, according to his experience, tea, coconuts and other plants raised in MTC laboratories perform much better that those established direct from traditional nurseries.

In closing the discussions, the Chairman advised all the Participants with more comments, to discuss them further with the Expert outside the meeting as time was running out.

8.0 Fibre extraction technologies, flume tow recovery and biogas production
Mr. Gilead Kissaka, Project Engineer, Tanzania

He informed the participants that current fibre extraction losses ranged from 15 to 20% and the cost of extraction was very high. The objectives of the study were therefore to evaluate processes of hammer milling versus roller crushing, to recover more fibre from leaves for paper, composites and other uses and to extract fibre from sisal boles hitherto left to rot in the field. During implementation he reported that two chippers imported from Brazil were modified by the Tanzania Automotive Technology Centre (TATC) to chip sisal leaves to small pieces of about 7 cm long. It was observed that at a maximum rated mill capacity of 12 tons per hour there was no excess material at the over flow chute and the mill ran smoothly. The proposed FEX pilot plant should have a chipping system capable of handling up to 12 tons of the raw material per hour. He recommended two mills in parallel. The first mill would have a capacity of 9.6 – 12 tons per hour for the first pass and second mill would be for the second pass with an injection of 27 cubic metres of water per hour.

He summarized the lessons learnt as being that fibre extraction with roller crushers damages the fibre. Combining roller crushers and the hammer mill did not improve the fibre quality. Washing the fibre in a water bath increased water consumption. It

was possible to extract fibre from the boles using the hammer mill but he cautioned that leaf fibres should not be mixed with bole fibres as they require different cooking conditions during pulping.

Discussion

Mr. Ndekirwa Nyari, Mohamed Enterprises Ltd, Tanzania
Wanted to know ways of commercially utilizing sisal boles besides extracting fibre.

Response by Mr. Gilead Kissaka, the Presenter
The sisal boles are rich in fibre as well as in polysaccharides (sugars) and other chemicals. The fibres could be used in pulp production while the juice can be converted to produce alcohol and other commercially useful products including pharmaceuticals.

9.0 Fibre production for the pulp and paper market: sisal fibre pulping trials, pulp and market analysis

Mrs. Rosely M. V. Assumpcao, International Expert, Brazil

World paper and board production was projected to increase between 1995 and 2010. Latin American countries were in the lead with projected production of about 400 million tons by year 2010 from about 205 million in 1995.

In second place were North American countries whose production was projected to reach 125 million tons by year 2010. Africa and Australasia were least with a negligible projected production increase quantities between 1995 and 2010.

In the world demand for paper and board, the largest consumers were the North America and Asia with a projected demand exceeding 400 million tons by 2010 while the last consumers were again Africa and Australasia.

The production of paper and board in Africa has been divided in three categories: Eastern developing, other developing and finally, Developed countries. According to her the production from the developed African countries was projected to rise from almost 2 million tons in 1995 to slightly about 2 million tons in 2010. The lowest producers were the Eastern developing countries i.e. Kenya, Uganda and Tanzania with a projected production by 2010 of less than 0.5 million tons.

The demand for specialty pulp, according to the questionnaires sent to large mills in Europe and the Americas, the projected total demand for abaca, flax, cotton, SW & HW and sisal was 225,000 tons by 2010 of which specialty pulp demand from cotton is leading at about 80,000 tons by 2010 followed with sisal at about 50,000 tons. She projected an increase demand for reinforcement pulp Bleached Kraft Softwood (BKS) from 15 million tons in 1995 to about 20 million tons by end of 2010. She also reported results done on the pulp breaking length for the four sisal varieties tried in CEPS I, CEPS II at Hale, percentage of pulp yields, pulping trials in Kenya, at different altitudes.

Finally, she concluded that sisal fibre from the hammer mill produced good quality pulps; viscosities of bleached and unbleached pulp were similar to Kraft pulps produced in Brazil; high brightness was obtained by using ECF (89 1S0) and TCF (91.6 1S0) sequences; ECF pulps presented better mechanical properties than the TCF pulps.

10.0 Utilization of sisal waste for animal feed
Mr. Joseph Tipape, former National Project Officer, Kenya

The animals used in the experiment conducted at Kilifi Plantations Ltd. in Kenya form 1999 to 2000 were sheep and goats (42), steers (30) and cows (36). The objective of the experiment was to evaluate the effect of feeding fresh and ensiled bogas compared to *Panicum sp.* The animals were kept in their pens for 24 weeks (goats and sheep), 36 weeks (steers) and 33 weeks cows. They were fed with fresh bogas, ensiled bogas and *Panicum sp.* Parameters observed were live weight gain/loss and mean daily milk yield for cows.

The results were: live weights (kg) for goats fed on fresh bogas fell from 20.5 kg to 17.0 kg; mean daily milk yield (kg) of cows fed on fresh bogas fell from 9 kg in week 2 to 6 kg in week 31. The live weights for sheep fed with the same diet fell initially during acclimatization phase but then rose sharply to exceed the weights before the experiment started. As for the steers, their live weights recorded a mean gain of 1 kg per day.

He finally, concluded that: Bogas can be used as additional or alternative to grass during dry season. Animals fed on fresh, ensiled bogas or panicum had similar performance, bogas is bulky and should be fed near the source and ensiled during wet weather. Since bogas is low in protein and crude fibre, supplements protein and other forage must be made.

Discussion

Dr. Ali Majani of Katani Limited, Tanzania
Despite the research findings and the fact that the animals have been eating the waste for over fifty years, the sisal industry has not been able to commercialize the stuff as an animal feed for the limitations outlined: The fresh sisal waste ferments aerobically very rapidly and thus its quality as an animal feed declines very fast and hence losing its palatability to the extent that animals have been observed to refuse to eat the putrefied material unless it is fed within a period of three days. Anaerobic fermented sisal waste is however preferred by the animals. Feeding the waste to the animals immediately it comes out of the decorticator can solve this. In order to solve the transportation problem of the wet and bulky sisal waste, the feed can be fed to animals kept in the same sisal estate. He recommended that ensiling the material preferably close to the decorticator could minimize transport cost and the animals have to be close to the silo. One would think of drying the feed to reduce cost of transportation. The technical problems are how to dry the sisal waste with the moisture content of about 90% to approximately 10 - 12% unless artificial drying using heat generated by

biogas from sisal waste is used. In view of the problems cited and solutions suggested above, Dr. Majani advised that the cost benefit analysis in pelleting the dried stuff for commercial cattle feeding should be undertaken.

11.0 Fibre production for the pulp and paper market; economic and financial evaluation for a pilot scale fibre extraction project

Mr. Francis Nkuba, National Project Officer Tanzania

He reviewed the opportunities in the sisal industry. World production of paper and paperboard was reported to be around 839.3 million tons while consumption was around 840 million tons per year.

The main concept of the Project was to reduce the cost of the sisal fibre to enable it compete with other crop fibres. The main competitors of sisal in specialty pulps were abaca, flux, hemp and jute pulps. The project intended to plant 399 ha of sisal and harvest after 24 months in the CEPS mode. The production of sisal leaves annually was estimated at 37,800 tons from year 3 producing 1,512 ADMT of sisal fibre from year 5 onwards. Three oxidation ponds were to be constructed to treat 315 tons of waste/day. Project costs were summarized as being USD 2.188 million in capital costs, USD 46,350 for net working capital and annual production costs of staple fibre ranging from USD 595,840 to USD 640,000. Katani Limited was to provide equity to the tune of USD 750,000 and CFC was to be asked to provide grants and soft loans of USD 1.25 million. The payback period to total investment was estimated at 6 years with an IRR to total investment of 14.23% while IRR to equity was 27.91%.

The conclusions and recommendations made based on existing costs of production and existing farming practices. It was recommended that the loan be turned into a grant to implement all the results of the project.

Discussion

Dr. N. Subbiah of Mohammed Enterprises, Tanzania
He wanted to know the net profit of sisal fibre per ton processed with a hammer mill compared with fibre processed by an ordinary decorticator.

Participant
He congratulated Mr. Nkuba for the good presentation, which showed viability of an alternative of fibre extraction technique instead of depending only on the traditional decorticator, which cannot extract fibre efficiently from very short sisal leaves. He suggested that serious consideration should be given to float shares after optimization of the fibre extraction with the hammer mill in order to involve outside investors in the sisal production.

Mr. Ndekirwa Nyari of Mohammed Enterprises, Tanzania
He observed that if it were possible to produce 1,512 tons from 399 hectares of sisal then this would be a good project; short of that, the mill would operate under capacity and therefore be forced to buy the bulky raw material from outside the sisal estate. This would erode the profit.

Response by Mr. Francis Nkuba, the Presenter

On Dr. Subbiah's question concerning profitability, the figure on the net profit of fibre per ton will be available after running the mill continuously for about six months in full capacity.

On the issue of equity, Mr. Nkuba replied that after optimizing the mill operations to establish its installed capacity and the profitability then investors would be invited.

On Mr. Nnyari question, he replied that the results of the five-year field trials by the Project at ARI Mlingano and Hale Estate confirmed that at a density of 6,666 plants per hectare, a farm of 399 ha could produce 1,512 tons of air dried metric tons of sisal fibre.

12.0 Demand for sisal products in Europe, North America & Asia

12.1 Mr. Joan Arque, CELESA, Spain

Mrs. Paula Brazier of Wigglesworth presented a paper on "African Sisal Fibre from the Crops to the Pulp Mill" on behalf of Mr. Joan Arque of CELESA. The participants were informed that CELESA started 52 years ago with production of pulp from rice straws. By 2004 its production had reached 20,000 tons of pulp per year. CELESA now uses flax, sisal, true hemp, abaca and jute. Flax accounts for 44% of the total sales, sisal 21%, true hemp 19%, abaca and jute each 8%. About 70% of the sisal used is from East Africa and the rest is from Brazil. CELESA's main market for pulp is Europe (76%), Asia takes 15% and 9% goes to America. However their strategic market is Asia. Sisal is used mainly in plug wrap cigarette paper, tea bags, filtration papers, capacitor condensers and electrolytic paper, grid pasting tissue and decorative paper. CELESA invited outside collaborators on fibre extraction technology and processing of byproducts from the decorticated wastes.

12.2 Mrs. Paula Brazier of Wigglesworth, UK

Mrs. Brazier started with a brief history of Wigglesworth & Co. Limited. For over 100 years, the Company has been merchants for all natural fibres from sisal abaca, jute, flax and coir for production of yarns, twines and cordage related products. The company distributes and markets about 40% of the total world sisal exports and 70% of East Africa sisal. The company also has sisal estates and spinning mills in Kenya and Tanzania. She further reported that Tanzanian sisal fibre production averaged 21,895 tons per year from 1998 to 2004 from sisal estates and about 2,100 tons annually from Lake sisal during 2000 to 2003. The Kenyan production from sisal estates from 1998 to 2004 averaged 22,665 tons per year and UHDS was 2,976 tons per year. Madagascar produced annually an averaged of 9,782 tons from 1998 to the end of 2004. She informed the Workshop that the African sisal industry has developed and maintained a good level of quality control.

Concerning current prices fetched for the East African sisal fibre, she warned the participants that the current top end prices were reaching a level at which sisal fibre will start to lose market share in some end products. On the Brazilian sisal market,

she reported that it produces annually 125,000 to 130,000 tons from about 90,000 hectares and this production is all from smallholders. Most of the fibre goes to agricultural twine for the North American market. The rest of the sisal is used in polishing cloth, padding industry, Kraft paper, carpets, matting and other products. Exports to China from Brazil have been increasing steadily from less than 5,000 tons in 2001 to 23,273 tons in 2003.

She forecast that there would be a continuation of the movement of value added sisal production to locations in the producer countries near to the source of supply. Secondly, the smallholder production in Tanzania and Kenya was expected to increase. Thirdly, there were possibilities of increasing freight rates in 2005 and finally she saw possibilities of increasing demand for African fibre by China over the next 5 - 7 years.

Discussion

Mr. D. D. Ruhinda
Wanted to know why sisal was considered hazardous by IMO?

Mr. N. Nyari
Wanted to know possibilities of getting this document.

Mr. Wilson Andrade of Brazil
Publications on advantages and disadvantages of sisal fibre are available on the Internet.

Journalist
He wanted to know factors, which caused sisal production to drop in Tanzania while that in Kenya was going up.

Dr. Subbiah
He wanted to be informed of the factors, which affected sisal fibre prices in 1970's compared to the present situation.

Mr. Salum Shamte
Unlike synthetic fibre and other products made from PVC material, sisal fibre can be stored and piled up without spontaneous combustion and as a result sisal has now been internationally declared NON FIRE HAZARD. On the advantages and disadvantages of sisal to synthetics in spinning: since the machines were made for synthetics, there is no other option but to use synthetics. However, for production of specialty paper from sisal fibre, if the sisal fibre prices continue escalating, paper manufacturer will switch to relatively cheap raw materials such as abaca.

On the fall of production of sisal fibre in Tanzania compared to that of Kenya, Mr. Shamte informed the participants that the first cause was nationalization of sisal plantations in 1967. This move drastically affected production in Tanzania as the new management had little knowledge of running sisal estates compared to Kenya where management and administration were continuous. The second reason was that Kenya largely exported fibre while Tanzania exported mainly products. When synthetic

products were introduced, their impact was more in Tanzania than in Kenya. The fibre quality of Tanzania was also affected.

Discussion on Joan Arque's Paper

Noted that it was appropriate to work with various government departments, industries and universities to avoid repeating the same research, which others have done, but use the data collected in order to cut costs and time.

13.0 Country experiences

13.1 Adopting technology in tequila production, the potential relationship with sisal and henequen products.

Dr. Aidee Orozco of Casa Herradura, Mexico

Dr. Orozco recounted the history of *Agave tequilana* whose exploitation began many years before Christ when it was used for ceremonial and religious purposes. Spaniards produced the first Mezcal wine in 1502. The first Tequila companies were Cuervo in 1795, Herradura in 1870 and Sauza in 1873. In 1902 Dr. Weber a German Botanist classified the agave used for tequila production as *Agave tequilana. Agave tequilana* needs 6-8 years to mature and can be used for ornamental, food, fiber source and beverage production purposes. The various species grown in Mexico for beverage production include *Agave tequilana* for tequila, *Agave potatorum* for Mezcal, *Agave pacifica* for Bacanora, *Agave angustifolia* for Sotol and *Agave atrovirens* for Pulque. The first Mexican official norm for tequila was established in 1949. In 1910 there were 87 distilleries and the number increased to 109 by 2004 of which 105 were in the State of Jalisco. In 1993 a Tequila Regulatory Council was established. According to Mexican Norms 100% Tequila is considered as that produced from agave sugars only while the 49% Tequila includes other sugars from cane and corn. Tequila with silver colour is called Blanco, the one with gold colour Abocado, the one with caramel colour and aged for 2 months is Reposado while the one aged for 12 months in oak tanks or barrels is called Añejo.

The tequila production process starts with harvesting of boles of tequila inulin is extracted from the boles, hydrolysis (chemical, thermal and enzymatic), natural and inoculum fermentation, and distillation and matured before the product is bottled ready for marketing. Traditionally *Agave tequila* was morphologically identified, rhizomes were used for planting, agro-chemicals and inorganic fertilizers were used, inventory control was by direct counting in the field, planting and harvesting was manual, and harvesting depended on age and inulin content. The new *Agave tequilana* technology involves genetic methods for identification, micro-propagation, organic farming and biological control, agave inventory by remote satellite, mechanical planting and harvesting, harvesting by phenological methods and inulin content.

Traditional production processes were hydrolysis by cooking in ovens or autoclaves, sugar extraction by milling and natural fermentation without temperature control. The

CO_2 was vented in the atmosphere, distillation was in batches in pot stills, liquid waste was disposed in the field for irrigation, bagasse was composted for fertilizer, tequila was aged in barrels, testing was by a panel of people and tequila was diluted and bottled. The new technology developed uses enzymes for hydrolysis, extracts sugar by a diffusion band, yeast is recycled, wort is optimized by RSM, high sugar and ethanol concentration resistant yeast strains are used, CO_2 is recovered and continuous distillation columns are used. The liquid waste is treated anaerobically and aerobically; the bagasse is used to produce thermal and electric energy; the temperature and humidity is controlled in warehouses to reduce loss, testing is by sensory evaluation group and flavoured tequilas are now produced.

Before the new developments CRT was used to trace tequila in the factory and in the market for authentication, analytical methods were slow and the agave plant was used for tequila production only. Due to this only 20% of the agave plant was used. Research and development was non-existent in most tequila companies and studies on the side effects of tequila consumption did not exist. After the new technological developments, authentication is now done using isotopes and agave analysis is by NIR method. The agave plant has new uses such as inulin, pectin, wax and saponin production. A bio-refinery concept has been developed to process the whole plant. In all major companies there exist research and development departments. The tequila quality, consistency and security have been improved and hangover compounds reduced. These developments have improved the health of the plants, reduced shortages and controlled oversupply. The products are now of higher quality, consistent and secure to consume. Costs in agave and tequila production have declined, the environment cared for and knowledge has been generated.

13.2 Henequen perspectives in Mexico in 2005

Engineer José Luis Azcorra Torre, Department of Agriculture, Yucatan Mexico

Engineer Torre showed a map on the distribution of industrial Agaves in Mexico. The main industrial Agaves were Bacanora, Tequila, Mezcal and Henequen. The Henequen industry started in 1830. Following Cirus Hall McCormik invention in 1878 the market for henequen products increased. In 1915 there was a revolution in Yucatan followed by an agrarian reform in 1937 when the Government took control of the industry up to 1992. In 1993 the Government privatized the Henequen industry. Since 2002 the Government has established 7 programs aimed at assisting farmers.

In Yucatan Henequen is grown by first establishing nurseries, which last two years before transplanting to the field. The plants stay in the field for 7 years before harvesting starts. The plants are then harvested for 12 years before they start to pole. After poling they last another 4 years. Thus the plants life cycle is 25 years.

By 1984 Yucatan had 55,000 farmers and 62 municipiums with a total land holding of 250,000 hectares producing 67,000 tons. By 1994 there were only 16,000 farmers and 56 municipiums with a land holding of 90,860 hectares producing 24,294 tons.

By 2004 the number had declined to 5,200 farmers and 42 municipiums producing 5,000 tons. In 1994 there were 57 decorticators working but the number declined to 25 in 2002 and 14 in 2004.

The way forward charted to reverse this trend hinges on increasing land under Henequen in 40 large estates, increasing the number of decorticating plants in operation and making them more efficient, wider distribution of economic resources from the Government and supporting research and development in new products such as inulin.

13.3 Planting and production of sisal in China

Professor Yu Chongwen, Dong Hua University of China

Prof. Chongwen informed the participants that the area under sisal in China was 15,000 hectares with an annual production of 45,000 tons of fibre or around 2.8 tons per hectare. Sisal is grown in tropic and sub-tropic regions of Guangxi, Guangdong, Hainan, Yunnan and Guizhou Provinces. The main cultivar grown was the Agave Hybrid 11648, which originated from East Africa. According to China's experience returns from sisal exceed those from sugarcane, pineapples, bananas, cassava etc since sisal can still be produce in soils deficient of plant nutrients.

The long fibre grades are used for production of yarn, twine, cordage, cloth, carpets etc. The short fibres are used for stuffing mattresses and the solid waste is applied as fertilizer or fed to pigs, horses and sheep. From the liquid waste a protein substance is extracted which is used in leather processing for removing the hair. Other chemicals of commercial value are saponin and hecogenin.

The participants were informed that China now produces a whole range of sisal processing machines and their spare parts. These include carding, drawing, spinning and weaving machines just to name a few. The sisal industry in China falls directly under the umbrella of the Ministry of Agriculture. The farmers and manufacturers have their association called The China Bast and Leaf Fibres Textile Association.

The university dealing with sisal is Donghua University also known as the China Textile University. Large companies dealing with sisal are Dongfang Sisal Group Company Limited in Guangdong and the Guangxi Sisal Limited Liability Corporation.

13.4 Sisal in South Africa

Professor Abisha Tembo, Centre Manager, National Fibre, Textile and Clothing Centre

The National Fibre, Textile and Clothing Centre (CSIR) is one of eight South African Science Councils. It is the largest research and development organization in Africa with 2,500 employees. It has seven business units dealing with Manufacturing and Materials Technology, Defence Technology, Building Technology, Environmental

Technology, Mining Technology, Food and Biochemical Technology and Transportation Technology. The production, manufacturing and materials technology section has an annual turnover of R161 million with 383 employees out of which 200 are professionals. It has offices in Pretoria, Johannesburg, Cape Town, Durban, Port Elizabeth and Richards Bay.

The Vision of the Centre is to develop into a world-class centre of excellence for the establishment of globally competitive fibre industries. Its Mission is to develop cutting edge technologies, expertise and innovative solutions for the fibre industry. Its corporate objective is to enhance the competitive capability of the fibre industry to compete in global markets, ensure high investment returns, create more jobs, spur economic growth and empower disadvantaged groups. Jurgen Schremp started the Project in 1977, with emphasis on technology transfer and social development. This coincided with localization of the Mercedes Benz C Class. In 1997 sisal was the only locally available fibre produced in 26 sisal estates, three of which were private estates in KwaZulu Natal and 23 state farms in Limpopo. The state owned farms were not producing to full capacity. South Africa imported sisal in spite of sufficient local supply. Replanting was behind schedule and equipment refurbishment was urgently needed. In 1998 CSIR was thus contracted to undertake a feasibility study on the farms on behalf of Daimler Chrysler SA. The study focused on three state owned farms and was carried out in conjunction with the Limpopo Government. The results of the study showed production costs on state farms were higher compared to sisal import prices. Some farms could be economically viable if operated independently and the infrastructure had to be rehabilitated. In 1999 a commercialization model was developed.

In 2000 Borgers AG developed a technology for flax and adapted it to sisal. The process involved fleece production, compression molding, lamination and finishing. In 2001 alternative applications approach was initiated. The activities were to identify opportunities and markets, identify entrepreneurs and evaluate the technology with respect to potential advantages to be able to decide on the go or no go. The objectives were to stabilize the process chain, increase demand for sisal and better utilization of capital equipment. In the same year the University of Stellenbosch carried out studies on sisal reinforced paper with significant improvement in properties. Tower technologies were developed in chipboard replacement with lighter and stronger sisal boards. Other products developed were handmade paper, slippers, sisal reinforced crash helmets, tablemats, geotextiles etc.

A feasibility study on production of sisal in the North West Province indicated that small-scale sisal production could be a viable business with considerable potential for job creation. It was therefore recommended to establish a sisal production and processing complex at Madikwe farm and the project was launched in 2002. A new bulbil sisal nursery was established. The farm was provided with a diesel engine, water pump and irrigation pipes purchased using Poverty Eradication Funds. The farmers were trained in all aspects of sisal production and sisal fibres were tested by NFTCC. Sisal based non-wovens and paper samples were developed. A needle punching line and hand paper unit was installed at Madikwe. Renovation of warehouses was initiated and a sisal decorticator and paper hand press provided using Poverty Eradication Funds. Pending activities included providing assistance in all aspects of establishing a new sisal plantation; building the infrastructure for sisal

production, processing and manufacturing by small scale manufacturing enterprises; commissioning the needle punching line and training people; producing sisal based textiles and paper products.

13.5 Development of Henequen crop in Cuba

Ing. Caridad Valdes Torres, Research Scientist, Liliana Dimitrova Horticulture Research Institute in Havana

Cuba has a surface area of 110,922 square kilometres, an agricultural area of 6.7 million hectares, a population of 11 million people and a subtropical climate with an average 1,375 mm of rain in two seasons running from May to October and November to April. Average temperatures are 24°C and atmospheric humidity ranges from 60 to 80%.

Henequen was introduced in Cuba in the second half of the 19th Century starting with Matanzas Province and later spreading to Cienfuegos, Havana and Holguin provinces. There are around 4,000 hectares planted with Henequen, of which 3,000 hectares are mature and 1,000 hectares are immature. Henequen is grown on land with limestone and pH from neutral to slightly alkaline. Seedlings are from rhizomes or bulbils from a nursery. Henequen is planted throughout the year though preferably during the rain season. The spacing used is 3 metres by 1 metre giving a plant population of 3,333 plants per hectare. Weed control is by mechanical means although cattle are sometime also used. Harvesting commences after 4-5 years from transplanting and the cutting cycle is 9-12 months leaving 14-20 leaves. Annual production is around 2,000 tons of dry fibre. The production is locally consumed and exported to Europe and America.

Research initiatives started include feasibility of improving bulbil as planting material. Other studies are on determination of seedling size, plantation distance and weed control in nursery stage. A study of different cutting cycles; determination of NPK levels in nursery stage; determination of NPK and carbon levels in production stage; studies on new products such as liquid detergent, animal feed and others; and use of biotechnology in the development of the crop are also being undertaken.

Future potential growth areas were in the eastern part of Cuba where soils are suitable for Henequen and employment needs are high. Future activities included commercialization of research results, development of new clones with higher yields, improvements in the technology for use of the waste as manure in nurseries and technology in cutting, studies on diseases, continued development of new products and enhancing the conservation of the germplasm bank. Research activities are carried out in collaboration by various institutions. These are Liliana Dimitrova Horticultural Research Institute under the Ministry of Agriculture; University of Matanzas and José Antonio Echeverria Polytechnic Superior Institute under the Ministry of Higher Education; Mario Munoz Medical Laboratory under Ministry of Health; Textile Research Centre under the Ministry of Light Industry and Henequen enterprises.

She welcomed collaboration and interchange of experiences relating to Henequen fibers and byproducts from other countries.

Discussions on country experiences

Mr. Gilead Kissaka
He wanted to know how the parenchyma is extracted, how the solid waste from tequila boles remaining after extracting the juice are used to run engines or turbines for power generation and how the fibre is separated from the juice if biogas is produced from the solid waste?

Hon. Ditopile, Regional Commissioner, Coast Region
Thanked organizers of the workshop for a job well done. His comments were directed on production, processing and marketing. He remarked that Mr. Seng'enge's presentation had provoked more questions than answers. He asked Brazil and Cuba to respond to the questions raised on status of land ownership, seedlings (can the smallholders raise them?), inputs such as fertilizer and extension services. On processing, he wanted to know how the smallholder decorticator could be popularized. He noted that proper packaging and quality control is essential in marketing. How is it done in other countries? Answers to these questions were considered crucial in sensitizing farmers to go for sisal. In Mexico the human resource is considered first, the next consideration is the market and finally is the production cost.

Mrs. Mary Githaiga, Kenya
Wanted to know the structure of production and marketing in other countries.

Mr. Gideon Seng'enge
Wanted to know how Brazil had increased productivity from 700 kg to 1,200 kg per hectare.

Mr. Francis Nkuba
The presentations had opened eyes to new opportunities. He wanted to know how the Mexicans plan to utilize 100% of the tequila plant. He also wanted to know from Professor Tembo the decorticating machine capacity at Madikwe Farm. He wondered why in Cuba sisal took 5 years before being harvested when the average rainfall was 1,300 mm per year.

Hon. A. Y. Mgumia, Regional Commissioner, Shinyanga
Remarked that he had worked in Kigoma Region prior to moving to Shinyanga and had attended a workshop on Palm Oil and learnt that Malaysia obtained its original seedlings for palm trees from East Africa and had risen to be the leading producers of palm oil in the world. After presentation from China he had learnt that China got its sisal from East Africa and was already producing more sisal fibre than any of the East African countries. This showed how one could easily lose leadership if all stakeholders do not work together. Shinyanga produces maize and other crops and wanted to know how one can produce sisal bags on small scale for packaging. He informed the participants that he was attending the workshop so as to learn as he intended to start sisal growing in Shinyanga Region.

Reponses by presenters

Mr. Wilson of Brazil

Farmers in Brazil keep the sisal plant growing before the mother plant is removed. This provides continuity in production. Sisal is less than 1.5% of Brazilian exports and only important because of its social contribution in creating more than 600,000 jobs. A total of 15,000 farmers with an average of 10 hectares each exist. In Brazil sisal waste is ensiled and fed to animals. The study on animal feed conducted by the project will increase utilization of sisal waste. There are 8-9 industrial factories in Bahia and every Saturday decorticating people sell fibre to firms with brushing and baling facilities who in turn sell to local industries or export. Fibre extraction is by mini-decorticators, which are owned by operators and not by individual farmers. The farmer's activity is just to produce sisal leaf in the field. On the land ownership, the Brazilian Government has a programme of land distribution to poor people in which the Government buys the land and then gives it to poor families. By the end of 2003 about 60,000 poor families had benefited from this programme.

Dr. Aidee Orozco of Mexico

In the Tequila Industry bagasse is used and not the leaves. A small part of the bagasse is used for organic fertilizer. On wet basis 40.5 kilocalories are obtained from 100 grams of bagasse. On dry basis 178 kilocalories are obtained from 100 grams of bagasse. One kilogramme of juice produces 6 kilogramme of bagasse. After squeezing the juice out of the henequen stems the remaining biomass is burnt in an incinerator generating heat to heat water in a boiler to generate steam. Electricity is generated from a steam turbine. The power produced is just enough for running the Tequila factory. This has significantly cut down the cost of production. There is no excess power put in the National Grid as the Government price for electricity is too low. The savings made amount to US$ 0.1 per litre of Tequila. Thus at a production of 12 million litres per year total savings amount to around US$ 2 million per year. Biogas is obtained from the treatment plant amounting to 1.2 cubic metres per day treated anaerobically. On the 80% utilization of the Tequila plant as posed by Mr. Nkuba she explained that 60% represented the leaves and 20% the bagasse remains used for organic fertilizer. A pilot project on use of Tequila leaves to produce pectins, waxes, saponins gas and inulin has been established. Extraction of inulin from the bole is another product being seriously considered for specialty applications. Inulin was reported to largely come from artichokes. The demand for inulin in 2003 was 60,000 tons per year.

Professor Tembo from South Africa

The success in the work undertaken was possible due to different Government Agencies coming to the aid of smallholders. The capacity of the decorticators was 60 kg per hour.

Dr. Manuel Robert from CICY Mexico

Observed how tragic it was to have left Katani to develop the smallholder scheme on its own. He assured participants that the MTC Laboratories set up should be able to produce planting materials for smallholder farmers. The smallholder's future is in the hand of the Government.

Mr. Jose Luis Azcorra Torre from Yucatan Mexico
He spoke in Spanish and Mrs. Sanchez translated. He stressed that smallholders needed to cooperate in production and work hard. In Mexico the emphasis was on the highest human values of equity, liberty and a better life for all. The intention was to change the mentality of the people and improve living conditions. This is possible if the values are adhered to. The second prerequisite was for everybody to ask what one can do for his/her country, for production and for him/herself. This forms the basis for success.

Ms. Elisa Valdes Torres of Cuba
Maintenance of the farms is throughout the life of the crop in the field. Total harvesting is done not selectively as in sisal. Cutting is done when leaves are one metre long. Ms. Sanchez translated as Ms. Torres spoke and further explained that originally sisal was used for agricultural twine. Ms. Sanchez had worked on the sisal programme in Cuba before joining UNIDO. She explained that research efforts were first directed to produce Hecogenin for the pharmaceutical industry. Dry decortication was introduced and a process to obtain an intermediate product named "coffee ground" as precursor for steroids for contraceptive pills production needed mature sisal leaves. The dry high pressure hydrolysis process for "coffee ground" production was introduced and performed in the decortication plant. Sisal was a marginal crop compared to sugarcane. It was and still is not mechanized but sugar production is mechanized. Interest in growing sisal revived because of high prices of synthetics. She requested all presenters to write down the questions made and the replies for them to be included in the proceedings.

Afternoon session and closing on 19th November 2004

Mr. Salum Shamte, Chairman
Mr. Shamte as Chairman recognized the presence of various dignitaries and the Guest of Honour for the closing ceremony.

He explained how the workshop had fared in its two days of deliberations and that that was the last session. He thanked the Regional Commissioner for agreeing to attend the whole afternoon session and close the workshop. Two presentations were to be made. The first was "Industrialization of Sisal" by Mr. Damian D. Ruhinda, the Chairman of the Sisal Association of Tanzania and the second on the "Achievements and Way Forward" by Ms. Mayra Sanchez Osuna Deputy to the Director, Energy and Cleaner Production in UNIDO. Mr. Neil Cuthbert the Chairman of Sisal Growers Association in Kenya was later to move a vote of thanks. He requested the Guest of Honour to have a group picture with participants after the closing ceremony. He thereafter introduced Mr. Ruhinda and asked him to address the workshop. He later introduced Ms. Mayra Sanchez Osuna and asked her to present.

14.0 Industrialization of sisal
Mr. Damian D. Ruhinda, SAT Chairman

Mr. Ruhinda started by assuring the participants that all natural hard fibres including sisal were poised for resurgence in the world market. This was due to the rapid demand in the last five years for new sisal products. He believed that if this situation were fully exploited, the Sisal Industry would be rapidly revived and thus contribute to poverty alleviation and increased rural employment.

He summarized the attributes of the sisal plant. Sisal is a natural, environmentally friendly renewable resource, which can serve mankind much better than synthetics. It has a worldwide market potential running into millions of tons in the paper, automotive and building industries, handicrafts, and other products. The waste accounting for 98% of the biomass is more valuable than the 2% currently exploited. Sisal can thrive in very adverse weather. It does not require expensive agro-chemicals. Sisal can be grown and harvested throughout the year. All plantations have well-developed infrastructure and are linked to the National Electricity Grid. In Tanzania for example, the managerial and skilled workers have experience built over 100 years. Sisal has a long established Research Centre at Mlingano equipped with a modern MTC laboratory. The smallholder/outgrower scheme recently re-introduced in Tanzania by Katani Ltd has shown significant success.

Mr. Ruhinda informed the participants that extensive studies had been undertaken in different parts of the world on sisal and products. Most of the research results were ready for commercialization. He named some of the local and international organizations involved in sisal research as being the Danish Technological Institute, Tanzania Sisal Authority, CAMARTEC, BOEL of Germany, Katani Limited, University of Dar-es-Salaam, and Sokoine University of Agriculture. The recently concluded Project on Sisal Product and Market Development for Sisal and Henequen Projects has been instrumental in developing the concept of "Industrialization of Sisal".

Investment opportunities in the Sisal Industry existed in large-scale production of sisal, production of superior planting material by MTC technology and agricultural machinery for cutting and transport of sisal leaves to the factories. Other investment opportunities were in primary processing, energy generation, organic fertilizer, animal feed, pharmaceutical and on fibre based products. All products identified need market development in one form or another and new markets and hence new customers locally in East Africa, in SADC countries and in other parts of the world to link producers and consumers.

The revitalization of the Sisal Industry required stopping marginalization of agribusiness in our thinking process, planning and resource allocation. All stakeholders should defend the sector's interests in ensuring availability of long-term finance at affordable interest rates for agricultural producers. Other areas included putting in place an incentive package to attract local and foreign investment into agriculture and processing. The incentive package should be in reduced costs of inputs like power, fuel, labour, and taxes by the Government to support the sisal smallholder/outgrower sisal scheme. A smart and true public-private partnership was essential for success.

Comments

Mr. R. Madabida Director Katani Ltd
He started by saying that Mr. Ruhinda's presentation has been an eye opener to him and probably to many other participants. He reminded the Workshop that sisal production had reached its rock bottom level and that it could not go down further, it had to go up and not anywhere, he insisted. He called on all the participants to refrain from re-creating the past but to invent the future. He asked the stakeholders to be prepared to take the courage and join forces with other partners in industrialization of sisal. He called on the support from Governments, as he believed that Government's close partnership with the private sector was a key ingredient for economic progress.

Judge John Mkwawa of Tanzania High Court
He remarked that a political will was needed to reach the Promised Land and that a Moses was needed to lead us to prosperity.

Mr. Joseph Tipape of Kenya
He recommended mobilization of funds to undertake research and development activities seriously. He therefore proposed establishment of a forum for sisal research and development among producing countries.

Dr. Edward Masanja, University of Dar es Salaam Tanzania
He informed the participants that the University of Dar es Salaam has had various collaborative research activities with the sisal industry in Tanzania for many years. He invited local partners in sisal to work with the University as some of them had done in the past. He reminded the Tanzanians that the University is theirs and so they should make full use of it.

Responses

Mr. Damian D. Ruhinda
He thanked all the respondents for their constructive comments and remarks. He emphasized that if all stakeholders joined hands, the goal would be achieved. Survival was dependent on being competitive in business.

After Mr. Ruhinda's comments **Mr.Wilson Andrade of Brazil** proposed that since Kenya, Tanzania and Brazil had similar problems facing the development of their sisal industries, the Sisal Associations in Kenya and Tanzania join the Sisal Associations in Brazil to pursue together as one entity the common problems. The proposal was adopted.

15.0 Achievements and the way forward

Ms Mayra Sanchez Osuna, UNIDO Project Backstopping Officer

Ms. Sanchez started by reviewing the eight-year activities of the project. During the first phase project teams were set up in Kenya and Tanzania. The two teams cooperated in enhanced production systems for increased fibre yield per hectare. Two MTC laboratories were established and operated. The project trained MTC staff and planted MTC plants in estate fields. Fertilizer and alternative harvesting trials were carried out. Smallholder farming systems were evaluated. Animal feed trials and trials on biogas to produce electricity were undertaken.

The project developed and tested technologies to optimize fibre extraction methods. Encouraging results were obtained on leaf fibres and trials on bole fibre showed more work needed to be done. A chart on the existing utilization of the sisal plant was shown as explained in her paper on the project rationale and highlights.

The second phase was the establishment of a pilot biogas plant to demonstrate the viability of the process, disseminate the experiences and carry out studies on replication. The second phase programme was explained in chart form showing decorticator and hammer mill waste being used to produce electricity, organic fertilizer and process heat. Electricity production would result in increase of clients, cheaper electricity for decorticators and the hammer mills and benefits to the national grid. Other studies to be undertaken were use of the biogas for lighting and cooking.

The third phase was to concentrate on new initiatives. These included demonstration, assimilation, and adaptation of technologies for integrated utilization of sisal. During this stage the products from the bole such as its fibre, inulin, alcohol, special food additives and electricity co-generation would be evaluated. Products from the leaves such as chemicals for pharmaceutical and other industries as well as waxes and surfactants would also be studied. The results would be disseminated globally, partnerships established and capacity building enhanced.

The programme for the third phase was to be formulated and negotiated in 2005. The third phase was expected to last five years with participants drawn globally. Programme partners at country level were to be farmers, industrialists, manufacturing and commercial institutions, public and private partners, R&D institutions, universities, consulting and engineering companies and others. At international level programme partners were to be drawn from North-South cooperation, South-South cooperation, multilateral development and financial organizations, manufacturing and commercial institutions, public and private partners, R&D institutions, universities, consulting and engineering companies and others.

She explained the new UNIDO approach and goal as being the reversal of the current situation where only 2% of the plant is utilized and 98% thrown away to using 98% and throwing away 2% by adding industrial and commercial value to the commodity. The goal is to ensure sustainability and total utilization of the sisal plant, minimize pollution and waste abating all negative environmental impacts, increase employment opportunities through new industrial developments. The approach will stress environmentally friendly and cleaner production.

She recommended follow up actions in continued agronomic trials to determine the optimal parameters and economic feasibility. Other activities were optimization of the selected fibre extraction technology, continued R&D activities for commercial valorization of sisal wastes and establishment of market outlets for the new products and development of strategies for market penetration. Most important however was the wide dissemination of technologies and market information and promotion of commercial adoption of the new technologies.

She thanked all for participating and contributing in ideas and financially and looked forward to meeting them again in the next workshop.

16.0 Closing speech of the workshop by the Guest of Honour

Capt (Rtd) Jaka Mwambi, Tanga Regional Commissioner

He began by thanking the workshop organizers for the honour bestowed on him to officiate the closing ceremony and the CFC, UNIDO, IFAD and the Belgium Government for financing the Project. He congratulated UNIDO, the Kenya Sisal and Tanzania Sisal Boards and Katani Limited for a job well done during all the stages of implementation of the Project.

He considered it a great honour for Tanga Municipality being chosen to host this important workshop. Tanga was once extolled as the African capital of the white gold, due to the fact that in the 1960's when the country's production peaked at 230,000 tons, about 65% of the production came from the Region. Despite its drastic decline, sisal still remained a major export crop for Tanga Region. It was therefore considered right to keep and hold alive the slogan "Tanga is Sisal and Sisal is Tanga".

He hoped the deliberations made during the Workshop would instill a sense of urgency in the resuscitation and rejuvenation of the Industry, so as to give a much more meaning to the Tanga sisal slogan. He pointed out that as we all live in a changing globalised world, it was necessary to positively accept the fact that global efforts are needed more now than ever before for solving social, economic and technological problems currently facing the world.

He summarized ways of reviving sisal as being to commercially utilize the whole sisal plant, adding value to export products from the sisal plant instead of raw sisal. Others included the involvement of smallholder farmers and out growers in sisal development and production and developing a cohesive collaboration among producers and consumers. This was important especially in R&D, market development, technological transfer and pursuit of joint ventures in various opportunities. Acknowledging the problem of long term financing faced by many developing countries like Tanzania, the Guest of Honour made an appeal to development partners, multilateral and bilateral financial institutions, local and foreign investors to support investments in the Industry.

The Guest of Honour urged the participants to implement the positive results learned in the Workshop rather than let them lie on shelves. He reminded the participants that revival for the sisal industry entails innovation, ingenuity, and much hard work. He invited investors from all over the world to invest in Tanga, as he believed that discouraging investments makes society worse off. He asked the participants to visit places in Tanga rich in tourist attractions such as Amboni caves, Amboni Sulphur Baths, East Usambara Nature Reserves and other places.

He conveyed his sincere gratitude and appreciation to Mkonge Hotel and the organizers for hosting the Workshop efficiently and peacefully. He closed the Workshop at 17.20 hours.

17.0 Vote of thanks

Mr. Neil Cuthbert, Chairman Kenya Sisal Growers Association

Mr. Cuthbert recognized the presence of the various dignitaries and thanked the Regional Commissioner for attending the whole afternoon session despite his heavy schedule of activities and for his words of wisdom.

He thanked the organizers, management of Mkonge Hotel and the people of Tanga for their hospitality and for providing a peaceful atmosphere for the workshop. He commended the work done by the project in both Kenya and Tanzania and underscored the Guest of Honour's urge to commercialize the results. He thanked FAO, CFC, UNIDO, IFAD, the Governments of Belgium, Kenya and Tanzania and the sisal industries in both countries for their financial, moral and material support to the project.

He asked the development partners to continue supporting the industry in commercializing all the results and developing new products and markets beyond what had been done. He thanked all who made contributions in the workshop and wished all a safe journey back but looked forward to meeting them again.

Dissemination Workshop Agenda

PROJECT ON PRODUCT AND MARKET DEVELOPMENT OF SISALAND HENEQUEN PRODUCTS

INTERNATIONAL DISSEMINATION WORKSHOP

TANGA, TANZANIA, 16-19 NOVEMBER 2004

AGENDA AND PROGRAMME

REGISTRATION AT MKONGE HOTEL – 8:00 TO 22:00 HRS [15TH TO 18TH]

[Hotels in Tanga Reserved for Participants – Choice at Registration]

Monday, 15th November 2004
Arrival of participants from Tanzania and Kenya at Tanga.
Arrival of participants from other countries at Dar-es-Salaam airport. Transportation to hotel and overnight stay in Dar es Salaam

Tuesday, 16th November 2004
Morning travel of participants from Dar to arrive at Segera by 12:00 Hrs.

Site visits by participants already in Tanga.

[Transport leaves from Mkonge Hotel at 08:00 sharp]

Time	Activity
08:00–12:00	**Visit ARI Mlingano: Tour Gene Bank and MTC Lab** Dr. A. Nyakyi, Mlingano Director and Mrs. Mlay - MTC **Visit Mwelya Estate and Tour Smallholder Farms** Mr. D. Mselela, Estate Manager **Visit Gomba Estate and Tour Fertilizer Trials** Mr. H. Shabani, Sisal Research Coordinator and Mr. A. Kamili Estate Manager **Visit Hale Estate: Tour Variety and Agricultural Trials** Mr. G. Seng'enge, Project Agronomist
12:00–13:30	**Lunch at Segera for all participants.**
13:30-13:50	**Travel to Kwaraguru Estate**

Tuesday, 16th November 2004 (cont.)

Foundation Stone Laying for the Sisal Biogas Plant at Kwaraguru Estate and Hammer mill Inauguration at Hale Estate

14:00 – 14:15	**Welcoming Address and Briefing on Biogas Project** Mr. O. O. Wilson, Director General Tanzania Sisal Board
14:15 – 14:25	**Address by the Minister for Planning and Privatization.** Hon. Dr. Abdallah O. Kigoda – (MP)
14:25 - 14:35	**Address by the Divisional Managing Director UNIDO** Dr. A. J. J. Rwendeire
14:35 – 14:45	**Address by The CFC Managing Director** H.E. Ambassador Ali Mchumo
14:45 – 15:15	**Flume Tow Recovery Plant Demonstration** Mr. F. Washa, Central Workshop Engineer
15:15 – 15:30	**Foundation Stone Laying Ceremony** H.E. Ambassador Ali Mchumo CFC Managing Director and Dr. A. J. J. Rwendeire UNIDO Managing Director.
15:30 – 15:50	**Travel to Hale Estate**
16:00 – 16:15	**Welcome and Briefing** Mr. S. Shamte, Chairman Project Coordinating Committee
16:15 – 16:25	**Address by The Leader of the Kenya Delegation.** Mr. J. K. A. Cheluget
16:25 – 16:35	**Address by CFC Managing Director** H.E. Ambassador Ali Mchumo
16:35 – 16:45	**Address by UNIDO Divisional Managing Director** Dr. A. J. J. Rwendeire
16:45 – 17:00	**Inauguration of Prototype Hammer Mill** Dr. A. J.J. Rwendeire, UNIDO Div. Managing Director and H.E. Ambassador Ali Mchumo, CFC Managing Director.
17:00 – 17:30	**Hammer Mill Demonstration** Mr. G. Kissaka, Project Engineer
17:30 – 18:30	**Travel to Tanga**

Wednesday, 17th November 2004

Official Opening Session

11:00	**Arrival of Guest of Honour H.E. Dr. A. M. Shein – Vice President of the United Republic of Tanzania** All Participants to welcome him at Tanga Airport
11:30-13:00	**Lunch at Mkonge Hotel and Harbours Club**
13:10 13:10 – 13:30	**All Participants to be seated at Bay View Hall- Mkonge Hotel** **Briefing on the Opening Ceremony and Programme** Mr. S. Shamte - Chairman - Project Coordinating Committee.
13:30 13:35 – 13:40 13:40 – 13:50	**Arrival of Guest of Honour at the Meeting Hall** - RC ***(Song by TOT)*** Welcoming Remarks **Hon. Capt. (Rtd) J. Mwambi – Tanga Regional Commissioner**
13:50 – 14.00	**Introduction of Key Guests and Foreign Participants** Hon. Mr. M. Mwandoro (MP), Chairman Tanzania Sisal Board
14.00 – 14:10	**Statement from Kenya** Mrs. Mary Githaiga - Head of Kenya Delegation
14:10 – 14:20	**Statement from FAO** Mr. Shakib Mbabaali
14:20 – 14:40	**Statement from UNIDO** Dr. A. J. J. Rwendeire, UNIDO Divisional Managing Director
14:40 – 15:00	**Statement from CFC** H. E. Ambassador Ali Mchumo, CFC Managing Director
15:00 – 15:20	**Invitation to Guest of Honor to Open the Workshop** Hon. Dr. Juma Ngasongwa (MP) Minister for Industries and Trade.
15:20 – 16:20	**OFFICIAL OPENING STATEMENT** **H.E. Dr. Ali M. Shein – Vice President of The United Republic of Tanzania.**
16:20 – 16:30	**Vote of Thanks** Mr. D.D. Ruhinda, Chairman Sisal Association of Tanzania
16:30 – 16:40	**Group Photographs with Guest of Honour**
19:30 – 23:00	**Dinner and Cultural Evening – All Participants**

Thursday, 18th November 2004

First Session: Enhancing and Improving Sisal Production

09:00- 09:05	**Introduction of Presenters for the Morning Session** Mr. S. Shamte, Chairman Project Coordinating Committee
09:05- 09:30	**Project Rationale and Highlights:** Sietse Van der Werff, Senior Project Manager CFC Mrs. Mayra Sanchez Osuna, Deputy Director UNIDO
09:30- 10:00	**New Sisal Production Systems; Estate Variety and Fertilizer Trials** Dr. Walid Khayrallah, International Expert
10:00- 10:50	Discussions (All Participants)
10:50- 11:00	Response: Dr. Walid Khayrallah
11:00- 11:30	*Tea /Coffee Break*
11:30- 11:50	**Smallholder Sisal Farming** Mr. Gideon O. Seng'enge, Project Agronomist
11:50 -12:20	Discussion (All Participants)
12:20- 12:30	Response: Mr. Gideon O. Seng'enge
12:30- 12:50	**Sisal Multiplication by Meristematic Tissue Culture** Dr. Manuel Robert, International Expert
12:50- 13:20	Discussion (All Participants)
13:20- 13:30	Response: Dr. Manuel Robert
13:30- 14:30	*Lunch – Mkonge Hotel and Harbours Club (All Participants)*

Second Session: Alternative Uses and Markets for Sisal

14:30- 14:35	**Introduction of Presenters for the Afternoon Session** Chairman, Mr. S. Shamte
14:35- 14:55	**Fibre Extraction Technologies, Flume Tow Recovery and Sisal Biogas Production** Mr. Gilead Kissaka, Project Engineer
14:55- 15:30	Discussions (All Participants)
15:30- 15:40	Response – Mr. G. Kissaka
15:40- 16:00	*Tea/Coffee Break*
16:00- 16:20	**Fibre Production for the Pulp and Paper Market: Pulping Trials with Sisal Fibre and Market Analysis** Mrs. Rosely Viegas Assumpcao, International Expert
16:20- 16:50	Discussions (All Participants)
16:50- 17:00	Response: Mrs. Rosely Viegas Assumpcao
17:00- 17:20	**Utilization of Sisal "Waste" for Animal Feed.** Mr. Joseph Tipape, Kenya National Project Officer [1997- June 2004]
17:20- 17.50	Discussions (All participants)
17:50- 18:00	Response: Mr. Joseph Tipape
19:30- 22:30	*Barbecue and Cocktails – Mkonge Hotel (All Participants)*

Friday, 19th November 2004

Third Session: Market Demand for Sisal

09:00- 09:10	**Introduction of Presenters for the Morning Session** Chairman, Mr. S. Shamte
09:10- 09:25	**Fibre Production for the Pulp and Paper Market: Economic and Financial Evaluation for a Pilot Scale Fibre Extraction Project** Mr. F. Nkuba, National Project Officer Tanzania
09:25- 09:55	Discussions (All Participants)
09:55- 10:00	Response: Mr. Francis Nkuba
10:00- 10:30	**Demand for Sisal Products in Europe, North America and Asia** Mrs. Paula Brazier, Wigglesworth - UK and Mr. Joan Arque, CELESA - Spain
10:30- 12:50	Discussions (All Participants)
10:50- 11.00	Responses: Mrs. Paula Brazier and Mr. Joan Arque
11:00- 11:30	*Tea/Coffee Break*
11:30- 12:00	**Experiences in Brazil and Mexico** Mr. Wilson Andrade – Brazil; Ms. Aidee Orozco - Mexico and Mr. Jose Azcorra Torre - Mexico
12:00- 12:20	**Experiences in China and South Africa** Prof. Yu Chongwen – China and Mr. Abisha Peter Tembo – South Africa
12:20- 12:30	**Experiences in Cuba** Ms. Elisa Valdes Torres – Cuba
12:30- 13:00	Discussions (All Participants)
13:00- 13:30	Responses: Presenters
13.30- 14:45	*Lunch – Mkonge Hotel / Harbours Club (All Participants)*

Fourth Session: Industrialization of Sisal, Way Forward and Closing Session

[Whole Afternoon Session to be Graced by the Guest Of Honour Hon. Capt. (Rtd) Jaka Mwambi – Tanga Regional Commissioner.]

14:50	**All Participants Seated in the Meeting Hall – Mkonge Hotel**
14:55	**Arrival of Guest of Honour and Introduction to Participants and the Closing Session.** Mr. S. Shamte Chairman
15:00- 15:20	**Industrialization of Sisal** Mr. D.D. Ruhinda – Chairman Sisal Association of Tanzania
15:20- 15:50	Discussions (All Participants)
15:50- 16:00	Response: Mr. D. D. Ruhinda
16:00- 16:30	**Achievements and the Way Forward** Mrs. Mayra Sanchez Osuna, Deputy Director UNIDO
16:30- 16:40	**Chairman to Invite Guest of Honour to Close the Workshop**
16:40-17:20	**Closing of the Workshop** Guest of Honor: Hon. Capt. (Rtd) Jaka Mwambi - Regional Commissioner, Tanga
17:20–17:30	***GROUP PICTURE WITH THE GUEST OF HONOUR***

- END -

Project Coordinating Committee
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Annex 3. List of Participants

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BASIL	BAHATI	HIGHLAND ESTATES LIMITED	P.O. BOX 1, NGERENGERE	
BHATT	ANJANA	MOHAMMED ENTERPRISES (T) LTD	P.O. BOX 20660, DAR ES SALAAM	255 22 2121866
BIEDA	REGINA	REGIONAL COMMISSIONER'S OFFICE, TANGA	P.O. BOX 5095, TANGA	255 27 2642430
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MKANDE	MATHEW	KWASHEMSHI SISAL ESATE	P.O. BOX 518, KOROGWE	
MKANGA	SHEIKH	BAKWATA, TANGA	TANGA	
MKANGIRWA	CHARLES JOHN	TROPICAL PESTICIDES RESEARCH INSTITUTE (TPRI)	P.O. BOX 3024, ARUSHA	255 250 8813 - 15
MKILINDI	ZAWADIEL	ELCT - NED	P.O. BOX 10, LUSHOTO	
MKILINDI	ADELASTELA	MP FOR SPECIAL SEATS (WOMEN)	P.O. BOX 6022, TANGA	
MKONDA	PIUS GERVAS	TANZANIA REVENUE AUTHORITY	P.O. BOX 1400, TANGA	255 27 2643983
MKWATA	IDDI RAMADHANI	TANZANIA HARBOURS AUTHORITY	P.O. BOX 443, TANGA	255 27 2643078
MKWAWA	JOHN	JUDGE, JUDICIARY	P.O. BOX 97, TANGA	255 27 2646424
MLASANI	KIMARO D.	TANZANIA PRISONS HEADQUARTERS	P.O. BOX 9190, DAR ES SALAAM	255 222110314/6
MLAY	BEATRICE	ARI-MLINGANO	P.O. BOX 5088, TANGA	255 27 2647647
MLEMBA	JOHN	MWEMBE SISAL GROWERS	P.O. BOX 117, SAME	
MMBANDO	SPEKE	LUGONGO ESTATE	PRIVATE BAG TANGA	255 27 262322296
MNDEME	OMARY	L.M. INVESTMENT	P.O. BOX 597, TANGA	255 744 465316
MNDEME	CHRISTINA	REGIONAL COMMISSIONER'S OFFICE, TANGA	P.O. BOX 5095, TANGA	255 27 2642430
MNKABENGA	JAMES	KATANI LIMITED	P.O. BOX 123, TANGA	
MNYANI	ALI	USAMBARA SPINNING COMPANY	P.O. BOX 5023, TANGA	
MNZAVA	GPDWOM	TANESCO TANGA	P.O. BOX 5048, TANGA	255 27 2646781
MOHAMED	MOHAMED SAID	THE EAST AFRICAN	P.O. BOX 5364, TANGA	
MONGOGWELA	RENATUS	COAST REGIONAL COMMISSIONER'S OFFICE	P.O. BOX 30080, KIBAHA PWANI	255 23 2402066
MPUMA	LAI	MTINDIRO SISAL ESTATE	P.O. BOX 1892, TANGA	255 27 2645640

LAST NAME	FIRST NAMES	ORGANIZATION/ DESIGNATION	ADDRESS	PHONE
MSAMBYA	MANJU	DISTRICT COMMISSIONER, HANDENI	P.O. BOX 2, HANDENI	255 27 2641702
MSANGI	MARKO GODFREY	NGOMBEZI SMALLHOLDER	P.O. BOX 101, KOROGWE	
MSELELA	DAMSON	KATANI LIMITED	P.O. BOX 61, MOMBO	
MSHAMU	RAYMOND	AGROTANGA LTD. MUHEZA/KITISA ESTATE	P.O. BOX 10 MUHEZA	255 27 2641173
MSUMARI	IRENE	RADIO TANZANIA	P.O. BOX 5053, TANGA	255 27 2644595
MSUMI	SAIDA	CHANNEL TEN - TV	P.O. BOX 21122, DAR ES SALAAM	255 22 2116342-50
MTEJETA	THEODORA	KATANI LIMITED	P.O. BOX 123, TANGA	255 27 2644401
MTEJETA	FAUSTINE	TANZANIA SISAL BOARD	P.O. BOX 277, TANGA	255 27 2645060
MTEY	ERICA	MUHEZA DISTRICT COUNCIL	P.O. BOX 20, MUHEZA	255 27 264105
MUBA	MSHAMU A.	DISTRICT ADMINISTRATIVE SECRETARY LUSHOTO	P.O. BOX 14, LUSHOTO	
MUINGIA	RAHAB	KENYA AGRICULTURAL RESEARCH INSTITUTE	P.O. BOX 16-80109 MTWAPA	254 041 5485842
MUJURU	JOSEPH	KIBO MATCH GROUP LIMITED	P.O. BOX 1894, MOSHI	255 27 2752367
MULLA	ABDULRAHIM	MULLA TRADING, TORONTO ESTATE	P.O. BOX 597, TANGA	
MUNUO	ELEZABETH	TANGA MUNICIPAL COUNCIL	P.O. BOX 178, TANGA	255 27 2643068
MUSTAFA	NAJMI	NAJMI ELECT AND REFRIGERATOR CO. LTD.	P.O. BOX 349, TANGA	255 27 2647200
MUTIZE	KUDEAYI	KIBO MATCH GROUP LIMITED	P.O. BOX 1894, MOSHI	
MUYA	HUSSEIN	TANGA MUNICIPAL COUNCIL	P.O. BOX 178, TANGA	
MWAKANYAMALE	WILLIAM	CHINA STATE FARM	P.O. BOX 123, TANGA	255 23 2623246
MWANAKATWE	THOBIAS	NIPASHE - THE GUARDIAN LIMITED	P.O. BOX 232, TANGA	255 27 2647705
MWANDEMELE	GODFREY	METL-MJESANI SISAL ESTATE	P.O. BOX 409, TANGA	
MWANDORO	MBAROUK, K.	TANZANIA SISAL BOARD	P.O. BOX 277, TANGA	255 27 2645060
MWINYIGOHA	ABDALLAH	PRESIDENT'S OFFICE PLANNING & PRIVATIZATION	P.O. BOX 9242, DAR ES SALAAM	255 22 2117103
NAHDI	AMER	NEW KIMAMBA FIBRES	P.O. BOX 4, KIMAMBA	255 23 2620116
NAKAJUMO	JOE	UHURU/MZALENDO	P.O. BOX 9221, DAR ES SALAAM	
NDAMBALILO	CASMIR	MAELEZO	P. O. BOX 9142, DAR ES SALAAM	
NDIMBO	STELLA	KATANI LIMITED	P.O. BOX 123, TANGA	255 27 2644401
NDONDE	WAZIRI	NATIONAL SOCIAL SECURITY FUND	P.O. BOX 901, TANGA	
NG'ANZI	ALLY A.S.	TANGA MUNICIPAL COUNCILLOR	P.O. BOX 1840, TANGA	
NGASONGWA	JUMA	MINISTER, MINISTRY OF INDUSTRIES & TRADE	P.O. BOX 9503, DAR ES SALAAM	
NGATUNI	(CAPT.) GEOFFREY	TANGA DISTRICT COMMISSIONER (PO -	P.O. BOX 832, TANGA	255 27 2645204

LAST NAME	FIRST NAMES	ORGANIZATION/ DESIGNATION	ADDRESS	PHONE
		RALG)		
NGIRWA	WILFRED	MINISTRY OF AGRICULTURE AND FOOD SECURITY	P.O. BOX 9192, DAR ES SALAAM	255 22 2862064
NGOLE	FLORA	SISAL ASSOCIATION OF TANZANIA	P.O. BOX 5577, TANGA	255 27 2647237
NGWEGA	NESTORY	BUSINESS TIMES	P.O. BOX 232, TANGA	255 27 2644130
NJOROGE	PHILIP	KEPHIS	P.O. BOX 00100 - 49421, NAIROBI	254-066-32715
NKUBA	FRANCIS	KATANI LIMITED	P.O. BOX 123, TANGA	255 27 2647237
NKUBA	HARRIET	CHAIRPERSON, UWT TANGA REGION	P.O. BOX 1387, TANGA	
NTEMO	ABDI B.	KATANI LIMITED, MAGUNGA ESTATE	P.O. BOX 92, KOROGWE	255 27 2640872
NYAKI	ADOLF	ARI MLINGANO	P.O. BOX 5088, TANGA	
NYAKONJI	COL. SALUM WILLIAM	DISTRICT COMMISSIONER, KOROGWE	P.O. BOX 532, KOROGWE, TANGA	255 2640507
NYAMGALI	MANASE	KATANI LIMITED	P.O. BOX 72, MUHEZA	
NYARI	NDEKIRWA	MOHAMMED ENTERPRISES (T) LTD	P.O. BOX 2066, DAR ES SALAAM	255 22 2121866
NYARI	G.M.	KATANI LIMITED, NGOMBEZI ESTATE	P.O. BOX 288, KOROGWE	
NYICHOMBA	BAVO	PCET TECHNOLOGY DEV. & TRANSPORT CENTRE UDSM	P.O. BOX 35075, DAR ES SALAAM	255 22 2410376
OROZCO	AIDEE	CASA HERRADURA, MEXICO	COMERCIO 172-I COL. MEXICACTZINGO	(52) 3747451100
OSMAN	SAID	OSKAR (K) LTD., NAIROBI & W.G. CLASEN HAMBURG	P.O. BOX 21708 - 00505 NAIROBI	25420 566733
PASCHAL	SEBASTIAN SANGA	THE GUARDIAN LTD (FINANCIAL TIMES)	P.O. BOX 12994, DAR ES SALAAM	255 22 2700735
PEREIRA	MARTIN	AMBONI SISAL PROPERTIES	P.O. BOX 5040, TANGA	
PIUS	JAMES	THE GUARDIAN LTD	P.O. BOX 31042, DAR ES SALAAM	255 27 2700735
RAHANE	DNYANDEO	NEW MSOWERO FARM LTD	P.O. BOX 20066, KILOSA	255 22 2152403/13
RAJABU	SALIM	MATI MLINGANO	P.O. BOX 5051, TANGA	255 27 2642884
ROBERT	MANUEL	CENTRE FOR SCIENTIFIC RESEARCH OF YUCATAN	AP 87 CORDEMEX YUCATAN, MEXICO	52 (999) 9813900
ROESER	JENNIFER	TANZANIA SISAL BOARD	P.O. BOX 277, TANGA	
RUEPPELL	RAINER G.	WILHELM G. CLASEN	GLOCKENGIESSERWALL 1 D-20094 HAMBURG	
RUHINDA	DAMIAN DANIEL	D.D. RUHINDA 7 CO. LTD.	P.O. BOX 1987, TANGA	255 27 2646579
RWENDEIRE	ABEL	UNIDO, VIENNA INTERNATIONAL CENTRE	P.O. BOX 300, A-1400 VIENNA AUSTRIA	+43-1-26026-3510
SALUM	MOHAMED SAID	TANZANIA HARBOURS AUTHORITY	P.O. BOX 443, TANGA	255 27 2643777
SANCHEZ-OSUNA	MAYRA	UNIDO, VIENNA INTERNATIONAL CENTRE	P.O. BOX 300 A-1400 VIENNA, AUSTRIA	+43-1 26026-3945
SASSI	SAMUEL O.Y.	MARA REGION AGRICULTURAL ADVISOR	P.O. BOX 855, MUSOMA	255 27 282620197
SEBASTIANO	BAGNASCO	UNIDO/TANZANIA	P.O. BOX 9182, DAR ES SALAAM	

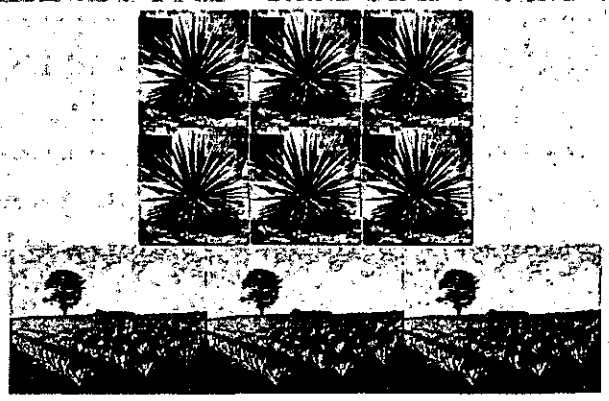
LAST NAME	FIRST NAMES	ORGANIZATION/ DESIGNATION	ADDRESS	PHONE
SEMBONY	GEORGE	THE GUARDIAN LTD	P.O. BOX 5000, TANGA	
SENG'ENGE	GIDEON	KATANI LIMITED	P.O. BOX 123, TANGA	255 27 2644401
SHAMTE	SALUM	KATANI LIMITED	P.O. BOX 123, TANGA	255 27 2647237
SHAMTE	MARIAM	PRINCESS NADIA LTD	P.O. BOX 123, TANGA	
SHAWEJI	ABDALLAH	MEMBER OF PARLIAMENT	P.O. BOX 4 KIMAMBA	
SHAYO	JOSEPH	PRESS SERVICE TANZANIA LTD	P.O. BOX 31042, DAR ES SALAAM	
SHAYO	EDITH	REGIONAL SECRETARIET	P.O. BOX 650, MOROGORO	255 23 2604227
SHEGA	JOSEPH	TANZANIA AUTOMOTIVE TECHNOLOGY CENTRE	PRIVATE BAG KIBAHA	255 27 232402299
SHENDE	RAJENDRA	NEW MSOWERO FARM LTD	P.O. BOX 20066, KILOSA	255 22 2152403/13
SHIMBA	HELLENA	MINISTRY OF AGRICULTURE & FOOD SECURITY	P.O. BOX 9192, DAR ES SALAAM	255 22 2864899
SILVA		EBDA	BRAZIL	(75) 262 1672
SKEHAN	MAURICE	AMBONI SPINNING MILL LTD	P.O. BOX 5023, TANGA	
SUBBAIAH	Dr. GAUDENS MARCUS	MOHAMMED ENTERPRISES (T) LTD	P.O. BOX 20660, DAR ES SALAAM	255 22 2121866
TARIMO	EDINGTON	FREE FOCUS PHOTOGRAPHER	P.O. BOX 6171, TANGA	
TEMBO	ABISNA PETER	CSIR	P.O. BOX 1124, PORT ELIZABETH, RSA	2741 5083200
THEWA	DICK	BANK OF TANZANIA	P.O. BOX 2939, DAR ES SALAAM	255 22 2112704
THOMAS	R.VIJAYASENAN	METL - MAZINDE ESTATE		
TIPAPE	JOSEPH	KENYA SISAL BOARD	P.O. BOX 41179, NAIROBI	254 20 223457
TORRE	ING. JOSE LUIS AZCORRA	DIRECCION DE AGRICULTURA	CALLE 21 NO. 444 CD. INDUSTRIAL, MERIDA, YUCATAN, MEXICO 97983	(999) 930 38 30 Ext 60063
TORRES	ING. CARIDAD VALDES	HORTICULTURAL RESEARCH INSTITUTE	CARRETERA BEJUCAL QUIVICAN, KM 331/2 QUIVICAN, HAVANA, CUBA	53-66-81603/7
TUNGU	LAMECK	RAS - TANGA	P.O. BOX 1474, TANGA	255 27 2645101
TUPA	FRANCIS	REGIONAL SECURITY'S OFFICE	P.O. BOX 698, TANGA	
TURUKA	FLORENS	MINISTRY OF COOPERATIVES AND MARKETING	P.O. BOX 201, DODOMA	255 27 262322296
UGOMBA	ERNEST	KAUZENI PLANTATIONS	P.O. BOX 5802, TANGA	
UNDOLLE	PAUL	MINISTRY OF COOPERATIVES AND MARKETING	P.O. BOX 201, DODOMA	255 27 262322296
VAN DER WERFF	SIETSE	COMMON FUND FOR COMMODITIES	P. O. BOX 74656, 1070 BR AMSTERDAM, THE NETHERLANDS	(31 20) 575 49 53
WASHA	FARES L.L.	NGOMBEZI CENTRAL WORKSHOP	P.O. BOX 288, KOROGWE	
WAZIRI	MWENI	TANGA TELEVISION	P.O. BOX 232, TANGA	
WILSON	ODHIAMBO, OLUM	TANZANIA SISAL BOARD	P.O. BOX 277, TANGA	255 27 2645060
YAHYA	SHARIF MOHAMED	MSHIKAMANO WA VIJANA TANGA	TANGA	
YAKUB	BURHANI	MWANANCHI	P.O. BOX 6002, TANGA	

LAST NAME	FIRST NAMES	ORGANIZATION/ DESIGNATION	ADDRESS	PHONE
		COMMUNICATION LIMITED		
YU	CHONGWEN	DONG HUA UNIVERSITY, CHINA	1882, YANAN ROAD (WEST),	86-21-62379181

Presentation by Ms. M. Sanchez Osuna, UNIDO Project Manager, on 18 November 2004

"Project rationale and highlights"

PRODUCT & MARKET DEVELOPMENT FOR SISAL AND HENEQUEN PTODUCTS



PRODUCT AND MARKET DEVELOPMENT OF SISAL AND HENEQUEN PRODUCTS

Project Dissemination Workshop
Tanga, Tanzania.

16-19 November 2004

PRODUCT AND MARKET DEVELOPMENT OF SISAL AND HENEQUEN PRODUCTS

PROJECT DEVELOPMENT OBJECTIVE:

Reduce sisal fibre production costs to enable compete with other traditional sources for pulp and paper industry

PROJECT ACTIONS APPROACH:

* *AGRONOMIC PRACTICES COMPONENT*
* *INDUSTRIAL PRACTICES COMPONENT*

PROJECT OBJECTIVES

- *Establish the techno-economic feasibility of using sisal fibre in various grades of paper*
- *Research on alternative various end uses of sisal plant*
- *Research on commercial valorization of sisal wastes*
- *Disseminate the technology and market information from the project widely and promote commercial adoption of the new technologies*

DESIGN OF THE EXPERIMENTS

AGRONOMIC PRACTICES COMPONENT:
•Varieties
•Densities
•Spacing
•Fertilizers trials
•Meristematic Tissue culture

INDUSTRIAL PRACTICES COMPONENT:

•Optimize extraction of fibre from leaves and boles.
• Evaluation of pulping technologies.
• Utilization of fibre extraction waste.

PROJECT LOGISTICS

Project Started:	*1997*
Planned Duration:	*5 years*
Real Duration:	*8 years*
Directly Participating Countries:	*Tanzania, Kenya*
Aim at Dissemination Experiences:	*Brazil, Mexico, Haiti, Madagascar, Philippines and China*
Project Executing agency:	*UNIDO*

MAIN COOPERATING INSTITUTIONS

IN TANZANIA:
Former TANZANIA SISAL AUTHORITY= KATANI LIMITED
TANZANIA SISAL BOARD

IN KENYA:
KENYA SISAL BOARD

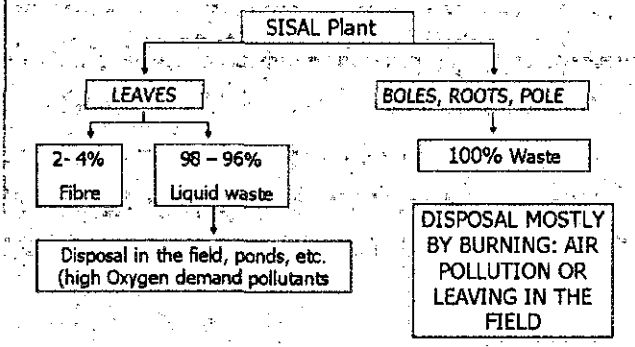
INTERNATIONAL CONTEXT AT PROJECT TIME

SISAL FIBRE (PLANT) AS COMMODITY
Low demand, low market prices. High competition from the synthetic fibre.
ENVIRONMENTAL CONCERNS
Non biodegradability of the synthetic fibres.
Needs for cleaner and environmentally friendly production practices.
Concerns about global warming and elimination of persistent chlorinated compounds
SOCIAL & ECONOMIC CONCERNS
Needs for jobs creation
Improve living standards

THE SISAL INDUSTRY SITUATION IN TANZANIA AND KENYA AT PROJECT TIME

- *A high waste industry: currently approximately 2%:98%, useful: waste ratio. Only leaf fibre used.*
- *Low profitability and high capitalization: unable to be sustainable and to compete in the global market.*
- *Inability to fully meet global conditions for export.*

SISAL PROCESSING CHART



THE PRESENTLY APPLIED INDUSTRIAL APPROACH IN TANZANIA AND KENYA

- *Environmentally unfriendly processing practices.*
- *High water and energy demands: even with the introduction of the dry decortication process.*
- *Limited utilization of the by products.*
- *Limited linkages and cross sectoral linkages with other sectors of the economy.*

EXTERNAL AID PROJECT BUDGET

DISTRIBUTED AS:

FC/RAF/96/001 -----	US$	2,248,957
US/RAF/96/060 -----	US$	365,276
XA/RAF/00/624 -----	US$	75,899
XA/RAF/96/613 -----	US$	62,485
XA/RAF/98/613 -----	US$	288,916
XA/RAF/03/651 -----	US$	95,000
YA/RAF/03/468 -----	US$	62,804
GRAND TOTAL ------	**US$**	**3,199,337**

CURRENT BUDGETARY DISTRIBUTION BY COMPONENTS

A.- DEVELOPMENT OF SISAL VARIETIES AND IMPROVEMENT OF CULTIVATION AND PROCESSING PRACTICES.

US$ 1,141,572

CFC:	574,567
UNIDO:	567,005
(US:	318,222)
(XA/YA:	248,783)

DEVELOPMENT OF NEW SISAL VARIETIES AND IMPROVEMENT OF CULTIVATION AND PROCESSING

OBJECTIVE: Select varieties to contribute to increase fibre yield per ha, reduce fibre production costs and improve competitiveness of sisal fibre for pulp production. Included:

- *Evaluation of Past Research*
- *Fertilizer trials: different fertilizers combination.*
- *Small holders system evaluation: improve farming system to optimize return of labor and capital.*
- *Variety trials in Estates. Three factor variety trials (H 11648, Sisalana, Hildana and Miola)*
  - *D: 4000, 6400, 8000 plants/ha*
  - *T: 36, 42, 48 months*
  - *S: 1.5 x 1.5–1.25 x 1.25–1.25 x 1.00*
- *High density trials = partial and complete defoliation.*
- *Meristematic Tissue culture.*

CURRENT BUDGETARY DISTRIBUTION BY COMPONENTS

B.- VALORIZATION OF WASTES FOR THE PRODUCTION OF NEW PRODUCTS.

US$ 296,285

CFC:	243,303
UNIDO:	52,982
(US:	970)
(XA/YA:	52,012)

FLUME TOW RECOVERY SYSTEMS
ANIMAL FEED TRIALS
BIOGAS FROM SISAL WASTE

B. VALORIZATION OF WASTES FOR THE PRODUCTION OF NEW PRODUCTS

- *Flume tow recovery system: To recover the short fibre from decorticator.*
  - *Evaluate the cost*
  - *Increase the yield*
- *Study for biogas production from sisal waste.*

CURRENT BUDGETARY DISTRIBUTION BY COMPONENTS

C.- RESEARCH AND DEVELOPMENT IN SISAL LEAF PROCESSING INTO PULPABLE FIBRE AND PILOT PRODUCTION OF PULPABLE FIBRE AND SISAL PULP.

US$ 467,253

CFC:	405,006
UNIDO:	62,247
(US:	14,105)
(XA/YA:	48,142)

R & D ON PULPABLE SISAL FIBRE
PRODUCTION OF PULPABLE FIBRE

CURRENT BUDGETARY DISTRIBUTION BY COMPONENTS

D.- MARKET STUDIES AND TRIALS.

US$ 108,242

To carry out market studies on sisal fibre and pulp for different uses in the paper industry

CURRENT BUDGETARY DISTRIBUTION BY COMPONENTS

E.- COOPERATING INSTITUTIONS COST

US$ 1,016,400

CFC:	**749,228**
UNIDO:	**267,172**
(US:	**101,531)**
(XA/YA:	**165,641)**

PRODUCT AND MARKET DEVELOPMENT OF SISAL AND HENEQUEN PRODUCTS

FOLLOW UP SUGGESTIONS TO COME.....ON 19-11-04!!!!

THANK YOU

Presentation by Mr. W. Khayrallah, International Expert

"New sisal production systems; estate variety and fertilizer trials"

Product & Market Dev. for Sisal & Henequen

- Confirmation & Demonstration of New Enhanced Fibre Production Systems
- Estate variety & Fertilizer Trials

Tanzania-Kenya

- By Dr. Walid Khayrallah
- International Expert
- Final Dissemination Workshop, Tanga, Tanzania
- 16-20 November 2004

Project's Main Objective

Revive the Industry by helping it to become more competitive and by opening-up a large new market

Pulping Fibre & Pulp

New Market Fibre & Pulp

1- The cost of fibre raw material has to be greatly reduced
2- The fibre has to be of uniform quality
3- The availability of the fibre from more than one source has to be assured.

Main Avenues for Success

1. Develop and demonstrate an improved and sustainable production system capable of greatly increasing fiber yields and reducing costs of production compared to the traditional system.
2. Develop and demonstrate a new cost-effective fiber extraction system, which produces fiber of uniform quality, in a cost-effective manner.
3. Get more value from sisal by valorizing " Wastes"

Critical Components

Treat sisal as an Agricultural Crop

1- Improve systems of producing planting stock. (Nurseries – tissue culture?)
2- Increase field-planting density
3- Introduce cost-effective field and crop management operations

Agro-R & D Activities

1. Enhanced nursery production trials
2. CEPS demonstration-confirmation trials
3. Ultra-high density trials
4. Selective leaf harvesting trials
5. Adapt and use new mechanical aids to enhance productivity
6. Estate Fertilizer & Sisal waste V. trials

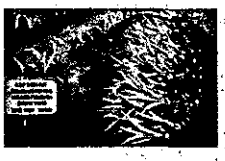
Enhanced-Nursery Trials

- Well prepared seed- bed
- Balanced package of soil amendments, fertilizer, and chemical weed control. +
- Sisal weevil control

Enhanced Nurseries

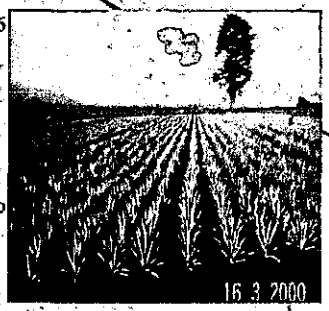
1. Adopt intensively managed permanent nursery site to assure productivity and reduce costs.
2. Increase number of plants/ha from 80,000 to (100,000-160,000) per hectare.
3. Apply an intensive soil- fertility program with Zero weed tolerance and effective cultural & chemical weevil control.
4. Ensure no moisture stress(provide irrigations when needed)
5. Introduce mechanical planting which becomes easy in an well-prepared seed-bed.

Healthy nurseries




Healthy Planting Stock

- 25 cm - 250 gm plants in 6 months or
- 35 cm & 800 g in 12 m.
- 2 cycles/ year.Quick (6 months cycle)
- Small but very healthy plants
- Benefit = reduced costs to 4 Tsh/plant.
- And reduced field establishment costs



Intensive Field Production Systems


- If one provides adequate soil fertility and plant nutrient availability, together with less competition from weeds and pests. &
- Increase # of plants/ha by 50% or more.
- Fibre production can be increased very significantly.

CEPS Demonstration Trials

- Balanced pkg of soil amendments + fertilizers + weed control for 1st 18 months after transplanting
- 8 MT lime before planting, 75 kg of Phospate, 75 kg of (K) and 50 kg of (N) at planting, Followed by 100 kg of (N) split over 2 applications 6 and 12 months after planting; + Final 50 kg (K) and 75 kg (N) slow-release at 18 months.
- Vigorous 6m old nursery plants with intact roots. Or 1-yr old nursery plants.
- 6400-8000 plants/ha.
- Effective stump control and frequent cultivation during first 18 m. + Weevil control.

Improved Crop Establishment

Mechanically assisted field marking reduces costs and is more productive.
20-30 Ha/day @ $ 5/ha

Post-planting cultural package- fertilization, weed control results in healthy plants

Reduced labour costs.

CEPS-I Trials

- 4 Varieties were compared under the same package of soil-fertility and crop management :
- 15-50, two hundred meter rows from each variety were planted
- Each at 6400 plants per ha. in a 1.25 m x 1.25 m spacing, and 8000 plants/ha in a 1.25 m x 1 m spacing.
- Hybrid 11648, Sisalna, Hildana, and Mlola 487 varieties were grown side by side.

CEPS-II TRIAL

5 HA of Hybrid 11648 at 6666 plants/ha. In rows 1.5 m apart and plants 1 m apart in the row.

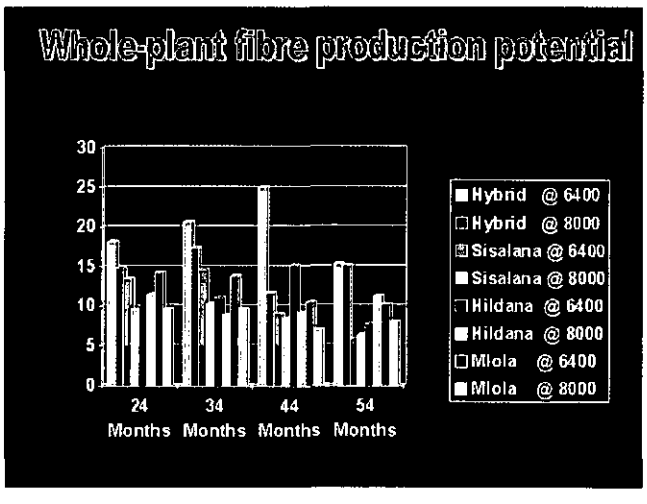
Planted in rotation with a maize crop followed by a forage legume crop,

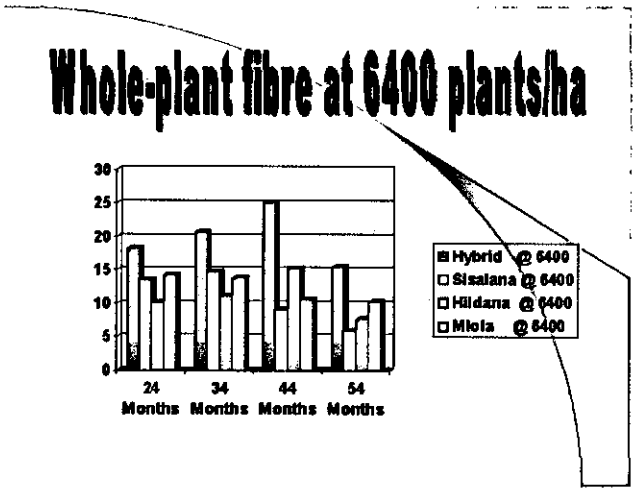
2.5 ha was produced using 1-year old nursery plants and the balance using smaller 6-m old nursery plants.

Sisal at 24 months

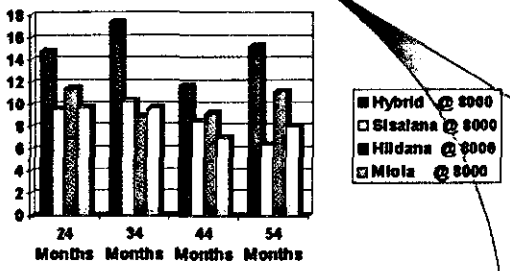
CEPS-I Biomass YLD

Treatment	Potential fresh whole-plant biomass (mt/ha)			
	24 m	34 m	44 m	54 m
Hyb6400	317	361	580	634
Hyb8000	260	306	295	344
Sis6400	234	254	239	250
Sis8000	202	230	235	351
Hil6400	224	247	372	323
Hil8000	272	258	224	319
Mlo6400	224	215	276	374
Mlo8000	211	229	148	377





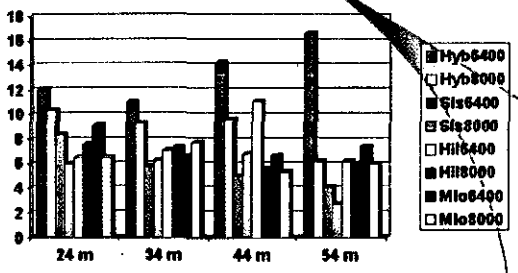
Whole-plant fibre at 8000 plants/ha



CEPS-I Leaf-Fibre yields

	24 m	34 m	44 m	54 m
Hyb6400	12.0	11.0	14.2	16.6
Hyb8000	10.3	9.3	9.6	6.2
Sis6400	8.4	5.8	5.0	4.1
Sis8000	6.0	6.3	6.8	2.7
Hil6400	6.5	7.1	11.1	6.2
Hil8000	7.6	7.3	5.6	6.0
Mlo6400	9.1	6.6	6.7	7.4
Mlo8000	6.5	7.7	5.3	6.0

CEPS-I Leaf-Fibre yields



Ultra-high Density

- With Hybrid 11648 only
- 3 basic trials :
  - --- Selctive plant lifting in 2 nurseries
  - --- Direct field planting using bulbils
- 6666, 12500, 16,666, 25,000, and 33,333 plants/ha
- For Whole-plant harvesting to produce whole-plant pulpable fibre.

UHDT performance

Planting density of. 16,000 plants/ha

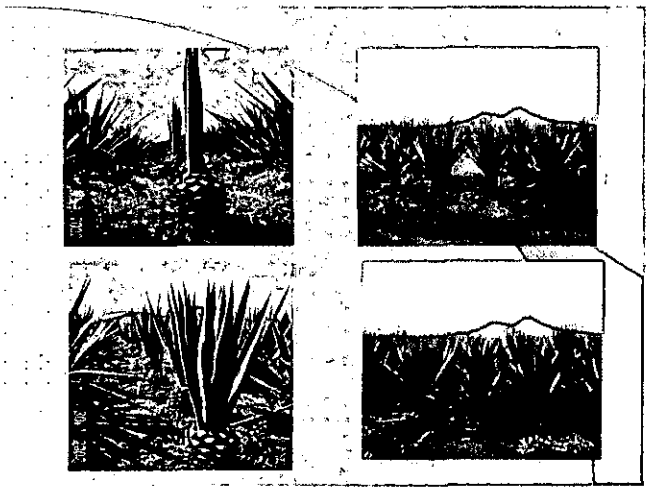
At 33,000/ ha

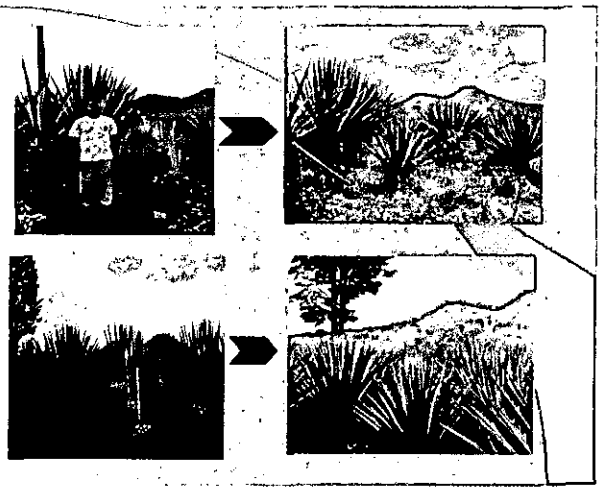
UHD Biomass & fibre

Density	Leaf wt	Bole wt.	MT/ha	Leaf fibre	Plant fibre
6666	314	215	352	13/ha	19/ha
12500	335	205	360	14	19.8
16666	346	247	395	15	21.7
25000	348	247	397	13	21.8
33500	331	235	377	16	20.7

Selective Leaf harvesting

- Study effects of intensity of leaf harvesting on fibre yields and plant persistence in 4 varieties.
- Intensities of 0, 5, 10, 15, & 20 leaves were kept around spike.
- Rest harvested & weighed every 7-12 m
- 0-5 leaves caused stunting + plant death.
- 10-15 best yield & health
- 20 leaves = good stand but less yield.





SLH- Results

- Higher yields and lower mortality when 10 or 15 unfurled leaves were left on the plant during each defoliation.
- Hybrid 11648 produced more leaf biomass than the three other varieties within same treatments.
- Total defoliation of Hybrid 11648 and Mlola 487 caused significantly more plant losses due to weevil infestation than in Sisalana and Hildana.
- High-Intensity defoliation is not recommended if the crop is to be kept for over 4 years or more.

Line Fibre production Potential by SLH

Hybrid 11648	Ceps-I 6400	CEPS-II 6666
Age	46 months	34 months
Cutting cycle	SECOND	First cut
Leaves/plant cut	52	53
Leaf length	100 cm	75 cm
Meters/ha	102	108
Tons/ha UG fibre	5.1	3.2

SLH for pulping fibre production

Variety	1st cut 24 m	2nd cut 34 m	3rd cut 44 m	4th cut 54 m	Total MT/ha
Hybrid	7 ?	5.3	5.2	4.4	21.9
Sisalana	6 ?	4.2	3.6	3.1	16.9
Hildana	6 ?	3.6	3.5	3.2	16.3
Mlola	6 ?	3	4.0	3.4	16.4

CEPS Costs-1

	US $$$/ha
Land Preparation	120
Soil Amendments & Fertilizers	(230)
Nursery Plants	36
Field Marking-Planting-replanting	25
Post-planting Fertilizers to age 18 months	105

CEPS Costs-2

Mechanical weed-control & Fertilizer application 3-4/18m	80
Manual weed & weevil control	120
Road Grading & maintenance	30
Field management & supervision	150
Other Overheads	50

CEPS Costs-3

Total Costs to First harvest @24m	956
Fertilizers + Man –apply @ 25 m + Manual-weed-control	200
Fertilizers + Man-apply @ 37 m + Man-weed-control	225
Fertilizers + Man-apply @ 47 m + Man-weed-control	250
Total cost of 20 MT/ha	$1631

In-Leaf Fibre Costs

Cost factor	US $/ MT
In-situ Production @ 20 MT/ha in 4 harvests	81.5
Manual Leaf harvesting	25-35
Loading- Transport-Unloading	25-35

Critical Assumptions

- No more than 5% plant losses in plantation at 18 m & thereafter.
- 4% Net minimum leaf fibre recovery from fibre extraction system FEX.
- Minimum average rainfall of 1000 mm
- Timely field management intervention
- Labour costs at 2004 levels.

Follow-up of Trials

- Continue gathering data from SAH in CEPS-I and CEPS-II
- Conduct complete analysis on soil fertility levels at end of cycle (4-6 years???) with particular emphasis on soil Calcium and OM levels. To evaluate requirements for correction for long term sustainability of productive soils.

Potential for further cost reduction

- Cheaper LIME & other inputs
- Employ more effective leaf gathering system (South Africa???)

Presentation by Mr. G. Seng'enge, Project Agronomist

"Smallholder sisal farming"

EVALUATION OF SMALLHOLDER FARMING SYSTEMS

Presented by
Gideon O. Seng'enge
(Project Agronomist)

INTRODUCTION

- In 1994 Tanzania Sisal Authority initiated a sisal smallholders' pilot Scheme at Kimamba Fibres in Kilosa District-Morogoro Region.
- By end of 1998 - 109 farmers were allocated 720 ha out of which 236 ha were planted sisal.
- Results from this Project were going to be used to start similar schemes in the country.
- During the same period, IFAD funded a similar sisal scheme in the Mara Region.

BACKGROUND TO HEDGE SISAL

- Hedge sisal is grown in the Lake Victoria Regions: Mwanza, Shinyanga, Mara and Tabora.
- Sisal hedges are used to protect crops and homesteads from livestock and wild animals, serve as a firebreak. The fibre is used for ropes, bags, building, fishing etc

OBJECTIVES OF THE MARA- FIP AND SISAL PROJECT STUDIES

- To analyze farming systems suitable for sisal smallholders for optimal returns.
- To evaluate field practices particularly new fibre extraction methods.
- To provide an alternative cash crop for poverty alleviation

TARGETED BENEFICIARIES

- Sisal smallholders in drought prone rural areas.
- Farmers living near sisal estates, workers in sisal estates, urban dwellers interested in sisal farming.
- Companies involved in sisal growing and processing into finished products.
- Villages and District Councils where sisal can thrive.
- Local and overseas sisal fibre traders.

MANAGEMENT AND IMPLEMENTATION IN MARA - FIP

- Each district established 1 ha of nursery for producing planting material for 48 ha of land provided by the Local Government.
- Land preparation, planting material, planting and sisal maintenance were financed by Project.
- By end of 2003 four farmers' groups were formed, two of which were registered as Savings and Credit Cooperatives Societies.
- The Project ended in June 2002 having spent a total of U$ 92,881.68 since its inception in 1996.

TRAINING IN MARA-FIP

- In 1997 an Agricultural Officer undertook an intensive sisal husbandry course at ARI Mlingano.
- In 1998 Subcomponent Managers and VEOs were trained by the Project Agronomist on sisal husbandry at Bunda.
- In 2000 five VEOs and 16 farmers underwent a week's course on sisal husbandry at ARI Mlingano. Trainers were drawn from ARI, Katani and TSB.

MANAGEMENT AND IMPLEMENTATION IN SISAL ESTATES

- **In 1997 The Project contracted the TSA Agronomist to review sisal farming systems from 1967.**
- **Data was collected from similar schemes in MARA FIP, tea and sugar outgrowers, smallholder schemes at Kimamba and Kingolwira Estates.**

CONSULTANT'S RECOMMENDATIONS

- Minimum area per family should be 4 ha.
- Land preparation, planting and sisal maintenance be subsidized by the Government or long term soft loans be provided.
- Mini-decorticators be developed for farmers living far from estates.
- Farmers to adopt mixed farming to provide food and cash.
- TSB to assist farmers in Mara Region in finding market for their fibre.

MANAGEMENT IMPLEMENTATION. -TRAINING

- Additional studies, sensitization and training of farmers were done by PSI of Dar es Salaam and ACDI-VOCA, an NGO in USA.
- In 1992 two officers went on a study tour of the southern areas of China for farming systems.
- In 1999 the NPO had a study tour of Brazil and Mexico to learn about farming systems and marketing. In 2000 two Engineers visited Brazil to learn about fibre extraction technology with small mobile decorticators.

MANAGEMENT IMPLEMENTATION -TRAINING Contd.

- In 2003 a total of 28 farmers were trained on sisal establishment, maintenance and harvesting.
- A Swahili manual was prepared and launched at the Stakeholders' Meeting in 2003.
- In 2004 a group of 70 farmers from Magoma Estate were trained on bookkeeping, group formation and sisal farming.

AREA PLANTED SISAL

- By end of Sept. 2004 all smallholders in sisal companies had planted 1,924 ha. of which farmers in Katani estates planted 1,912 ha or 99.3% of the total.
- Up to September 2004, Katani Ltd had allocated 21,591 ha to 2,121 farmers.
- Leaf cutting at Mwelya started in 2003. By end of September 2004 the farmers had sold 5,573 metres of leaf and earned Tshs. 22.1 million.

GROUP FORMATION, REGISTRATION AND FINANCING

- **So far 43 groups were formed. Groups at estates joined to form one Coop Society.**
- **5 Coop Societies have been formed and applied to Govt. for registration.**
- **So far only one Coop has been registered.**

DISSEMINATION OF RESULTS

- By the Project Newsletters.
- During Project Dissemination Workshops.
- During Project NCC and PCC Meetings.
- During annual sisal stakeholders' meetings.
- During Tanzania Sisal Board Meetings.
- Through SAT Executive Meetings.
- Through the press at various farmers' meetings.

LESSONS LEARNED

- Capacity building through participatory approaches and training are necessary for success.
- Commitment and cooperation of political leaders are a key to smooth implementation.
- Ownership must be assured from the beginning and beneficiaries should contribute in a form of labour and materials for Project sustainability.
- Sisal has proved an insurance crop since even under adverse weather, farmers survive from sisal leaf proceeds.

CONCLUSIONS AND RECOMMENDATIONS

- **Grants/and or long term soft loans are necessary for financing land preparation, planting and sisal maintenance.**
- **Spinners, weavers and other processors be provided with affordable loans.**
- **There is a need to establish savings and credit societies leading to establishment of a Sisal Bank.**
- **Farmers near estates be encouraged to grow sisal in their farms and sell the leaf to nearby estates.**

CONCLUSIONS AND RECOMMENDATIONS -Contd.

- Schools should plant sisal for training and income generation. Same for National Service camps and Prisons.
- Efforts be encouraged among farmers to strengthen coop groups, provide education to the groups on participatory planning, monitoring, evaluation and organization.
- Financial assistance be available for R&D on new sisal products.

Presentation by Mr. M. Robert, International Expert

"Micropropagation of Agaves"

CICY

MICROPROPAGATION OF AGAVES

A BASIC TOOL TO INCREASE THE PRODUCTIVITY OF THE PLANTATIONS

Manuel L. Robert

CICY

MICROPROPAGATION

Micropropagation

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Micropropagation is the rapid and efficient multiplication of any plant species by means of in vitro tissue culture techniques such as

- Meristem culture
- Adventitious organ induction
- Organogenesis
- Direct or indirect somatic embryogenesis

Micropropagation

CICY

ADVANTAGES

- Applicable to practically any plant species
- Permits the rapid production of very large numbers of plants
- Produces genetically homogeneous lines (Clones)
- Produces disease free materials

APPLICATIONS:

- Propagation of elite cultivars
- Germplasm rescue and conservation
- Generation of new genetic variability
- Disease control

COST

EUROPEAN COOPERATION IN THE FIELD OF SCIENTIFIC AND TECHNICAL RESEARCH

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COST Action 843

Quality Enhancement of Plant Production Through Tissue Culture

COST Action 843

CICY

For a sustainable and competitive agriculture and forestry in Europe, *in vitro* culture is essential: it is a prerequisite for the successfull application of plant breeding by biotechnological methods, for the rapid introduction of improved plants in the market and it offers unique possibilities for the production of plants of superior quality.

In the EU the competitiveness of the plant-based industries is compromised and the benefits that may be achieved through tissue culture are being applied successfully only to a limited number of crops.

COST Action 843

CICY

- **COST action 843 deals with various aspects of plant production through tissue culture. The proposal for this action was submitted in 1999 by The Netherlands and runs from December 1999 till December 2004.**
- **At the end of 2000, 22 countries had joined the action.**
- **The main objectives are:**

  1) Innovation of plant propagation methods that permit and enhance sustainable and competitive agriculture and forestry in Europe

  and

  2) Initiation and extension of networks amongst European scientists in the field of *plant tissue culture that facilitate exchange of knowledge and transfer of* expertise.

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The Micropropagation method

Introduction

CICY

Most micropropagation processes are carried out on small plastic culture vessels containing a culture media composed of

- mineral salts and vitamins
- a carbon source of energy (sucrose)
- growth regulators.

This nutrient media is solidified with a gelling agent on top of which cells, tissues, organs or plants are sown

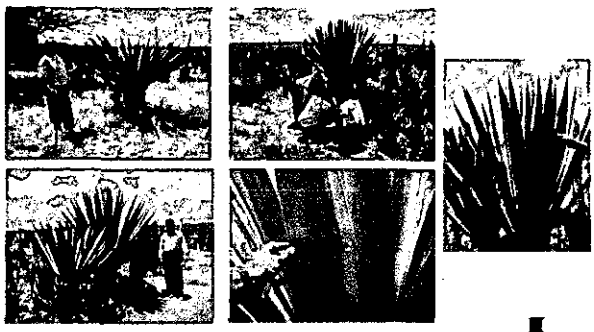
The culture dishes are incubated under controlled light and temperature

The culture media and the culturing conditions vary depending on the species, the type of tissue and the objectives pursued. There is a method for each type of tissue

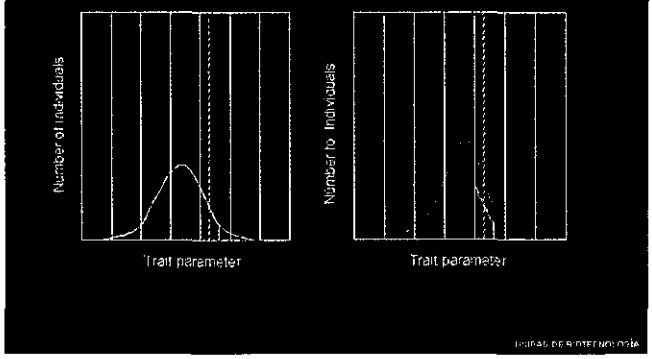
Sterile conditions are essential throughout the whole process

Selection

CICY

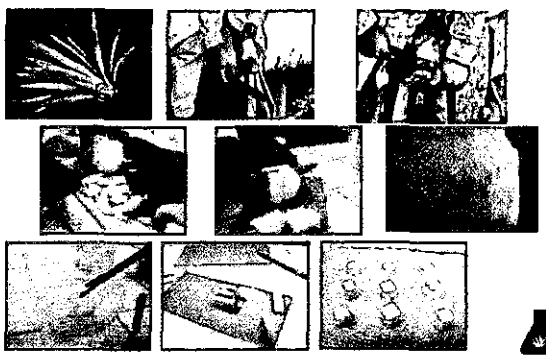


Selection



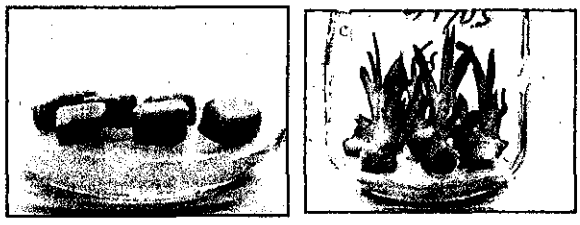
Extraction of explants

CICY



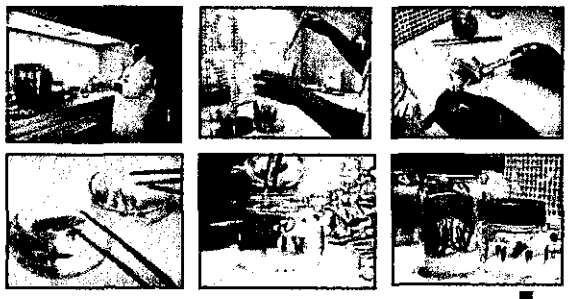
Induction

CICY



Multiplication

CICY

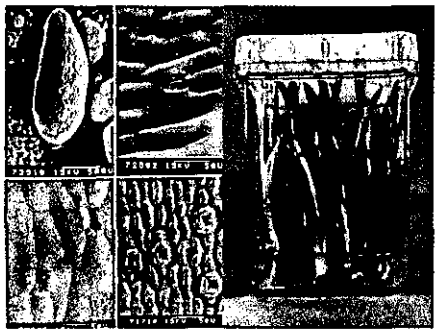


Incubation

CICY

Pre-adaptatión

CICY

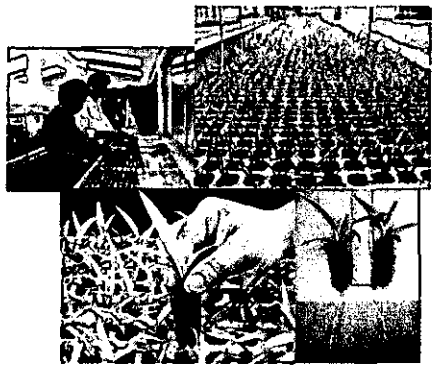


Transfer to *ex vitro* conditions

CICY

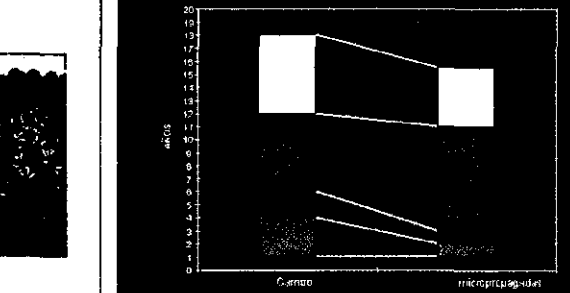
Transfer to soil

CICY



Nurseries

CICY



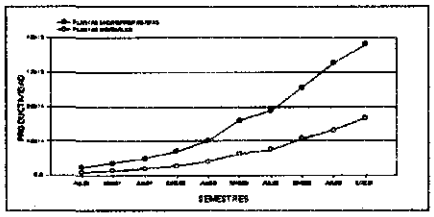
Differences in the cultivation stages of selected micropropagated lines and rhyzome propagated plants

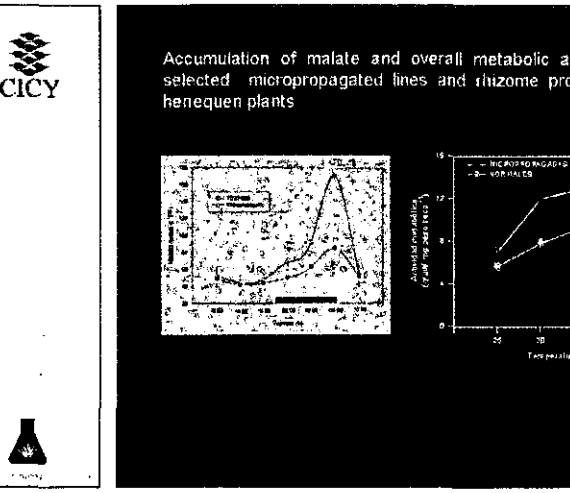
* Fuente: 1993, Datos de la Hacienda Santa Teresa proporcionados por el Ing. Alejandro Aguilar

UNIDAD DE BIOTECNOLOGÍA

Field performance of henequen plants: elite clonal lines vs. traditionally propagated ones

CICY





Accumulation of malate and overall metabolic activity in selected micropropagated lines and rhizome propagated henequen plants

UNIDAD DE BIOTECNOLOGÍA

Performance of elite henequén plants

CICY

- Reach the harvesting stage two years earlier
- Produce an average of 30 % more leaves per year
- Produce leaves 25% bigger.
- Generate an overall 80% increase in foliar biomass
- Produceun a large number of rhizomes in the nursery

- Present a higher exchange of CO_2 (mainly during the dry (season)
- Incorporate twice the amount of malate
- Show an overall higher metabolism (microcalorimetry)

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PRODUCT AND MARKET DEVELOPMENT FOR SISAL AND HENEQUEN PRODUCTS PROJECT

Subcomponent A5

Multiplying sisal by meristematic tissue culture

Objectives of subcomponent A5

CICY

Main Objective

To multiply elite varieties and individuals through tissue culture in order to generate high quality planting material and reduce the time required by breeders to produce new commercial varieties

Specific objectives:

- Establish a functional laboratory at ARI Mlingano
- Train proficient technical staff
- Define a method for the efficient micropropagation of the main species and hybrids used in the project
- Establish demonstrative plots of micropropagated materials
- Maintain the germplasm collection at ARI Mlingano
- Draft a bussiness plan for the laboratory
- Establish a sisal tissue culture laboratory in Kenya along the same lines outlined above

Outputs of subcomponent A5

CICY

- Establishment of well equipped laboratories in Tanzania and Kenya
- Trained technical staff
- A defined method for the micropropagation of several hybrids and species
- Initial production of plants and establishment of the first demonstration plots
- Partial recovery of the germplasm collection and establishment of a new site

The tissue culture laboratory at ARI Mlingano

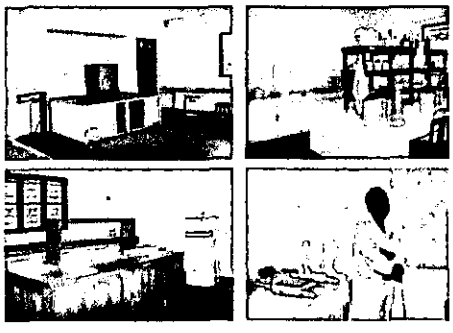
CICY

The access to the clean areas

CICY

The media preparation room

CICY



The sterilization room

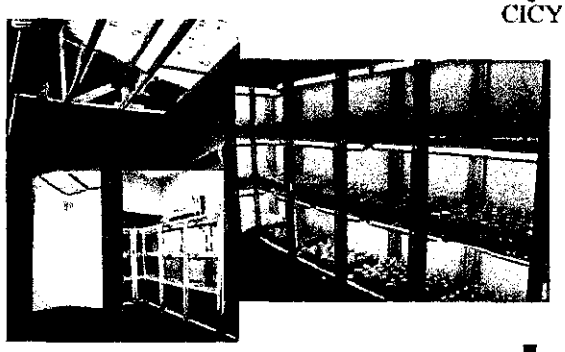
CICY

The transfer room

CICY

The incubation rooms

CICY



The adaptation area

CICY

The germplasm collection

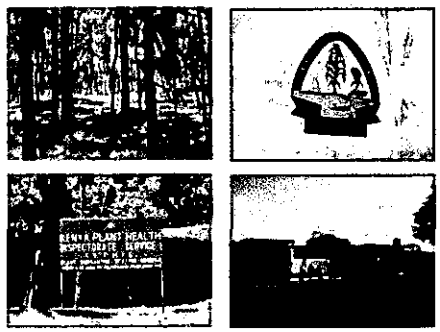
CICY

The Tanzanian team

CICY

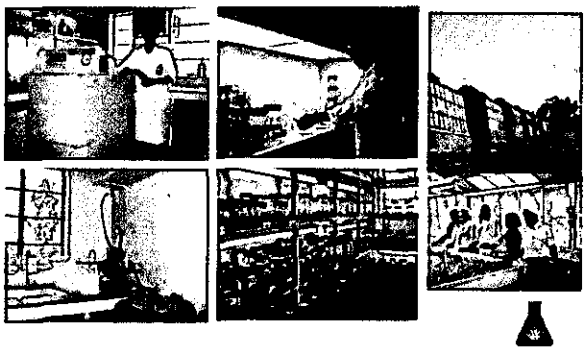
The KEPHIS laboratory at Muguga

CICY



The tissue culture laboratory at KEPHIS

CICY



The Kenyan team

CICY

CICY

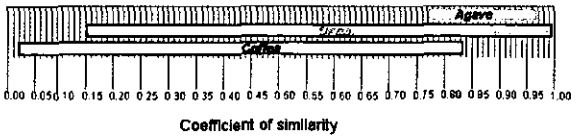
THE FUTURE OF AGAVE TISSUE CULTURE

CICY

Genetic Improvement

Comparison of the level of genetic variability in species within the genus *Agave* (propagación vegetative propagation) and *Coffea* and Oryza (sexual reproduction)

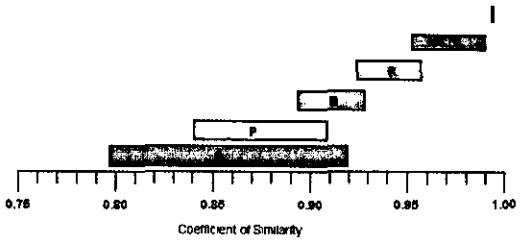
CICY



Aggarwal et al., 1999
Leshermes *et al.*, 1993.

Genetic variability

CICY



Characterístics that make the genetic improvement of agaves difficult

CICY

Long life cycle
Vegetative propagation
Some species do not produce flowers
Low production of seeds and low viability
Polyploidy

Induction of new genetic variability

CICY

- Genetic improvenment through cross pollination
- Selection and cloning of "elite"plants
- Mutagenesis
- Somaclonal variation
- Genétic transformation

Cross pollination

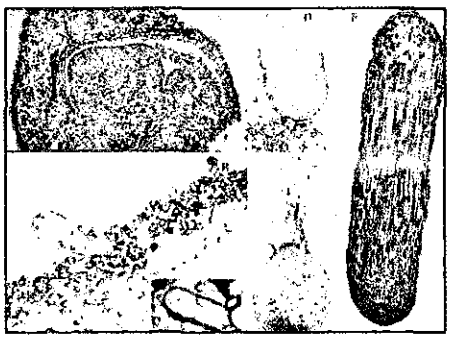
CICY

CICY

SOMATIC EMBRYOGENESIS

Somatic embryogenesis

CICY



Somatic embryogenesis in henequen (Agave fourcroydes Lem) under two different culture systemsi

CICY

Somatic embryo formation andconvertion to plants in two different culture systems

CICY

CULTURE SYSTEM	BAP (mg/l)			
	10		20	
	mbryos formed/g of tissue	Plants developed	Embryos formed/g of tissue	Plants developed
Temporary Immersion	145	223	80	460
Semisolid medium	4	0	8	20

Average after eight weeks in culture

CICY

LIQUID BIOREACTOR SYSTEMS

Micropropagation:
Problems and disadvantages

CICY

- Heterogeneous culture conditions
- Labor intensive: 60 – 70% of total cost
- Too expensive for low added value species
- Some species are recalcitrant

Liquid systems

CICY

Advantages

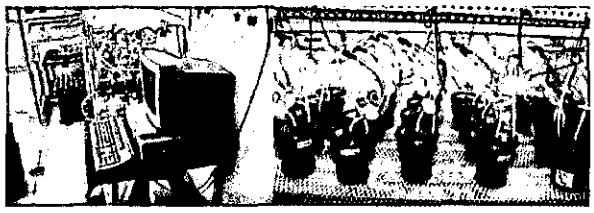
- More homogeneous culture conditions.
- Direct contact of the tissues with nutrients and growth regulators.
- Elimination of gelling agents that require several steps of manual operation and increase cost.
- A simplification of culture transfers

Problems

- Vitrification or hyperhydricity
- Microbial contamination
- Aereation
- Scaling up

Henequén tissue culture in RITA

CICY



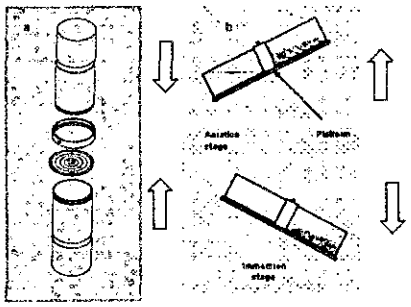
CICY

BioMINT
(PA/a2004/003837)

TEMPORARY IMMERSION
MODULAR BIORREACTOR

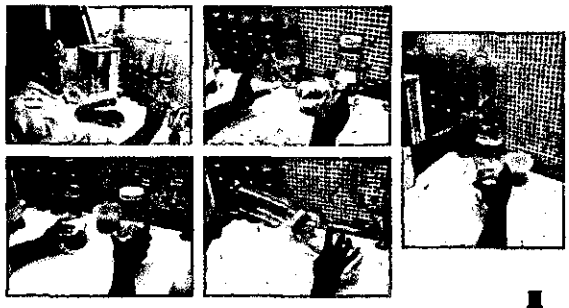
BioMINT
Temporary immersion modular bioreactor

CICY



Culturing in BioMINT

CICY



SyB

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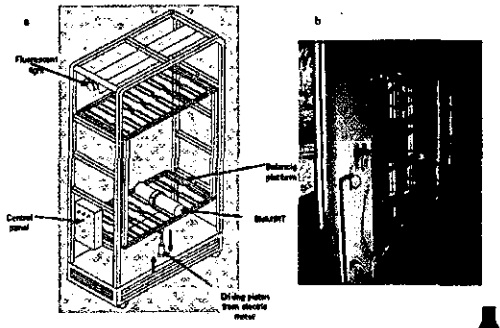

BioMINT cultivated agaves

CICY

BioMINT Advantages

CICY

- Totally autonomous driving system that works on electricity and does not require special installations.
- The bioreactor units are completely independent and easy to operate heir size allows for medium culture capacity but are easy to move from the sterile to the culture areas
- The bioreactors are autoclavable and reusable.
- The wide mouth and simple assembling and disassembling parts permit to carry out easy and rapid transfers and media changes.reducing labour and production costs
- Can be used for all stages of the micropropagation process.and for full immersion culture
- It is cheaper than all other commercial systems available.
- Reduction of vitrification as compared with permanent immersion.
- Better nutrition of tissues through direct contact with the culture medium
- Microbial contamination, if it happens, is compartmentalized and easily controled

Presentation by Mr. G. Kissaka, Project Engineer

"Selection of Fibre Extraction Technology for FEX Pilot Plant"

PRODUCT AND MARKET DEVELOPMENT FOR SISAL AND HENEQUEN PRODUCTS

Selection of Fibre Extraction Technology for FEX Pilot Plant

Presented by

Gilead Kissaka – Project Engineer

1.0 Background and Concept in which the Project was conceived.

Current fibre extraction is not very efficient. Fibre losses range from 15 to 20%.

Sisal fibre from current decorticators is produced at high cost.

It was considered necessary to change the traditional fibre extraction techniques to increase productivity and lower production costs.

Change of Fibre Extraction Technology

- Recover more efficiently fibre from the leaf for paper, composites and other applications.
- Make use of fibre from the boles, hitherto left in the field to be crushed and burnt in the field for new planting

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2.0 Objectives:

To evaluate processes of Hammer Milling and Roller Crushing

To determine the technology basic unit operation and parameters for designing of a FEX Demonstration Plant.

To carry out Feasibility study for the FEX Demonstration Plant

3.0 Project Implementation and Results Achieved

Hammer mill Testing

Full load operation was performed intermittently for periods of 15 minutes after installation of the modified forage chippers and feeding trailer.

It was observed that at maximum rated mill capacity of 12 tons/hr there is no excess material at the over flow chute of the screw conveyor 420mm and the hammer mill runs smoothly.

Chipping

Two chippers were imported from Brazil and modified by TATC to chip sisal leaf to piece of about 7 cm long. The chippers have capacity of 2.5 tons of sisal chips per hour, but limited by manual feeding.

Roller Crusher

The fibre produced had some parenchyma around 10% by weight after washing 6 to 7 passes. Water used was about one cubic metre/kg of dry fibre

Fibre recovery was 3.1% weight basis

Hammer Mill - One Pass

It was observed that not all detached parenchyma was separated from the fibre in the hammer mill.

The fibre had parenchyma content of about 33% before washing at chips feed rate of 10 tons per hour.

Output was about 50% of the fresh chips.

Washing the fibre manually reduced parenchyma to about 10% which required mechanical force to detach from the fibre

The parenchyma separated through the screen had very low fibre content 0.6%

Roller Crusher/Hammer mill Combination

It was observed that crushing sisal chips three times in a roller crusher and then making one pass in the hammer mill, produced fibre of same quality as one produced by one-pass hammer milling alone. It was realized that a combination of roller crusher and hammer mill does not improve the quality of fibre.

Hammer mill Two Passes

It was observed through trial runs that when fibre is produced from first pass in a hammer mill and passed again in the hammer mill the fibre quality is improved.

Feeding the second pass without washing at 10% of mill capacity produced fibre with parenchyma content of around 5%, which improved to around 4.1% after washing. Power consumption for two operations was estimated to be 12 units/ton fresh leaf or 300 units/ton of air dry fibre based on current draw of the meter, but it is likely to go down under continuous run.

Optimisation of Parenchyma Removal in the First Pass

Mechanical washing in water trough could reduce parenchyma with large quantities of water but not below 10%.

The system requires modification of the discharge mechanism to enable picking of the fibre at the end, and the screen.

Injection of about 8 cubic metres of water per hour through hammer mill screen reduced parenchyma to 15%.

Optimisation of Parenchyma Removal in the Second Pass

Feeding the fibre with parenchyma content of about 15% to the hammer mill with about 10 cubic metres of water per hour injected into the mill through the screen, produced fibre with parenchyma content 5%

4.0 Selection of Optimum Extraction Sequence

The optimum extraction sequence is the one with high efficiency in terms of fibre recovery and fibre quality.

Selected Extraction sequence:

Two passes in the hammer mill with water supplied inside the hammer mills. It was difficult to quantify tasks for hammer mill operations as the activities were not continuous. Cost of harvesting to baling under continuous operation is estimated to be US $ 160/ADMT of fibre excluding power and water. It is can be confirmed under continuous operation.

Kissaka G. E - Project Engineer 13

5.0 Proposed FEX Demonstration Plant

2 Chipping systems up to12 tons/hour each

Two hammer mills in parallel with capacity of 9.6 to 12 tons/hour to perform the first pass operation

Water system with capacity of up to 27 m^3/hr to supply water into the three hammer mills.

A squeezer to reduce moisture and A drier to dry fibre to about 10% moisture content

A Balling Press for baling the fibre to about 200kg

Kissaka G. E - Project Engineer 14

Waste Treatment

The waste ejected from the hammer mill has low fibre content and can be used in biogas plant without removal of short fibre.

Construction of oxidation ponds is alternative for short term pollution control, but the use of waste for biogas production has more impact on adding value of the crop

Kissaka G. E - Project Engineer 15

6.0 Lessons Learned

Roller crushers have disadvantage of fibre damaging especially at the later stages

Combining the roller crusher with the hammer mill does not improve quality of the fibre.

Water bath washing is likely to use large quantities of water.

Commercial pulpable fibre can be produced through two passes in the hammer mill with water injected into the mill.

Hammer mill can extract fibre from the bole, but need to be separated from the leaf as it has different pulping conditions

Kissaka G. E - Project Engineer 16

6.0 CONCLUSSION

The FEX Plant of capacity 20 tons/hour comprising three hammer mills supported with chipping and feeding systems, could be proposed for commercial pulpable fibre at a rate of 814 kg/hr or 5.7 ADMT fibre per 8-hour shift.

However, the trial runs were not continuous to confirm reliability of the equipment and other operational parameters such as water consumption, tear and wear of the machine components, power consumption, and labour requirements

Confirmation of Parameters

The above mentioned parameters need to be confirmed in a continuous system as proposed above and tested for longer period.

Presentation by Ms. R.Viegas Assumpçao, International Expert

"Pulping Trials and Market Analysis"

PULPING TRIALS AND MARKET ANALYSIS

Product and Market Development of Sisal and Henequen Products
Dissemination Workshop
17-19 November 2004
Mkonge Hotel, Tanga, Tanzania

Papermaking pulps

- Wood Pulp: Long Fiber (Softwood), Short Fiber (Hardwood) and Mechanical and High Yield Pulps
- Non-wood Pulp: Long Fiber (cotton, flax, abaca, sisal) and Short Fiber pulps (cereal straw, sugar cane bagasse)
- Secondary Fiber (waste paper)

2

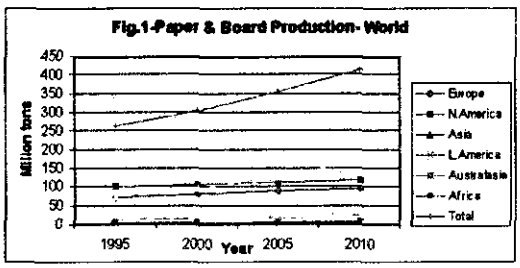
Pulping Trials and Market Analysis

- Market Demand- Specialty and Reinforcement Pulps
  - Paper and Paperboard Production and Demand
  - Specialty Pulp Demand
  - Reinforcement Pulp Demand
- Pulping trials
  - Samples from Agricultural Trials
  - Samples from Selection of Technology Trial
- Prospects for Sisal Pulp

Market Demand- Paper & Paperboard
Production and Demand

- **Statistics on production and trade of paper;**
- **Future demand for paper based in the population and GDP using an econometric model;**
- **Furnish (fiber balance) of selected paper grades its future trends;**
- **Questionnaires-pulp and paper mills worldwide**

Paper & Paperboard
World Production and Demand



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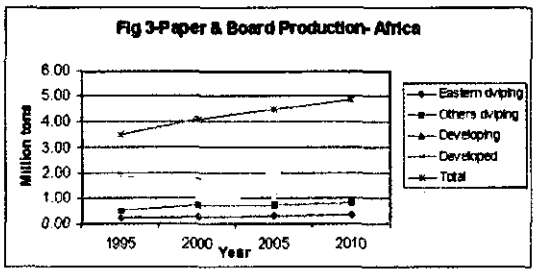
Paper & Paperboard
Africa Production and Demand



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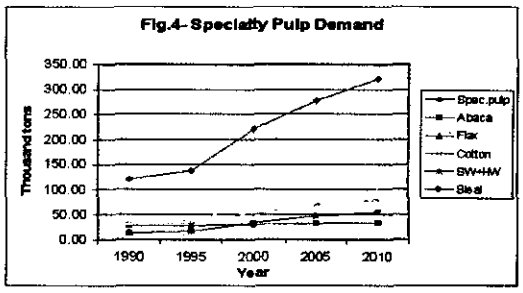
Pulp Demand for Specialty Paper
(based in questionnaires answers)



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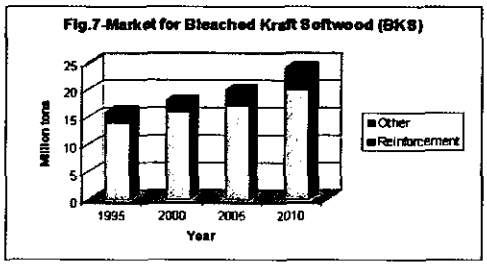
Reinforcement Pulp Demand
Bleached kraft Softwood (BKS)



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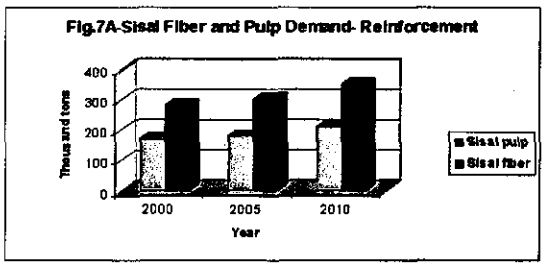
Reinforcement Pulp Demand Sisal Fiber and Pulp



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Market Study- Conclusions

- Competitors of Sisal Pulp
  Reinforcement- Bleached Kraft Softwood
  Specialty- Abaca, Flax, Jute, Kenaf
- Potential Market

Estimated Demand-Sisal Pulp (Thousand tons)	2000	2005	2010
Reinforcement	169.2	180.2	212
Specialty	34.7	46.4	55.1

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Pulping Trials – Samples from Agricultural Experiments

- Laboratory Pulping Conditions- Soda process
  Active Alkali as NaOH: 13.5 %
  Time to Maximum Temperature: 90 min
  Maximum Temperature: 173 ° C
  Time at Maximum Temperature: 90 min
  Dilution ratio: 4:1 (liquor:fiber)
- Samples evaluated
  CEPS I, CEPS II, UHDT, 3-Factor Variety Trials, Kenya Variety Trials

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Pulping Trials- CEPS I- Results

- Different equipment for leaf fiber extraction: Test rig (33m); Roller crusher (47 m); Hammer mill-1 pass (52m) seems to influence pulp yield and characteristics;
- Pulp yields are lower and pulp breaking lengths of plants 47 months older are higher for all varieties and densities than for 33 and 52 months. The pulps produced with roller crusher extracted fiber seem to be softer and easy to collapse.
- In general, older fibers (52 m) produce higher pulp yield than younger ones but, breaking lengths are similar or slightly lower.

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Pulping Trials- 3 Factor Variety Trials - Results

- The pulp yields of *H. 11468* practically are not affected by planting densities (plants/ha) (Fig.7).Pulp yields increase for *A. sisalana* and slightly decrease for *A. Hildana* and *Mlola 487* with the increase in the density.
- The pulp breaking length (Fig.8) of *H. 11648* remained practically constant in all densities. This property presents a tendency to decrease with the increase of density for *A. sisalana* and *A. hildana*. The lower value observed for *Mlola* 487 is at density 6400 plants/ha and the higher at 8000 plants/ha.

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Pulping Trials- CEPS II & UHDT Results

- **Pulp yield increases with age in CEPS II.**
- **Pulp yield presents a strong decrease with the increase of density in UHDT of young plants(24m).**
- **Age seems to improve pulp yield for densities 12,500 and 16,666.**

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Pulping Trials- Variety Trials-Kenya Results

- The pulp yield from fiber of *H. 11648* was negatively affected by the sites' climate conditions in the first harvest but not in the second harvest.
- Similar behavior was observed concerning breaking length of the pulps.
- Pulp yields present logarithmic trends with age for *H. 11648* and *A. hildana* at Nakuru site.
- Breaking Lengths present linear trends with age for *H. 11648* and *A. hildana* at Nakuru site. *H.11468* seems to be less affected than *A. hildana.*

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Pulping Trials- Selection of Technology Conditions

- Sisal fiber extracted by the Hammer mill technology.
- Unbleached Pulp produced at Kibo mill, Moshi (spherical rotary digester direct heated with steam)-based in lab. trials

  Active alkali as NaOH: 13.5%

  Anthraquinone: 0.1%

  Time to Maximum Temperature: 90 min.

  Maximum Temperature: 165°C

  Time at Maximum Temperature: 75 min.

  Initial dilution rate: 4:1

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Pulping Trials- Selection of Technology

- **ECF and TCF bleaching and sisal fiber pulping trials at Ljubljana Paper Institute**
- **Samples of sisal fiber and pulp sent to selected pulp and paper mills**

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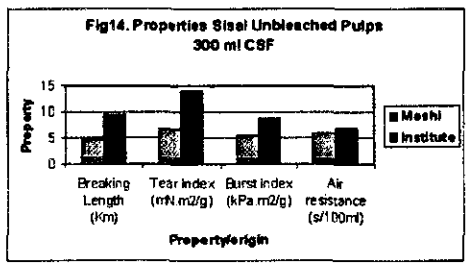
Pulping Trials- Selection of Technology



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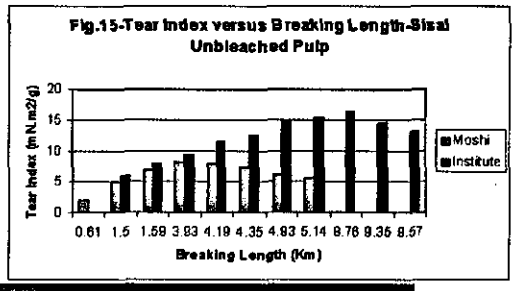
Pulping Trials- Selection of Technology



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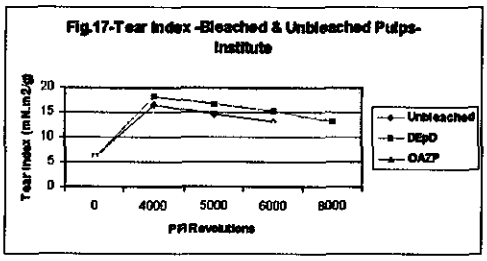
Pulping Trials- Selection of Technology



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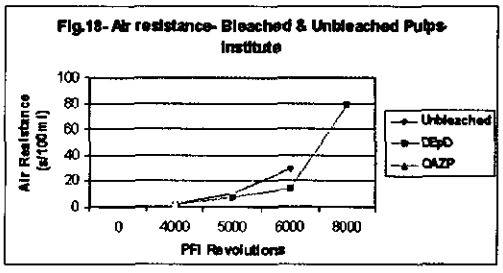
Pulping Trials- Selection of Technology



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Pulping Trials- Selection of Technology Conclusions

- Sisal fiber from the HM produces good quality unbleached and bleached pulps.
- Viscosities of unbleached sisal pulps (soda/AQ) and bleached pulps (ECF, TCF) are similar to kraft pulps produced in Brazil.
- High brightness can be obtained using ECF (89 ISO) and TCF (91.6 ISO) sequences.
- ECF pulps present better mechanical properties than TCF pulps. Air resistance is also better.
- The pulping conditions have to be adjusted to the type of digester used. Spherical rotary digester direct heated requires milder conditions than laboratory digester indirect heated.

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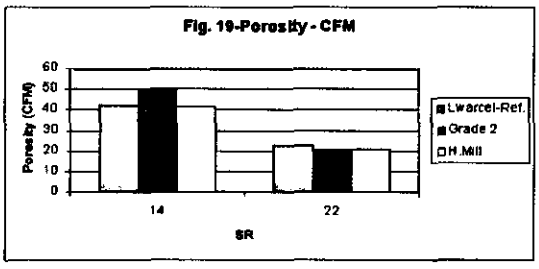
Pulping Trials- Selection of Technology Preliminary results from Lwarcel



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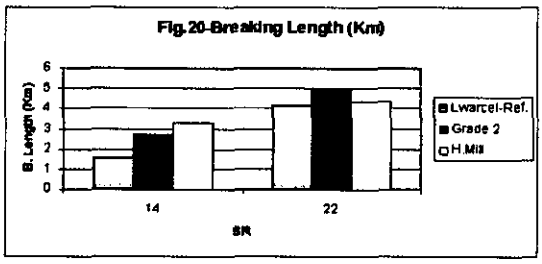
Pulping Trials- Selection of Technology Preliminary results from Lwarcel



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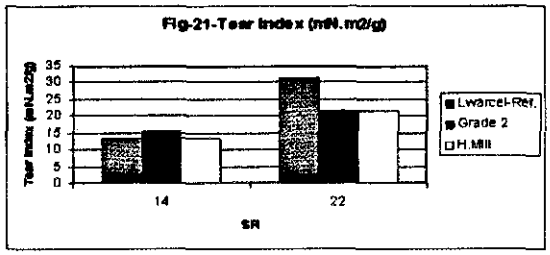
Pulping Trials- Selection of Technology
Preliminary results from Lwarcel



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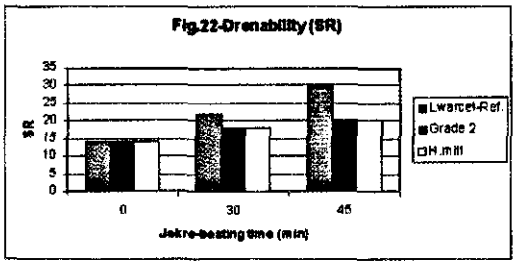
Pulping Trials- Selection of Technology
Preliminary results from Lwarcel



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Pulping Trials- Selection of Technology
Preliminary observations (Lwarcel tests)

- Air permeance (porosity) of HM unbleached pulp is similar to reference at same SR.
- Breaking Length of HM pulp is similar to reference at 14 SR but higher at 22 SR.
- Tear index of HM is similar to reference at 14 SR but lower at 22 SR.
- HM pulp required more energy for refining than reference.

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Prospects of Sisal as Specialty Pulp

- **Porosity, tensile and tear are lower than abaca but sisal prices are about 60 % lower than abaca (abaca U$ 2,600 and sisal U$ 1,600). Porosity of flax and hemp pulps are lower than sisal pulp. Mechanical properties and prices for flax, hemp and jute pulps are the same as sisal.**
- **HM pulp produced by Lwarcel has porosity, B.Length similar to and tear index lower to than Lwarcel reference.**
- **Estimated demand of sisal pulp for 2005 and 2010 are 46,000 and 55,000 ADT**

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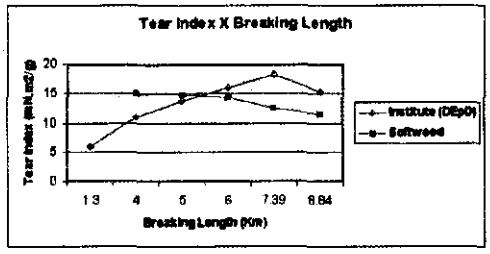
Prospects of Sisal as Reinforcement Pulp



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Prospects of Sisal as Reinforcement Pulp

	Aspect Ratio		
	Fiber length- L (mm)	Fiber width- W (mm)	Aspect Ratio L/W
Sisal 1 (literature)	3.30	0.020	165:1
Sisal 2 (literature)	3.03	0.017	128:1
Sisal 3 (Ljubljana pulp)	2.29	0.025	92:1
Western Hemlock	3.35	0.035	96:1
Douglas Fir	4.00	0.040	100:1

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Prospects of Sisal as Reinforcement Pulp

- Aspect ratio (L/W-92:1) of sisal bleached pulp (HM) is slightly lower than for softwood (100:1). Fiber dimensions need revision.
- Tear x Tensile strength of sisal pulp (HM) is better than kraft softwood for breaking length above 6 Km.
- Optimization of pulping conditions can improve sisal pulp properties.
- Brightness levels similar to BKS can be achieved for soda AQ sisal pulp using ECF and TCF sequences

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Prospects of Sisal as Reinforcement Pulp

- The potential demands for sisal pulp in 2005 and 2010 are 180,000 and 212,000.
- To penetrate the market the price of bleached sisal pulp can not be higher than 10% of the BSK price (U$ 550-600/ADT-2004)

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Presentation by Mr. J. Tipape, Project Agronomist

"Sisal Waste as Animal Feed"

PRODUCT AND MARKET DEVELOPMENT OF SISAL AND HENEQUEN PRODUCTS PROJECT-COMMON FUND FOR COMMODITIES

SISAL WASTE AS ANIMAL FEED

International Dissemination workshop

Tanga, Tanzania

17-19 November, 2004

Introduction

- Sisal and other *Agave hybrids* are grown for line fibre
  - fibre forms 6%, water 70% and bogas 24% of the leaf
  - Bogas is a residue made up of soft tissue
  - Normally thrown away and is a disposal challenge
  - If used it adds value to sisal production and reduces environmental pollution

Uses of bogas

- Manure for crop production
- Livestock feeding
- Biogas production
- Recovery of flume tow

Livestock feeding

"Ruminants eat grass"

- However its availability is seasonal
- Need for other complement feed resources
  - crop residues like stover
  - agro-industrial by-products like bogas

Past experiences

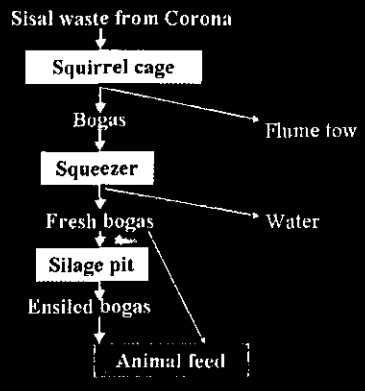
- Earliest record of sisal feeding in Kenya was in 1955 during the dry season
  - Borans fed on sisal waste had better body condition than those without (Agric. & Vet. Dept 1957)
- No difference between milk yield and quality of Ayrshire cows fed sisal waste compared to those fed sorghum hay (Frank, 1957)
- Borans fed on sisal waste in wet and dry seasons for 7 years showed no undesirable side-effects (Rodseth, 1969)
- When sisal waste was withdrawn after feeding it for 5 years, milk yield dropped by 10% and recovered when restored (Wilson, 1970)

Animal feeding trials in Kilifi Plantations Ltd 1999 to 2000

Objective

Evaluate the effect of feeding fresh and ensiled bogas compared to panicum on the performance of sheep, goats, steers and dairy cattle

Bogas recovery system



Feeds

- **Treatment diets**
  - Panicum – control
  - Fresh bogas
  - Ensiled bogas
- Bogas replaced 0.5, 0.3 and 0.4 of the panicum in the sheep/goat, steers and cows' diets respectively
- Bogas was obtained from Hybrid 11648

Chemical analysis of fresh bogas

Feed characteristics	%Composition
Dry matter	19
Crude protein	4-7 (Panicum: 5-7)
Crude fibre	28-30 (Panicum: 40-50)
Ether extracts	2-4
Ash	8-12
Soluble carbohydrates	26-31
Gross energy	3.7kcal/kgDM
pH	3.9-4.5

Animals in the experiments

Animal	Number in experiment	Period of experiment (weeks)
Sheep/goats	42	24 weeks
Steers	30	36 weeks
Cows	36	33 weeks

Housing and feeding

- All animals were housed in well ventilated individual pens
- The diets were fed in two equal halves daily
- Water and a mineral lick were available at all times

Results

Fig 1. Live weights (kg) for sheep fed fresh bogas, ensiled bogas or Panicum

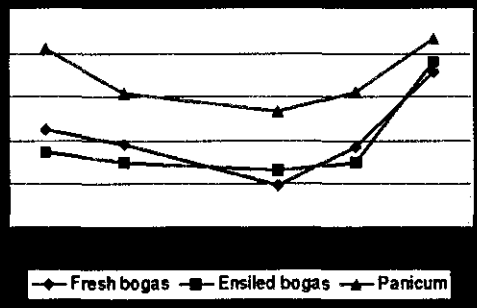


Fig 2. Live weights (kg) for goats fed fresh bogas, ensiled bogas or panicum

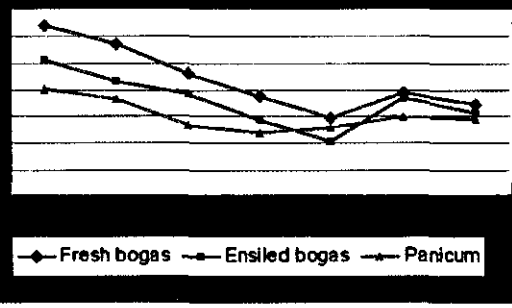


Fig 3. Live weights (kg) for steers fed fresh bogas, ensiled bogas or panicum

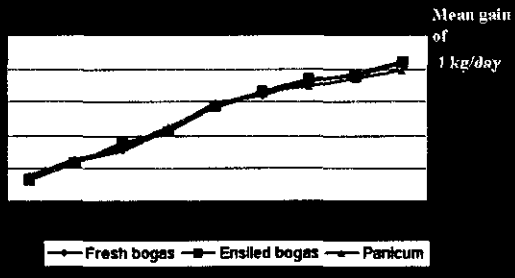
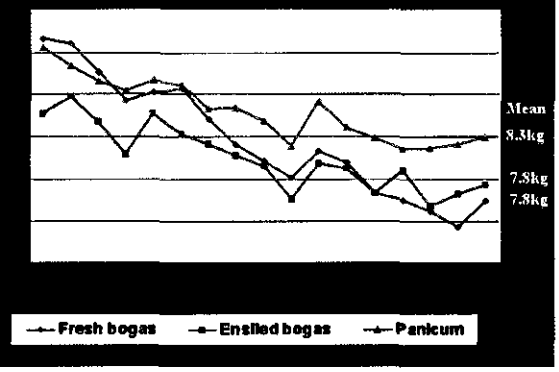


Fig 4. Mean daily milk yield (kg) of cows fed fresh bogas, ensiled bogas or panicum



Conclusions

Although "Ruminants eat grass"

- Bogas can be used as an additional or alternative to grass during the dry season
- Animals fed on fresh, ensiled bogas or Panicum had similar performance
- Steers fed on the three diets gained 1 kg per day
- The mean daily milk yield was similar for dairy cows fed the three diets

Recommendations

- Bogas is bulky and should be fed near the source
- Bogas should be ensiled during the wet season for dry season feeding
- Bogas is low in protein and fibre, it therefore should be fed with supplements high in protein and other forages
- Further studies are needed to verify the sheep, goats and cows results and qualify the effect of bogas on rumen fermentation

Integration of Livestock in Sisal Estates will add value to the sisal enterprise and reduce pollution through feeding of bogas

AHSANTENI

Presentation by Mr. F. Nkuba, National Project Officer

"Economic and Financial Evaluation for a Pilot Scale FEX Project"

[KATANI LIMITED]

Feasibility Study for Pilot Pulpable Fibre Project

Introduction

- Katani Limited is a company privately-owned by Tanzanians, which owns 5 sisal estates with a total of 20,309 hectares, a sisal spinning and weaving mill and a central workshop.
- Katani has a vision to create, by 2013, a vibrant integrated sisal company, widely owned, sensitive to environmental issues and producing high value added sisal products for the local and export markets.
- The company has a keen interest in research and development and has over the years contributed a lot to the revival of sisal.

Opportunities in the Sisal Industry

- After decades of decline, new opportunities have emerged in the sisal industry such as the use of sisal fiber for pulp production and composites.
- Sisal pulp can be used in specialty applications e.g. bank notes, coffee filters, tea bags, oil & fuel filters, cigarette papers or as a blend with other pulps.
- Sisal can also be used as reinforcement pulp for commodity paper grades.
- Katani Ltd has requested CFC and UNIDO to finance a pilot pulpable sisal fiber project.

Market Summary

- According to FAO 1998-2002 yearbook the world production of pulp was in the region of 613.163 million tons and the consumption was 622.636 million tons.
- World production of paper and paperboard including newsprint, printing and writing paper, household and sanitary paper, wrapping and packaging paper was 839.308 million tons while consumption was 840.157 million tons.

Market Summary Continued

- The current market for specialty pulp is around 250,000 tons growing at 5-6% p.a. in the last four years. Current production of sisal specialty pulp is about 45,000 tons requiring around 90,000 tons of sisal fiber. The price of unbleached and bleached sisal pulp ranges from US$ 1,200-2,300 ADMT CIF Europe.
- Reinforcement pulp is another potential market for sisal pulp with a demand of around 150 million ADMT growing at 9% p.a in the last 9 years. Bleached Kraft *Softwood pulp (BKS) is the main raw material and costs* US$ 650 CIF Europe.

Business Concept

- The main strategy of the project is to reduce the cost of staple fiber to enable sisal compete with wood and other crop fibers and increase demand. The project targets niche markets where properties of sisal are as good or better than those of other crop fibers. Sisal is superior to abaca in porosity. In comparison to wood, sisal is superior in porosity, freeness, strength and tear. It is possible to capture significant portion of the sisal specialty pulp market of 90,000 tons.
- This can be achieved by growing sisal under enhanced production systems and new fiber extraction technology.

Competition

- Main competitors of sisal in specialty pulp are: abaca pulps, flax pulp, hemp and jute pulps.
- Prices of abaca are 60% higher than those of sisal. Prices of flax, hemp and jute pulps are similar to that of sisal. Prices of sisal pulp are presently however about twice as much as those of BKS pulp.
- In the short term sisal pulp cannot compete with softwood pulp in reinforcement applications unless fiber prices are drastically reduced.

Objectives

- **Main objectives of the project are:**

(a) To implement all the results of the project by cultivating 399 hectares of sisal under CEPS mode in year 1 and start harvesting after 24 months.

(b) To harvest a maximum of 37,800 tons of sisal leaves annually from year 3.

(c) To produce 5.7 tons per 8-hour shift or 1,512 ADMT staple sisal fiber p.a. from year 5 onwards.

(d) To generate US$ 907,200 from staple fiber from year 7 at US$ 600/ADMT, F.O.B. Tanga.

Details are shown on slide 8.

Production & Revenue Projections

Year	Ha harvested	Leaves (tons)	Fibre (tons)	Sales (tons)	Revenue (US$)
3	336	25,200	1,175	1,128	676,800
4	336	29,400	1,343	1,335	810,000
5	336	33,600	1,411	1,408	844,800
6	336	35,280	1,512	1,508	904,800
7-10	336	37,800	1,512	1,512	907,200

Environmental aspects

- The plan is to construct 3 oxidation ponds to treat about 315 tons of wastewater per day from the extraction process.
- After treatment, the solids will be used as fertilizer on the estate and the wastewater for irrigation.
- A better option would be to establish a biogas plant to convert the sisal waste into electricity and fertilizer.

Resource Requirements

- The fiber extraction technology selected will use 3 hammer mills, 2 in parallel for 1st pass and the third in series for the 2nd pass. The capacity of the plant is 5.7 ADMT per 8-hour shift at fiber yield of 4.5% of fresh leaves by weight.
- A total of 21 workers including technical staff will be recruited locally from those trained during installation of the first hammer mill.
- 800 hectares have been set aside at Mruazi-Hale Estate for the pilot pulpable fiber project.

Project Costs

- **Investment costs:**

During the construction phase (two years), total capital costs amounting to US$ 2.188 million will be required. US$ 100,000 will be needed during production phase.

- **Working Capital:**

Net working capital requirements will be US$ 46,350 during the entire project life.

- **Cost of Production:**

The Annual total cost of staple fiber will be in the range of US$ 595,840 to US$640,000.

Financial Plan

- The Project will be financed from two sources: Katani Limited will provide equity capital to the tune of US$ 750,000 while CFC will be asked to provide US$ 1.25 mil. as a grant or soft loan.
- Equity capital and the loan will be disbursed within 2 years of the construction period.
- A grace period of 3 years will be granted and the loan is repayable in 5 equal installments with interest charged at the rate of 4% per annum on the outstanding balance.

Financial Viability

- **Payback period:**
  The total investment outlay will be recovered after 6 years.
- **Internal rate of return:**
  The IRR to total investment is 14.23% while the IRR to equity is 27.91%. Both are higher than 10% discount rate used in the analysis.
- Economic viability was attempted but for a small project its impact to the national economy is minimal.

Risks & Assumptions

- There are still a number of issues to be addressed on the agronomical and technical side before the project can be implemented.
- Due to limited financial resources assumptions were based on operation of the hammer mill for 25 days for short periods. A longer period of production with all systems balanced would give more confidence to investors.
- Prices of staple fiber used are conservatively estimated at US$ 600 ADMT for effective competition in the specialty pulp market.
- Workings are based on only one shift due to financial limitations in using all project results.

Conclusions & Recommendations

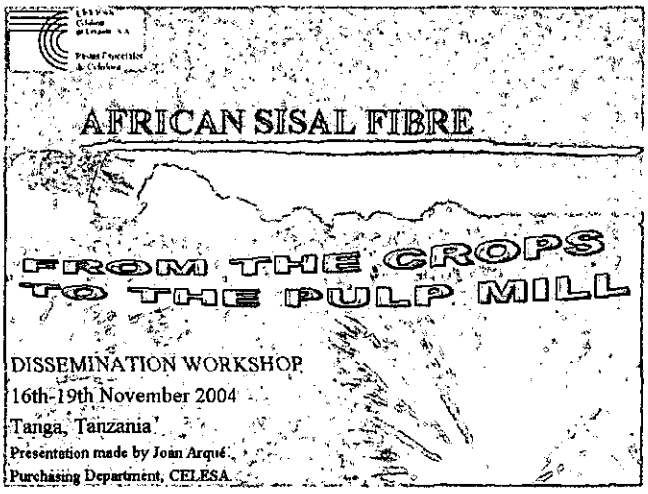
- **Conclusions:**
  At current costs of production and current practices it is recommended to target the specialty pulp market.
  Adverse environmental effects are not many but people have to overcome technophobia.
- **Recommendations:**
  It is strongly recommended the loan be turned into a grant to implement all the results of the project.

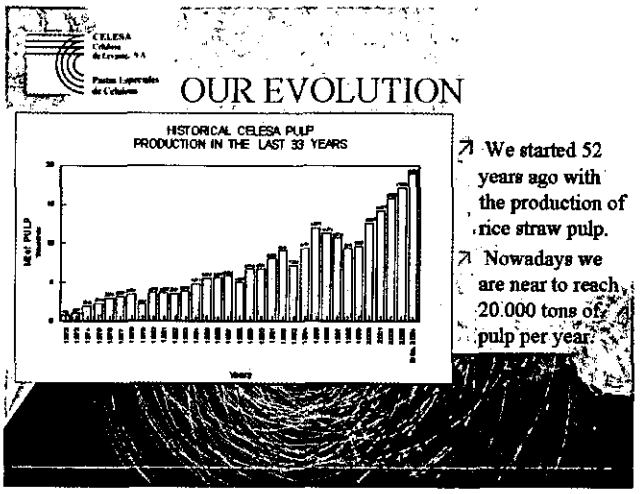
Acknowledgements

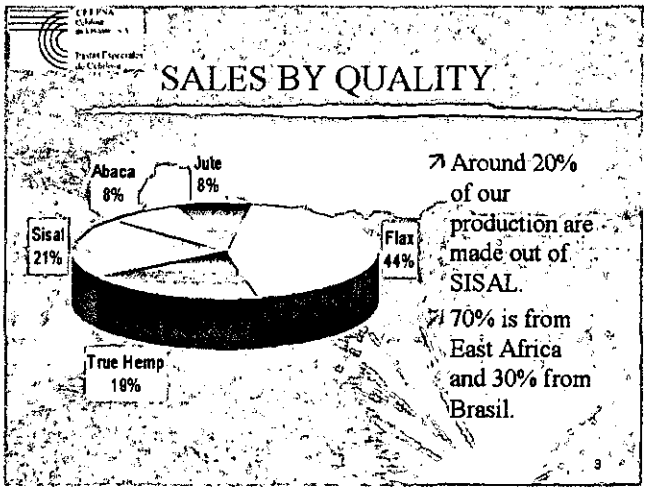
I take this opportunity to thank the Common Fund for Commodities, UNIDO, FAO, the Management of Katani Limited and the Tanzania Sisal Board and my fellow officers for their unconditional support and assistance. Without COMFAR and the UNIDO Manual for the preparation of Industrial Feasibility Studies this work would have been impossible to finish in 6 weeks. We request their *continued support as there is yet a lot to be* done. THANK YOU.

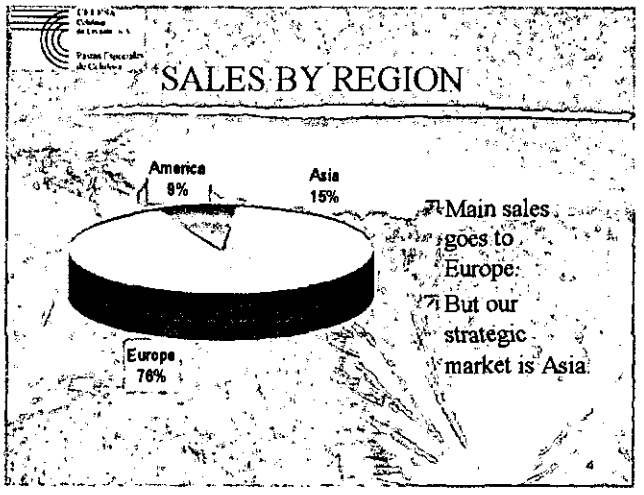
Presentations by Ms. P. Brazier, Wigglesworth, UK

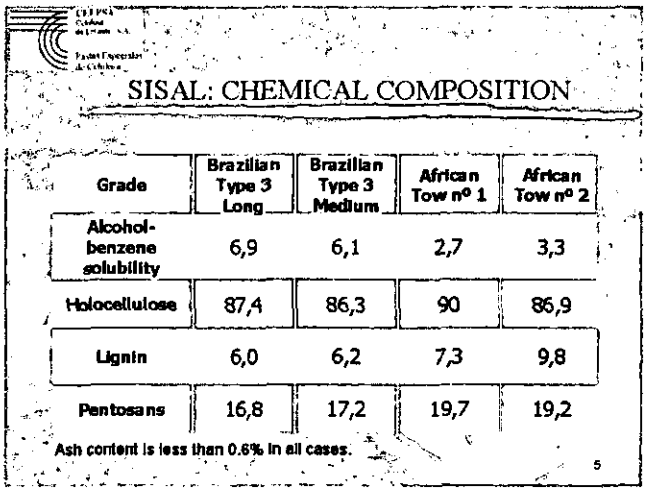
"African Sisal Fibre" – Presentation on behalf of Mr. J. Arque, CELESA, Spain







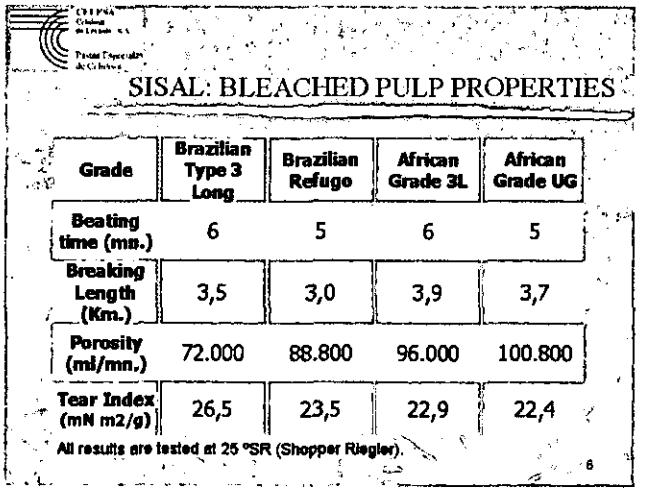




SISAL: CHEMICAL COMPOSITION

Grade	Brazilian Type 3 Long	Brazilian Type 3 Medium	African Tow nº 1	African Tow nº 2
Alcohol-benzene solubility	6,9	6,1	2,7	3,3
Holocellulose	87,4	86,3	90	86,9
Lignin	6,0	6,2	7,3	9,8
Pentosans	16,8	17,2	19,7	19,2

Ash content is less than 0.6% in all cases.



SISAL: BLEACHED PULP PROPERTIES

Grade	Brazilian Type 3 Long	Brazilian Refugo	African Grade 3L	African Grade UG
Beating time (mn.)	6	5	6	5
Breaking Length (Km.)	3,5	3,0	3,9	3,7
Porosity (ml/mn.)	72.000	88.800	96.000	100.800
Tear Index (mN m2/g)	26,5	23,5	22,9	22,4

All results are tested at 25 °SR (Shopper Riegler).

Conclusions: sisal fibers

- Sisal exhibits strength and porosity properties higher than flax and hemp.
- *Grades of sisal depends on the cleanness/stripping of the* fiber strands and thus, on its chemical composition.
- Grading influences the final pulp properties but in a different way as it happens in cordage or handicraf works. Fiber strands dissolve into the individual cells during the cooking process.
- African sisal appears to have higher porosity and tensile strength than the Brazilian type.
- Abaca exhibits higher strength properties than sisal for an equivalent porosity.

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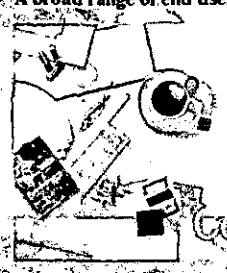
SISAL APPLICATIONS

A broad range of end uses is as follows:



- Plug Wrap Cigarette Paper.
- Tea Bag Paper.
- Filtration Papers.
- Capacitor / Condenser and Electrolytic Paper.
- Grid Pasting Tissue.
- Art and Decorative Paper.

6

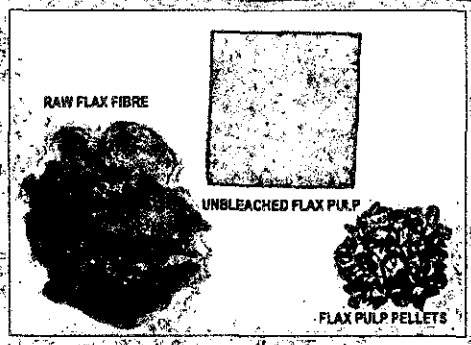
OTHER APPLICATIONS

CELESA is actively involved in a number of international projects, working in collaboration with industrial and academic groups and with various government agencies in order to study and develop the latest innovative production and application technologies.

In this sense, it highlights the development in the last years of very specific qualities aimed to replace the glass fibre as a reinforcement in the composites production, especially regarding the elaboration of pieces for the automobile industry.

9

COMPOSITES SAMPLES



10

Any Questions ?.

"Demand for Sisal Products in Europe, North America and Asia"; with a detailed paper on the subject, presented by Ms. Brazier, that was distributed to the participants, during the Workshop

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Product and Market Development of Sisal

And Henequen

Tanga, Tanzania

16th – 19th November 2004

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- ***REA Vipingo Plantations Limited***
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- Kenya
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- Summary 2003
- Quality and Market Development
- Pricing

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- Production and Export Figures
- Market Position
- ***The Chinese Factor***
- ***Future Trends***

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  - Commercial Yarns, Twines, Ropes and Cordage Pulp
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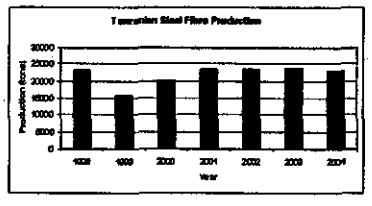
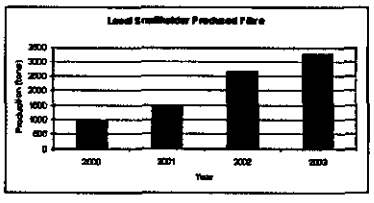
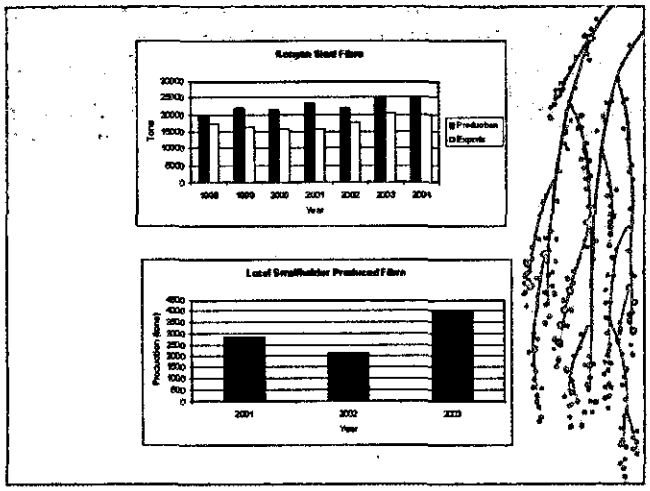
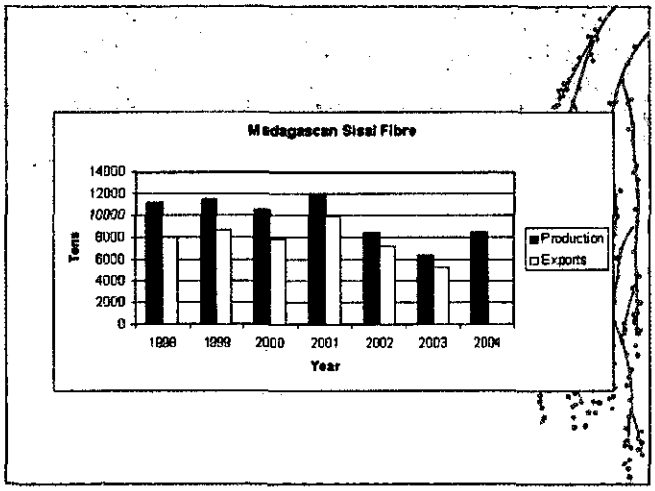
  - Fibre
  - Commercial Yarns and Twines Pulp
- Jute:
  - Fibre
  - Yarns and Twines
  - Carpet Backing
  - Hessian Sacks and Bags

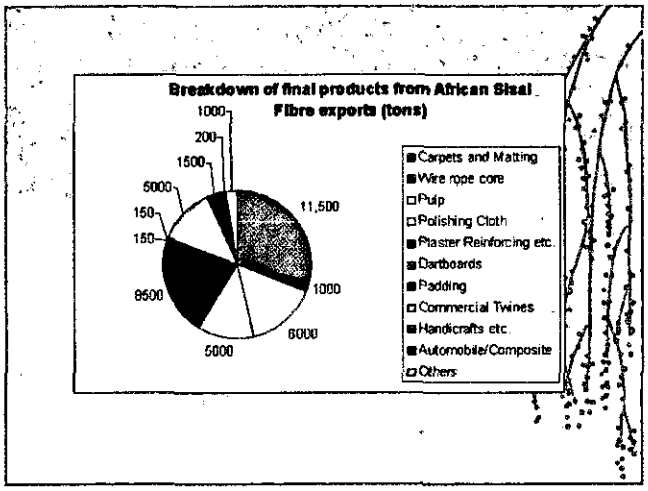
- Flax:
  - Fibre
  - Yarns and Twines
- Coir:
  - Fibre
  - Yarns and Twines
- Espartos Grass
- Cotton Linter Pulp

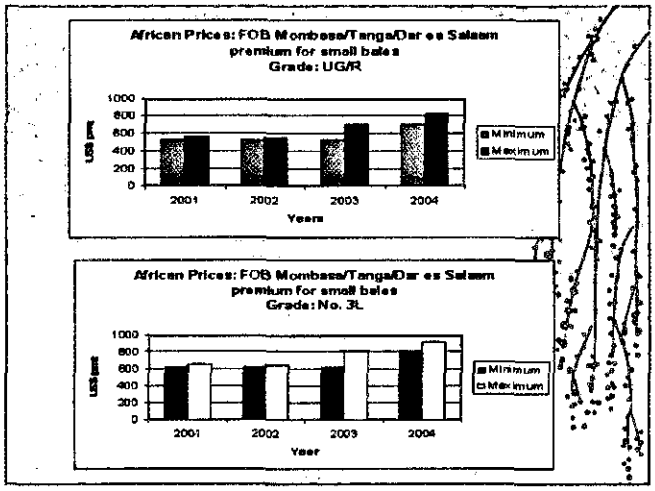


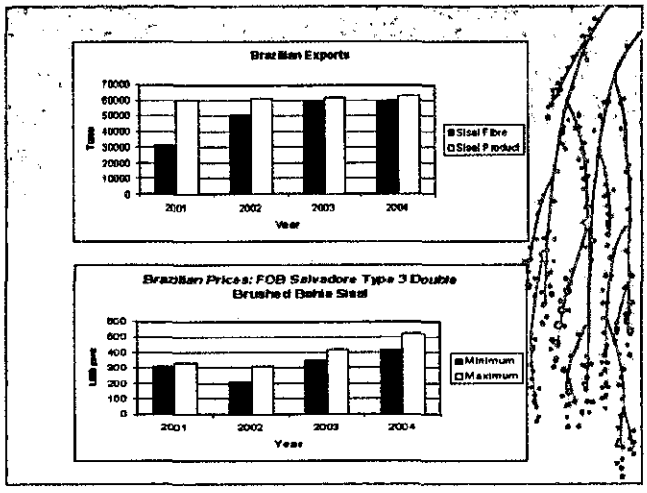


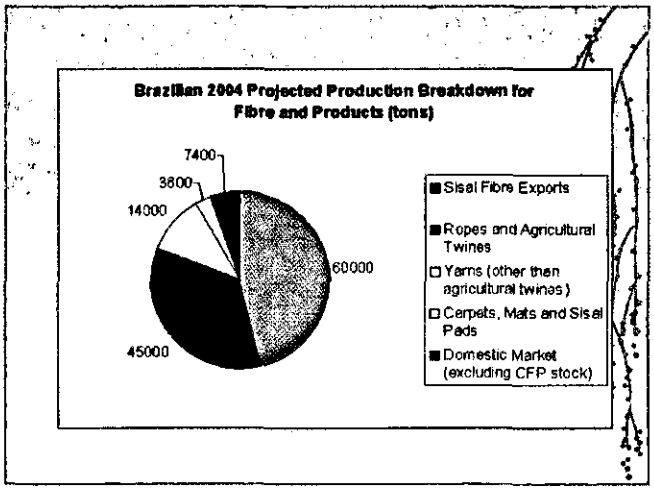

Local Smallholder Produced Fibre
2001
2002
2003
Year

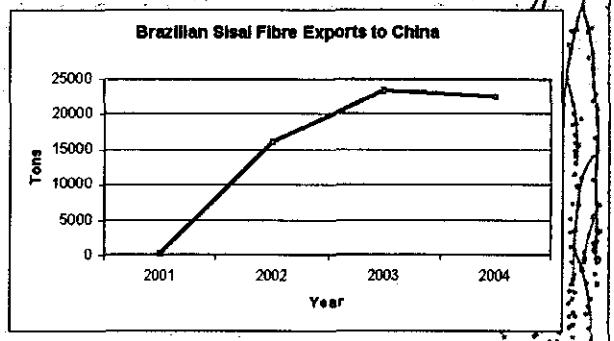

Madagascan Sisal Fibre
14000
12000
10000
8000
6000
4000
2000
0
Tons
1998
1999
2000
2001
2002
2003
2004
Year
Production
Exports


Breakdown of final products from African Sisal Fibre exports (tons)
1000
200
1500
5000
150
150
9500
11,500
1000
6000
5000
Carpets and Matting
Wire rope core
Pulp
Polishing Cloth
Plaster Reinforcing etc.
Cartboards
Padding
Commercial Twines
Handicrafts etc.
Automobile/Composite
Others


African Prices: FOB Mombasa/Tanga/Dar es Salaam premium for small bales
Grade: UG/R
US$ pmt
1000
800
600
400
200
0
2001
2002
2003
2004
Years
Minimum
Maximum
African Prices: FOB Mombasa/Tanga/Dar es Salaam premium for small bales
Grade: No. 3L
US$pmt
Year


Brazilian Exports
70000
60000
50000
40000
30000
20000
10000
0
Tons
2001
2002
2003
2004
Year
Sisal Fibre
Sisal Product
Brazilian Prices: FOB Salvadore Type 3 Double Brushed Bahia Sisal
US$ pmt
Minimum
Maximum


Brazilian 2004 Projected Production Breakdown for Fibre and Products (tons)
7400
3600
14000
60000
45000
Sisal Fibre Exports
Ropes and Agricultural Twines
Yarns (other than agricultural twines)
Carpets, Mats and Sisal Pads
Domestic Market (excluding CFP stock)



Future Trends

•It is likely that in the longer term there will be a continuation, in the trend that started over 20 years ago, of the movement of value added sisal production to locations in the producer countries, near to the source of supply.

•Smallholder production (Lake and UHDS fibre) is likely to develop more in Tanzania and in Kenya, but unlike the Brazilian method, it will be based on the traditional African centrally based processing units, which should ensure that quality levels can be controlled and maintained. It will serve as a useful addition to the traditional largescale sisal farms which are the cornerstone of the sisal industry.

•One area where there is cause for concern, is with regard to the worldwide freight market. Since the beginning of 2004, the freight rates on exports out of Brazil have nearly doubled. The African market, has as yet been largely unaffected, but given that there is an acute shortage in vessels, containers and that the primary market is into and out of China, all the indications are that this freight market in balance will continue through to the end of 2006. There could be an increase on African rates from the beginning of 2005.

•China's developing domestic consumer market could realise a steady increase in demand for sisal, particularly from Brazil but also possibly for African fibre for higher value added products. This would occur over the next 5 – 7 years as there is unlikely to be any recovery in their sisal production before this time and as such assumes that a programme of replanting and development is already in place. It is all, of course, dependent upon the substantial rate of growth of recent years continuing in that country.

•New EU regulations for the car industry that come into play in 2015 – where reportedly 85% of all new cars should be recyclable, 10% combustable and only 5% land fill sites, should have an impact on many natural fibres. Sisal will have a role in this market but price sensitivity in the car industry could prove a barrier for widespread use of sisal, particularly African sisal, when compared with other cheaper and more readily available fibres.

•An area which could well be interesting and not so price sensitive is the much larger composite industry which has shown increasing interest in the use of good quality clean sisal as a strengther.

•Speciality pulp is a potential area for development but it will necessitate sisal being price competitive with Abaca which in most instances is the fibre of preference in this area. However, producing and making available sisal fibre specifically for use by pulp and paper makers should lead to a diversification of the types of end paper applications, especially if significant price reductions are achieved.

•Geotextiles, is an area in which there is already a background but, to date, little penetration has been achieved by sisal (except in South Africa), again largely for pricing issues. The natural fibre market is dominated by jute and coir geotextiles but sisal should have a place in this industry. Certainly, within the sisal growing countries and their neighbours, efforts should be made to encourage the civil engineering sector to consider the utilisation of sisal geotextiles in suitable applications. Government projects could be a key area in getting sisal accepted in this field and the wider the experience in this field could well influence its use elsewhere in the world.

- The future for both African and Brazilian sisal looks reasonably positive provided there is price stability at market pricing that allows traditional business to continue, and possibly expand usage and new areas of business to be developed. Current prices are certainly at *the higher end of what is acceptable to be able to* achieve this.

Finally are there any questions?

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Introduction and Brief History of
Wigglesworth & Co Ltd

- § Wigglesworth & Co. was established in London in 1895 by Mr Alfred Wigglesworth - initially involved in Hemp sourced from Russia, Italy and Hungary for marine ropes and general cordage.

- § In 1913 Alfred visited the Amboni Estates near Tanga and he was so impressed that he entered into a marketing agreement with their Swiss owners in 1921. This was the beginning of Wigglesworth's involvement in the East African Sisal Industry.

- § From these very early days - a Fibre Report was published on the market for the fibres traded. This continues today and can be found on our company website - www.wigglesworthfibres.com

- § Throughout this time we have been merchanting all the natural vegetable fibres traditionally used to prepare yarns, twines and cordage related products namely;

  Sisal
  Abaca
  Jute
  Flax
  Coir

- § Our worldwide and long standing relationships with our customer base of over 200 companies, just in the sisal fibre and products business alone, has placed us in a unique and commanding position in what can only be described as a highly specialised niche business.

- § Today, Wigglesworth, through its close relationship with the RVP group - the largest single sisal growing group in the world - and many other growers worldwide, alongside its major customer base, has a privileged position to be able to comment upon the market and its likely development.

- § Wigglesworth distributes and markets approximately 40% of the total world exported sisal and 70% of exported East African sisal

- § From our offices in London our natural fibre based business has developed to cover the following range of fibres and related products;

  - Ø Sisal
    Fibre
    Commercial Yarns, Twines, Ropes and
    Cordage Pulp

  - Ø Abaca
    Fibre
    Commercial Yarns and Twines Pulp

  - Ø Jute

Fibre
Yarns and Twines
Carpet Backing
Hessian Sacks and Bags

- Ø Flax
  Fibre
  Yarns and Twines

- Ø Coir
  Fibre
  Yarns and Twines

- Ø Espartos Grass

- Ø Cotton Linter Pulp

REA Vipingo Plantations Limited

- § RVP has four sisal estates - two based in Tanzania and two based in Kenya.

- § Mwera and Sakura, located south of Tanga. Combined production of approximately 4,500 tons of sisal fibre each year.

- § Vipingo, on the coast north of Mombasa and DWA at Kibwezi. Combined production of approximately 10,000 tons of sisal fibre each year.

- § All of these farms follow an aggressive replanting policy, bringing in virgin land and increasing their total hectarage under sisal. There has been a steady annual increase in RVP's sisal production over the past 5 years, which is forecast to continue to grow.

- § This continued programme of replanting will enable Wigglesworth and the RVP group to be in a strong positon to offer long term continuity of product and quality to their current customers and to develop new areas with potential new industries and companies.

- § Wigglesworth is the exclusive marketing distributor for this group and for several other major East African sisal producers. It is also extensively involved in the trading of sisal fibre and products from the other sisal producing areas in the world, namely Madagascar and Brazil.

The African Sisal Market

- § The sisal fibre market has developed both geographically and agronomically into two distinct areas of production - Africa and Brazil. These two areas use different planting material and differing farming and production methods. As a result the quality of the fibre

differs materially which, particularly over the last 20 years, has led to sisal from each origin going into very different end product areas.

- § The African Market comprises the three major African sisal producing countries - Tanzania
  Kenya
  Madagascar

a) Production and Export Figures

- § Tanzanian Sisal Fibre production;

1998	23,220 tons
1999	15,555 tons
2000	20,489 tons
2001	23,502 tons
2002	23,642 tons
2003	23,858 tons
2004 (projected)	23,000 tons

- § Local smallholder produced fibre - referred to as Lake Sisal, estimated production;

2000	1,000 tons
2001	1,500 tons
2002	2,670 tons
2003	3,269 tons

- § It is estimated that some 7 - 9,000 tons of sisal has been processed locally, in each of the past 5 years into product for both the domestic and export market.

- § Kenyan Sisal Fibre;

	Production	Exports
1998	19,991 tons	17,443 tons
1999	21,914 tons	16,219 tons
2000	21,430 tons	15,627 tons
2001	23,209 tons	15,579 tons
2002	22,108 tons	17,623 tons
2003	25,009 tons	20,470 tons
2004 (projected)	25,000 tons	20,000 tons

- § Again, an important factor in the above figures is the development of smallholder produced fibre, referred to in Kenya as "UHDS", of which the estimated production is;

2001 2,800 tons
2002 2,121 tons
2003 4,008 tons

- § Madagascan Sisal Fibre;

	Production	Exports
1998	11,190 tons	8,050 tons
1999	11,534 tons	8,619 tons
2000	10,510 tons	7,875 tons
2001	12,009 tons	9,924 tons
2002	8,363 tons	7,221 tons
2003	6,369 tons	5,227 tons
2004 (projected)	8,500 tons	

- § The marked decline in production from 2001 was largely due to prolonged climatically unfavourable growing conditions.

- § The difference between the production and export figures above represents the tonnage converted locally into sisal product, predominantly for the export market.

b) Summary 2003

- § Total fibre production in African countries in 2003 - approximately 55,000 tons

- § 15,000 tons (estimated) to have been used domestically to produce bags, yarns, twines, ropes, carpets and mats, polishing cloth, pulp, dartboards and handicrafts.

- § 40,000 tons (estimated) exported as sisal fibre - to be used in the following industrial sectors - W&Co estimated breakdown

  - § Carpets and Matting - 11,500 tons
  - § Wire rope core - 1,000 tons
  - § Pulp - 6,000 tons
  - § Polishing cloth - 5,000 tons
  - § Construction, Plaster reinforcing and mouldings - 8,500 tons

- § Dartboards - 150 tons
- § Padding - 150 tons
- § Commercial Twines - 5,000 tons
- § Handicrafts etc - 1,500 tons
- § Automobile and composite sector - 200 tons
- § Others - 1,000 tons

c) ***Quality and Market Development***

- § African production is largely based on locally cultivated hybrid sisal plants which were specifically developed to produce fast growing consistent, high quality, less coarse, white fibre which lends itself to a wide range of the niche higher value added products.

- § The African sisal industry has developed a good level of quality control both at the farming and government supervisory level, and maintaining the long established independent grading monitoring system. This has enabled most African producers to adapt more easily to the changing demands of worldwide modern business requirements.

- § The movement, in the past 20 years, away from a dependency on the original lower quality agricultural twine and cordage sector, with their lower pricing structure, has been an essential factor, in the development of the African sisal industry. African production, by its capital intensive and plantation based nature, incurs higher costs than its Brazilian counterpart in turn requiring a higher value added end product.

- § This growth and development of some of these specialist niche markets has been largely responsible for what can be considered as a "renaissance" within the field of natural fibres and in particular the African sisal industry - specialist paper, construction (plaster reinforcing), and high quality carpets and mats.

- § The maintenance of such markets, and the continuing development of new high value product markets is essential to the future health of the African sisal business.

d) ***Pricing***

- § The African sisal market has been stable and increasingly firm since the most recent "low" in the market - early in 2000. A major contributory factor to this strength has been the sustained level of excess demand for good quality fibre over the available supply.

- § The continuing growth of China, together with a marked increase in demand from the Middle Eastern market, combining with traditional market sales, has underpinned the ongoing strength of the market.

- § There is currently some concern among many involved in the African market that the prices being achieved today, at the top end of the range for each grade, are at levels that could ultimately, have a negative impact upon the longer term health of the African sisal industry and certainly act as a brake to the development of sisal in the "new" markets.

- § It would be short sighted in the extreme if the attraction of a short-term benefit, resulting from maximising prices to beyond acceptable levels, were allowed to damage the long term potential for the fibre.

- § The definition of what is an acceptable level will vary from one end product to another, and from market to market, but the current top end prices are reaching a level at which sisal fibre will start to lose, rather than gain, market share in some end products.

- § Over the last eighteen months, there has developed, a two tier market at the top of the pricing range and this has resulted in a very marked difference in the price for the same grade of sisal. This sharp price rise in a small specialised area of the market must not be taken as a true reflection of the whole African market.

- § This premium pricing, to areas such as the Middle East, must not be to the detriment or at the expense of the main traditional market for African sisal which must continue to be serviced and supplied with the fibre it requires.

- § African Prices;

	UG/R	No 3L
2001	US$ 530-560pmt	US$ 620-650 pmt
2002	US$ 520-550 pmt	US$ 615-640 pmt
2003	US$ 525-700 pmt	US$ 620-815 pmt
2004	US$ 700-820 pmt	US$ 815-915 pmt

FOB Mombasa/Tanga/Dar es Salaam basis
Premium for small bales.

The Brazilian Sisal Market

- § The Brazilian sisal fibre industry is considerably larger than its African counterpart - current estimates of an annual production in the region of 125 - 130,000 tons. This production is almost exclusively smallholder based, consequently, comparatively unsophisticated in production techniques, with much less quality control.

- § The absence of water during the decorticating process, and the paradox of high moisture levels that occur naturally in the fibre, coupled with the related problems in consistency in fibre quality has limited the scope of end products where it can be utilised.

- § The largest share of Brazilian sisal still goes into agricultural twine, primarily for the North American market.

- § Other areas in which Brazilian sisal is used;
  Polishing Cloth
  Padding industry
  Full range of yarns and twines (but limited to non fine yarns)
  Kraft paper
  Carpets and Matting
  Specialist pulp and paper - lower specification qualities
  Brazilian automobile industry.

a) Production and Export Figures

- § Brazilian Exports;

	Sisal Fibre	Sisal Product
2001	31,280 tons	59,820 tons
2002	50,720 tons	60,653 tons
2003	59,966 tons	61,440 tons
2004 (projected)	60,000 tons	62,600 tons

- § Total Brazilian sisal production is estimated to be in the region of 130,000 tons.

- § Total estimated area under sisal cultivation - 90,000 hectares

- § Brazilian Prices;

2001	US$ 310 – 330 pmt
2002	US$ 290 – 310 pmt
2003	US$ 350 – 420 pmt
2004	US$ 420 – 520 pmt

FOB Salvador basis for Type 3 Double Brushed
Bahia Sisal

- § Brazililan 2004 projected production breakdown for fibre and products;

60,000 tons	46.15%	Sisal fibre exports
45,000 tons	34.62%	Ropes and Agricultural Twines
14,000 tons	10.77%	Yarns (other than agricultural twines)
3,600 tons	2.77%	Carpets, Mats and Sisal Pads
7,400 tons	5.69%	Domestic market (excluding CFP stock which was sold out in Oct/Nov 2003)

b) Market Position

- § In common with the African market, Brazilian prices have been increasingly firm over the past 3 years. Today's levels are in the range of US$ 625 – US$ 650 pmt CIF basis for Type 3 DB Bahia sisal – up in excess of 50% on the prices 3 years ago.

- § The increasing firmness in the Brazilian sisal export market over the last two to three years is largely attributable to the emergence of a strong and consistent demand from China, as per the following export statistics to that country;

2001	100 tons
2002	16,100 tons
2003	23,370 tons
2004 (projected)	22,500 tons

- § The growing demand from the Chinese has been largely related to the rapidly expanding domestic polishing cloth market.

- § China currently takes a major share of the exported fibre from Brazil and until recently has been prepared to follow the upward trend in prices. The very recent price increase have, however, been resisted by some Chinese buyers and the continued firmness in the Brazilian market is likely to be determined by the position taken by the Chinese over the coming months.

- § Part of the increased demand in the past 2 years has been satisfied with sisal from the CFP stocks, government sponsored stocks accumulated at times of overproduction, in an attempt to keep prices maintained at a certain level for the farmers. These stocks have been fully sold.

- § The Brazilians have developed, in recent years, a higher quality grade of sisal fibre – Bahia Type 1 Double Brushed. It is limited in production – capacity is currently around 250 – 300 tons per month and it is closest in terms of quality to an African UG, although some buyers have taken it in place of No 3L grade. It is not possible for this grade to be utilised as a direct substitute for all products where African sisal is currently used, but,

there are many end products for which it is suitable. With the recent and current shortage of African sisal, this has been a useful adjunct to the market.

- § It is, however, a development that African producers should be aware of, particularly as the current pricing differential between Bahia Type1 and standard quality African UG is in excess of US$ 200 pmt on an FOB basis.

The Chinese Factor

- § The Chinese are still producers of sisal fibre – their current production is in the region of around 20 – 25,000 tons.

- § 10 years ago they were producers of 50,000 tons. The decline in production is largely as a result of several years of adverse weather conditions that destroyed the sisal plants and, latterly, the onset of the privatisation process in China. Small farmers can utilise the same land more profitably growing cash crops of fruit and vegetables for the growing population.

- § China has a well developed domestic sisal consuming sector. Many of these industries continue to use the locally grown Chinese sisal, although, due to the decline in domestic sisal production coupled with the growth explosion within the country, increasingly the demand has been met from imported Brazilian sisal.

- § The increased demand for Brazilian sisal is from the Chinese companies that are servicing the domestic polishing cloth market. This has seen a marked expansion in the last couple of years and can be related to the increased demand for this product from the car industry and the shipbuilding sectors, as well as all the other metal based industries which require a buffing process.

Future Trends

- § It is likely that in the longer term there will be a continuation, in the trend that started over 20 years ago, of the movement of value added sisal production to locations in the producer countries, near to the source of supply.

- § Smallholder production (Lake and UHDS fibre) is likely to develop more in Tanzania and in Kenya, but unlike the Brazilian method, it will be based on the traditional African, centrally based processing units, which should ensure that quality levels can be controlled and maintained. It will serve as a useful addition to the traditional largescale sisal farms which are the cornerstone of the sisal industry.

- § One area where there is cause for concern, is with regard to the worldwide freight market. Since the beginning of 2004, the freight rates on exports out of Brazil have nearly doubled. The African market, has as yet been largely unaffected, but given that there is an

acute shortage in vessels, containers and that the primary market is into and out of China, all the indications are that this freight market imbalance will continue through to the end of 2006. There could be an increase on African rates from the beginning of 2005.

- § China's developing domestic consumer market could realise a steady increase in demand for sisal, particularly from Brazil but also possibly for African fibre for higher value added products. This would occur over the next 5 – 7 years as there is unlikely to be any recovery in their sisal production before this time and as such assumes that a programme of replanting and development is already in place. It is all, of course, dependent upon the substantial rate of growth of recent years continuing in that country.

- § New EU regulations for the car industry that come into play in 2015 – where reportedly 85% of all new cars should be recyclable, 10% combustible and only 5% land fill sites, should have an impact on many natural fibres. Sisal will have a role in this market but price sensitivity in the car industry could prove a barrier for widespread use of sisal, particularly African sisal, when compared with other cheaper and more readily available fibres.

- § An area which could well be interesting and not so price sensitive is the much larger composite industry which has shown increasing interest in the use of good quality clean sisal as a strengther.

- § Speciality pulp is a potential area for development but it will necessitate sisal being price competitive with Abaca which in most instances is the fibre of preference in this area. However, producing and making available sisal fibre specifically for use by pulp and paper makers should lead to a diversification of the types of end paper applications, especially if significant price reductions are achieved.

- § Geotextiles, is an area in which there is already a background but, to date, little penetration has been achieved by sisal (except in South Africa), again largely for pricing issues. The natural fibre market is dominated by jute and coir geotextiles but sisal should have a place in this industry. Certainly, within the sisal growing countries and their neighbours, efforts should be made to encourage the civil engineering sector to consider the utilisation of sisal geotextiles in suitable applications. Government projects could be a key area in getting sisal accepted in this field and the wider the experience in this field could well influence its use elsewhere in the world.

- § The future for both African and Brazilian sisal looks reasonably positive provided there is price stabililty at market pricing that allows traditional business to continue, and possibly expand usage and new areas of business to be developed. Current prices are certainly at the higher end of what is acceptable to be able to achieve this.

Presentations by Mr. E. da Silva and Mr. W. Andrade, Brazil

- Experiences in Brazil -

EBDA Empresa Baiana de Desenvolvimento Agrícola S.A.
Vinculada a Secretaria da Agricultura e Irrigação da Bahia

Eduardo Ferreira da Silva
Engenheiro Agrônomo

Coordenador Estadual do Programa de Sisal

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Tel.: (75)262-1125

SITUAÇÃO ATUAL

- A Bahia é o maior produtor de sisal do Brasil.
- A região sisaleira chove de 500 a 600 mm/ano.
- A área de sisal do Estado é de 194.000 ha.
- O sisal gera 600 empregos, desde o campo até a indústria.
- 50% dos campos de sisal precisam ser recuperados.

O DESFIBRAMENTO

- É realizado diretamente no campo com máquinas pequenas tipo PARAIBANA.
- O produtor não é dono da máquina.
- O produtor recebe 40 a 50% do valor da produção.
- O dono da máquina recebe 50 a 60% .

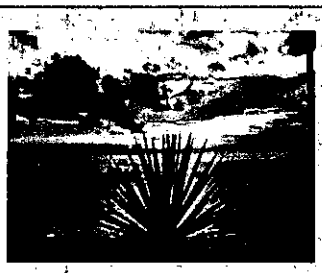
PROGRAMA DE INSENTIVO A LAVOURA SISALEIRA DA BAHIA

OBJETIVOS

- Recuperar a cultura do sisal nas regiões a serem atendidas pelo programa.
- Aumentar a renda do pequeno produtor rural.
- Promover assistência técnica e capacitar o produtor rural.
- Melhorar a qualidade da fibra do sisal.

METAS

- Recuperação de 60.000 ha de sisal.
- Instalação de 12 batedeiras comunitárias.
- Instalação de 16 unidades didáticas.
- Capacitação de 60 técnicos, 4.200 produtores e 120 beneficiadores.
- Atendimento a 4.000 produtores com crédito rural.
- Aumentar a produtividade de 700 para 1200Kg/ha.



SINDIFIBRAS

Dissemination Workshop

Product and Market Development of Sisal and Henequen Products.

Tanga - Tanzania 17 – 19 Nov 2004

Wilson Andrade - President

SINDIFIBRAS - Natural Fibres Industries Association

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SINDIFIBRAS

TYING TOGETHER PRODUCERS AND CONSUMERS OF NATURAL FIBRES IN ALL THE WORLD

SINDIFIBRAS

Sindicato das Indústrias de Fibras Vegetais da Bahia

Unindo produtores e consumidores de Fibras Naturais

O Brasil é o maior produtor mundial de sisal, com uma fatia de 40% do mercado. A produção da Bahia respondeu em 2002 por 90% da produção nacional, ou seja, por quase 40% da produção mundial. Assim como outras fibras duras, o sisal está vivendo um bom momento pela elevação da demanda mundial. Mas, o que a Bahia quer não é apenas ser o maior produtor nacional de sisal, e sim continuar a investir em tecnologia para elevar ainda mais a produção no Estado. Na Bahia, mais de 600 mil pessoas vivem direta ou indiretamente do sisal. Vale destacar as várias aplicações do sisal, que vão desde a formulação de ração animal até a produção de artesanato, cordas, tapetes e fios. As possibilidades de substituir a fibra de vidro, na indústria automotiva, e o amianto, na construção civil, são alternativas que despertam o interesse dos empresários internacionais. O sisal também pode ser aproveitado na indústria farmacêutica, na composição de inseticidas naturais e de fertilizantes.

Tying Together Producers and Consumers of Natural Fibres

Brazil is the world's largest producer of sisal fiber, with 40% of the world market. Production in Bahia for 2002 represented 90% of national production - almost 40% of worldwide production. Like other hard fibers, the increased worldwide demand has resulted in an opportune moment for producers of sisal fiber. Bahia does not wish to be merely the largest national producer of sisal fiber, but rather to continue to invest in technology in order to further increase production in this state. In Bahia, more than 600,000 people are sustained either directly or indirectly from sisal fiber production. There are many applications for sisal fiber, from the formulation of animal food to the production of handcrafts, ropes, mats and twine. The possibility of substituting fiberglass, in the automotive industry, and asbetos, in civil construction, are alternatives that have increased the interest of international companies. Sisal fiber can also be used in the pharmaceutical industry, in the composition of natural insecticide and in fertilizers.

ARTESANATO DE SISAL / *SISAL FIBER HANDICRAFTS*
NCM: 4602.10.00

CORDAS DE SISAL / *SISAL ROPES*
NCM: 56.29.00

FIBRAS DE SISAL / *SISAL FIBERS*
NCM: 5304.10.0000

FIOS DE SISAL PARA FENADEIRAS / *SISAL FIBER TWINE FOR SILAGE*
NCM: 5607.21.00

FIOS DE SISAL PARA EMBALAGEM / *SISAL TYING TWINE*
NCM: 5308.90.00

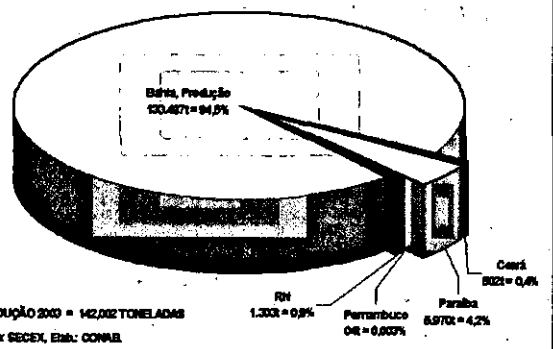
MANTAS DE SISAL / *SISAL PADS*
NCM: 5602.10.00

TAPETES E CARPETES DE SISAL / *SISAL FIBER MATS AND CARPETS*
NCM: 5705.00.00

CARACTERÍSTICAS

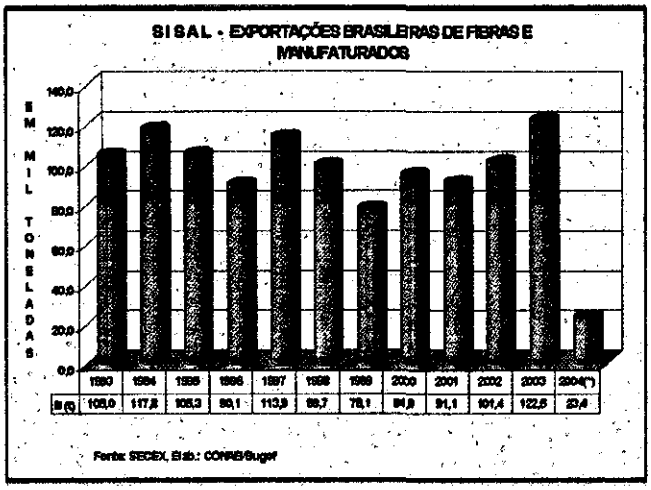
• Elevada oferta de empregos	offer employments
• Biodegradabilidade	biodegradable
• Altas propriedades mecânicas	mechanical properties
• Baixa densidade	low density
• Não abrasividade	no abrasivity
• Baixo consumo de energia	low energy consumption
• Custo competitivo	competitive cost
• PIB de US$ 150 Milhões	agp us$ 150 mi

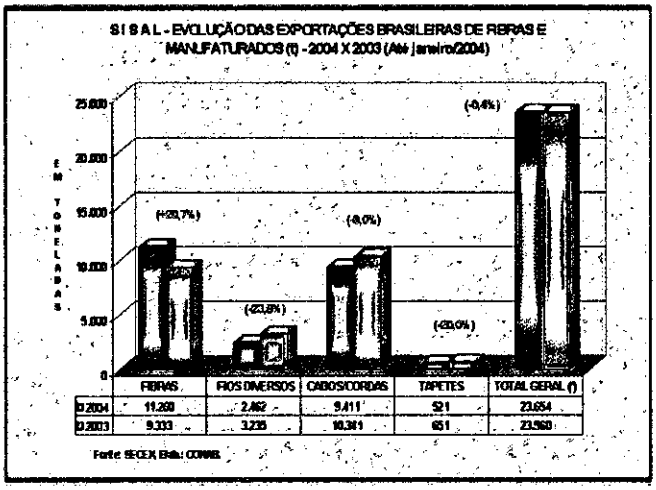
BRASIL - ESTADOS PRODUTORES DE SISAL E PARTICIPAÇÃO % EM 2003

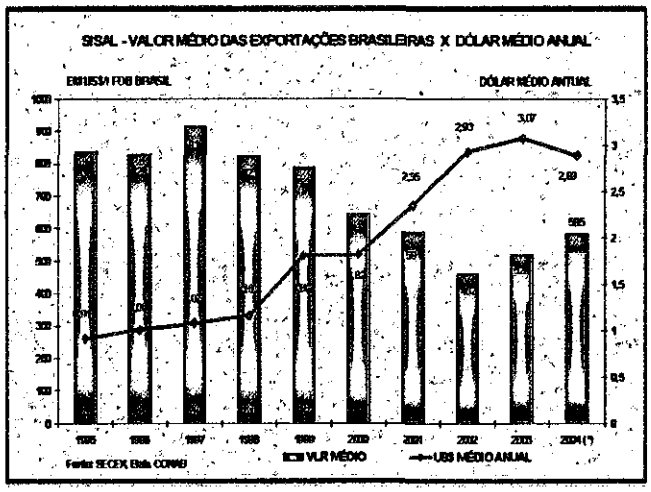


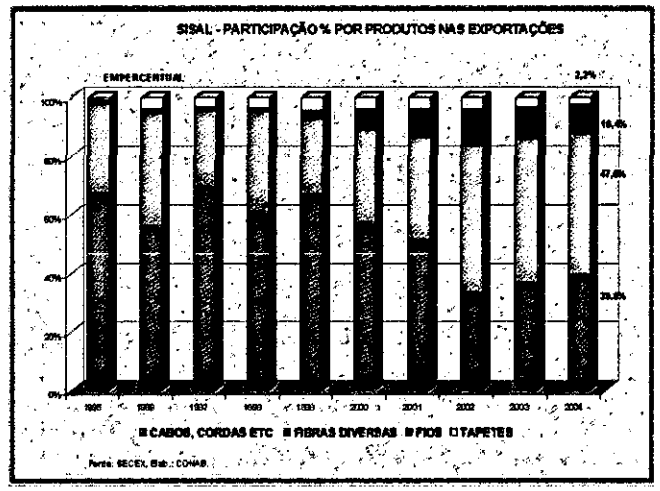
PRODUÇÃO 2003 = 142,002 TONELADAS

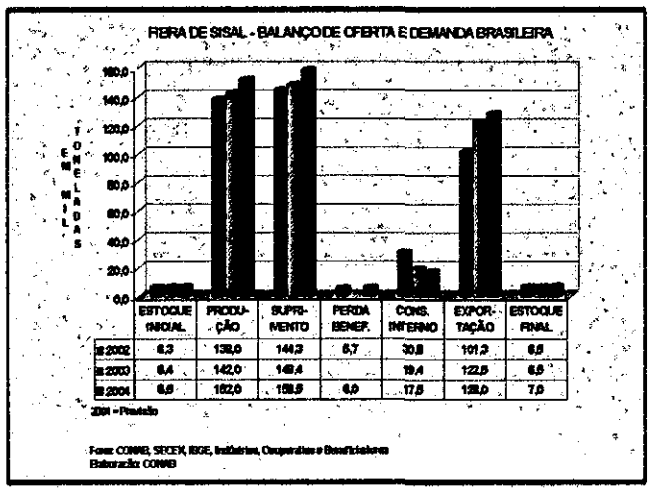
Fonte: SECEX, Elab.: CONAB

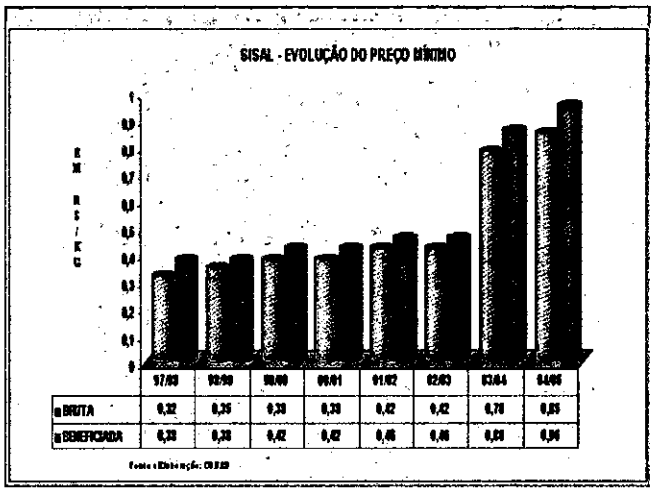

SISAL - EXPORTAÇÕES BRASILEIRAS DE FIBRAS E MANUFATURADOS
EM MIL TONELADAS
1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004(*)
(t) 105,0 117,8 105,3 90,1 113,9 99,7 78,1 94,8 91,1 101,4 122,5 23,4
Fonte: SECEX, Elab.: CONAB/Sugof

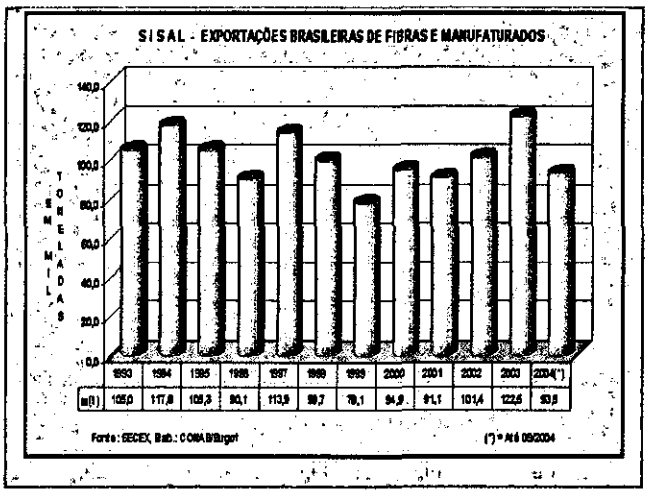

SISAL - EVOLUÇÃO DAS EXPORTAÇÕES BRASILEIRAS DE FIBRAS E MANUFATURADOS (t) - 2004 X 2003 (Até janeiro/2004)
EM TONELADAS
(+29,7%)
(-23,8%)
(-8,0%)
(-25,0%)
(-0,4%)
FIBRAS FIOS DIVERSOS CABOS/CORDAS TAPETES TOTAL GERAL (*)
2004 11.268 2.462 9.411 521 23.654
2003 9.333 3.235 10.361 651 23.560
Fonte: SECEX, Elab: CONAB

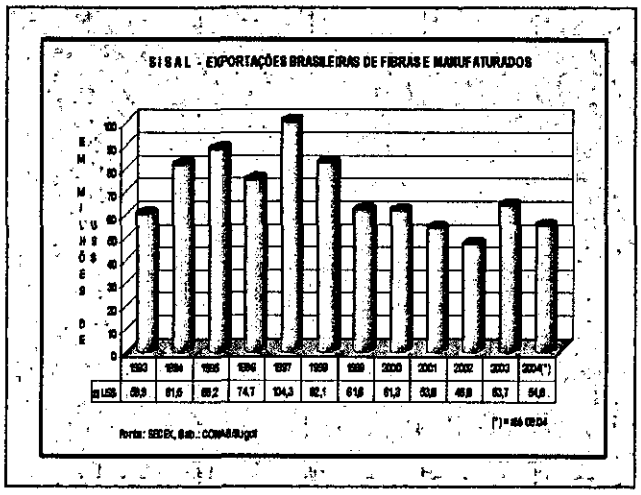

SISAL - VALOR MÉDIO DAS EXPORTAÇÕES BRASILEIRAS X DÓLAR MÉDIO ANUAL
EXPORTAÇÃO FOB BRASIL
DÓLAR MÉDIO ANUAL
2,35
2,93
3,07
2,89
VLR MÉDIO
US$ MÉDIO ANUAL
Fonte: SECEX, Elab. CONAB

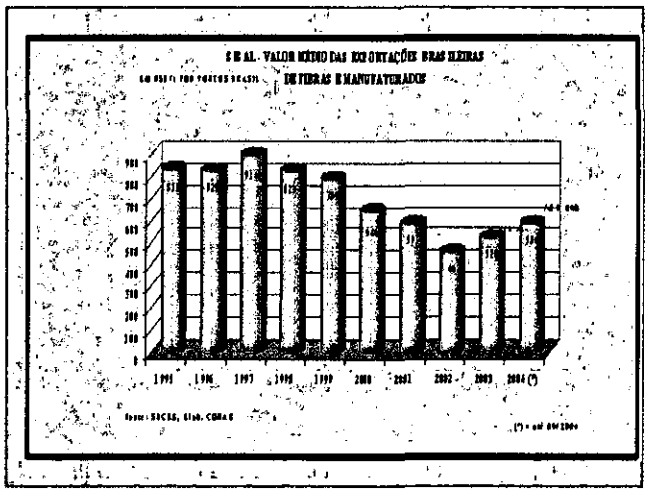

SISAL - PARTICIPAÇÃO % POR PRODUTOS NAS EXPORTAÇÕES
EMPERCENTUAL
2,2%
16,4%
47,8%
33,6%
CABOS, CORDAS ETC
FIBRAS DIVERSAS
FIOS
TAPETES
Fonte: SECEX, Elab.: CONAB

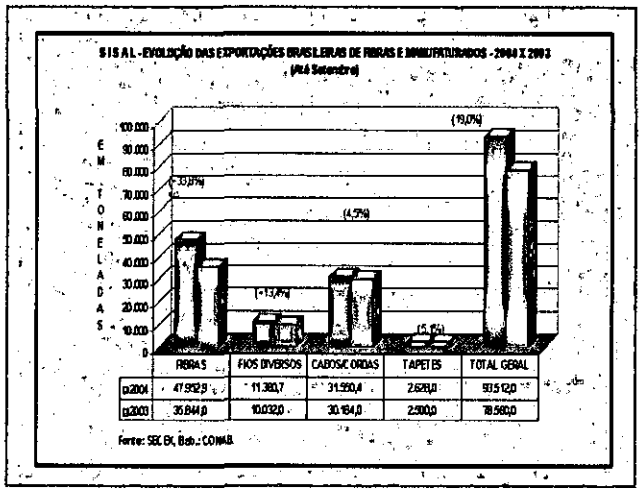

FIBRA DE SISAL - BALANÇO DE OFERTA E DEMANDA BRASILEIRA
EM MIL TONELADAS
ESTOQUE INICIAL PRODUÇÃO SUPRIMENTO PERDA BENEF. CONS. INTERNO EXPORTAÇÃO ESTOQUE FINAL
2002 6,3 138,0 144,3 5,7 30,8 101,2 6,5
2003 6,4 142,0 148,4 19,4 122,5 6,5
2004 6,5 152,0 158,5 6,0 17,5 125,0 7,0
2004 = Previsão
Fonte: CONAB, SECEX, IBGE, Indústrias, Cooperativas e Beneficiadores
Elaboração: CONAB


SISAL - EVOLUÇÃO DO PREÇO MÍNIMO
EM R$/KG
97/98 98/99 99/00 00/01 01/02 02/03 03/04 04/05
BRUTA 0,32 0,35 0,33 0,33 0,42 0,42 0,70 0,85
BENEFICIADA 0,33 0,38 0,42 0,42 0,46 0,46 0,80 0,90

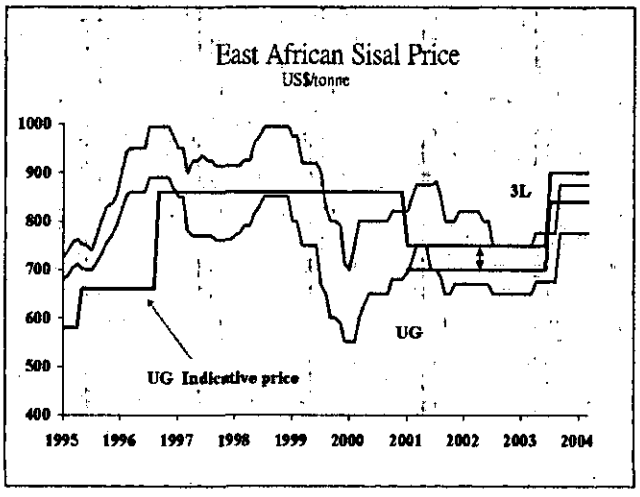

SISAL - EXPORTAÇÕES BRASILEIRAS DE FIBRAS E MANUFATURADOS
EM MILHARES DE TONELADAS
1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004(*)
US$ 105,0 117,8 109,3 90,1 113,9 99,7 78,1 94,9 91,1 101,4 122,5 93,8
Fonte: SECEX, Estb.: COMA B/Agrot
(*) = Até 09/2004

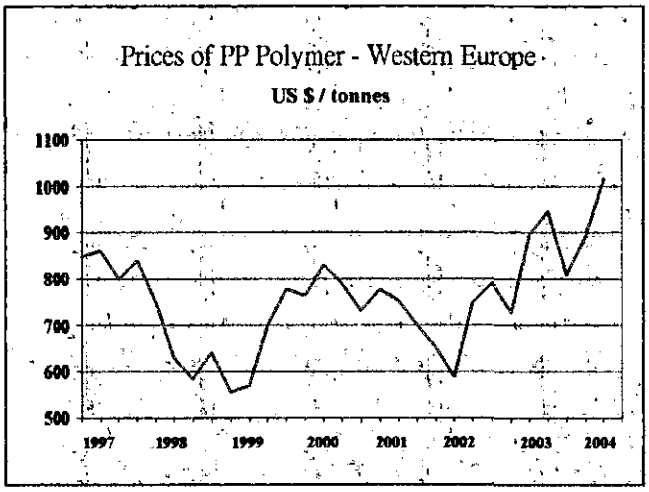

SISAL - EXPORTAÇÕES BRASILEIRAS DE FIBRAS E MANUFATURADOS
EM MILHÕES DE US$
1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004(*)
US$ 89,9 81,6 89,2 74,7 104,3 92,1 61,9 61,2 53,8 46,8 63,7 54,6
Fonte: SECEX, Estb.: COMA B/Agrot
(*) = Até 09/04

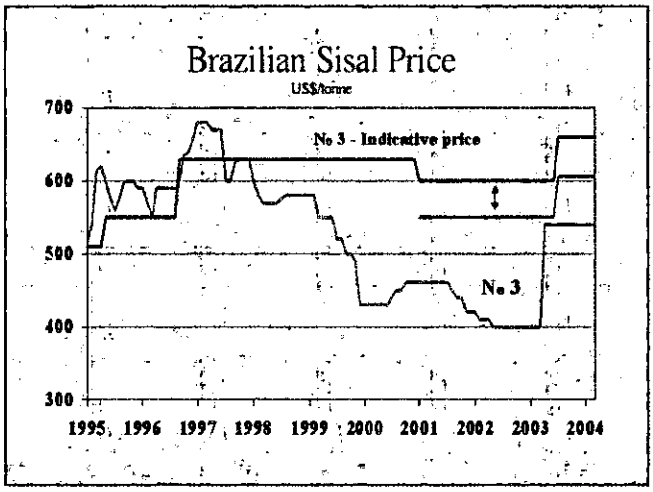

SISAL - VALOR MÉDIO DAS EXPORTAÇÕES BRASILEIRAS
DE FIBRAS E MANUFATURADOS
1991 1996 1997 1998 1999 2000 2001 2002 2003 2004 (*)

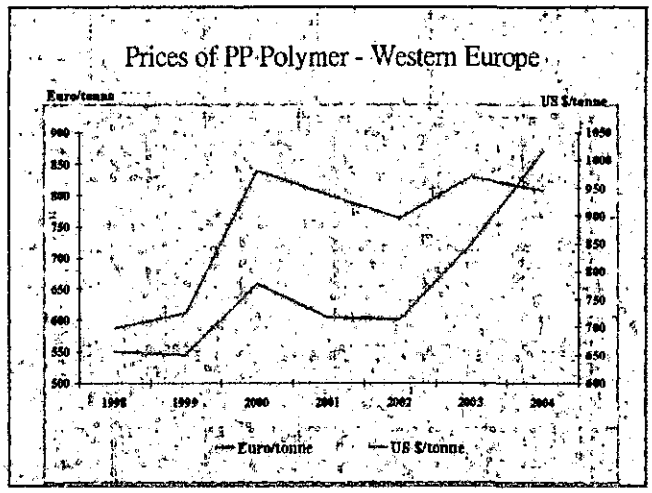

SISAL - EVOLUÇÃO DAS EXPORTAÇÕES BRASILEIRAS DE FIBRAS E MANUFATURADOS - 2004 X 2003
(Até Setembro)
EM TONELADAS
(-33,8%)
(-13,6%)
(4,7%)
(-5,9%)
(19,0%)
FIBRAS | FIOS DIVERSOS | CABOS E CORDAS | TAPETES | TOTAL GERAL
2004 | 47.912,0 | 11.380,7 | 31.550,4 | 2.670,0 | 93.512,0
2003 | 35.844,0 | 10.032,0 | 30.164,0 | 2.500,0 | 78.560,0
Fonte: SECEX, Estb.: COMAB

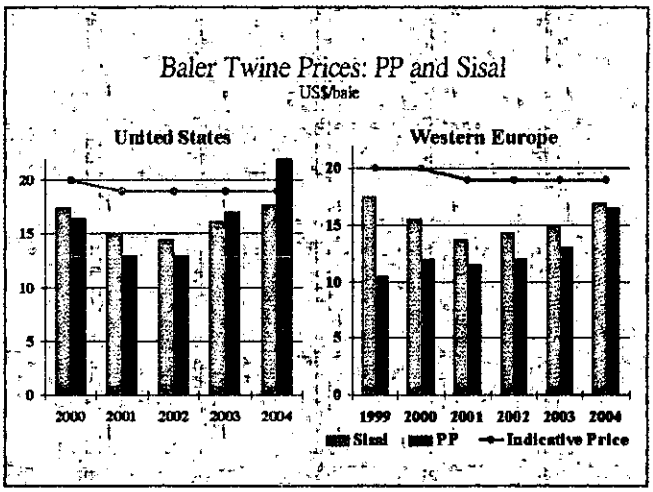

Consultation on Natural Fibres
Rome, Italy
26 March 2004

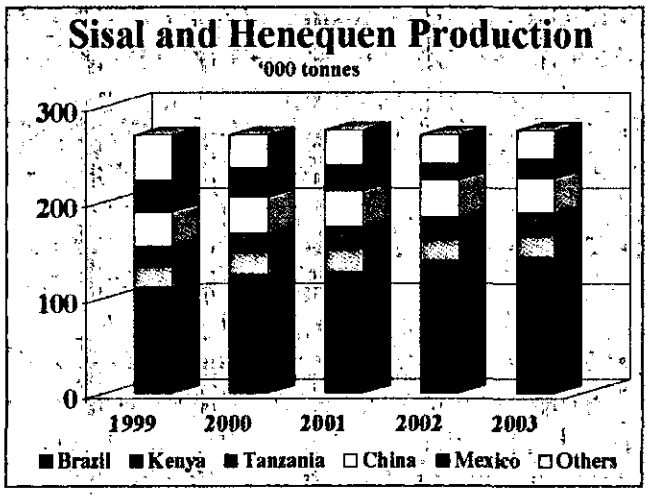

East African Sisal Price
US$/tonne
1000
900
800
700
600
500
400
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
3L
UG
UG Indicative price

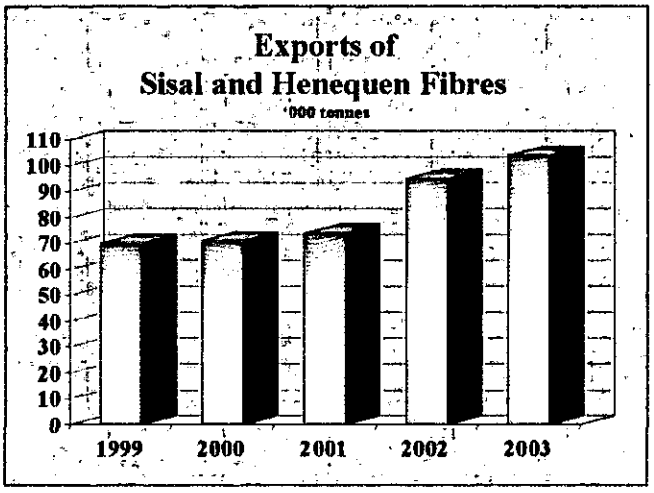

Prices of PP Polymer - Western Europe
US $ / tonnes
1100
1000
900
800
700
600
500
1997
1998
1999
2000
2001
2002
2003
2004


Brazilian Sisal Price
US$/tonne
700
600
500
400
300
No 3 - Indicative price
No 3
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004


Prices of PP Polymer - Western Europe
Euro/tonne
US $/tonne
Euro/tonne
US $/tonne

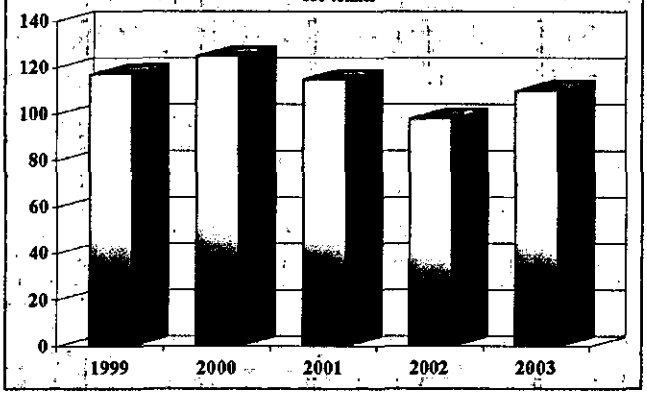

Baler Twine Prices: PP and Sisal
US$/bale
United States
Western Europe
20
15
10
5
0
2000
2001
2002
2003
2004
1999
2000
2001
2002
2003
2004
Sisal
PP
Indicative Price


Sisal and Henequen Production
'000 tonnes
300
200
100
0
1999
2000
2001
2002
2003
Brazil
Kenya
Tanzania
China
Mexico
Others


Exports of
Sisal and Henequen Fibres
'000 tonnes
110
100
90
80
70
60
50
40
30
20
10
0
1999
2000
2001
2002
2003

Exports of Sisal and Henequen Manufactures

'000 tonnes



Actions - On the farm

- Productivity - 700 kg to 1,200 kg per hectare
- Quality
- Social improvements for workers and smallholders
- Utilization of the all plant
- New varieties
- Decortication Machinery
- Enviromental care

In the industry

- New brushed machine
- New yarn machine
- New rope machine

On the market

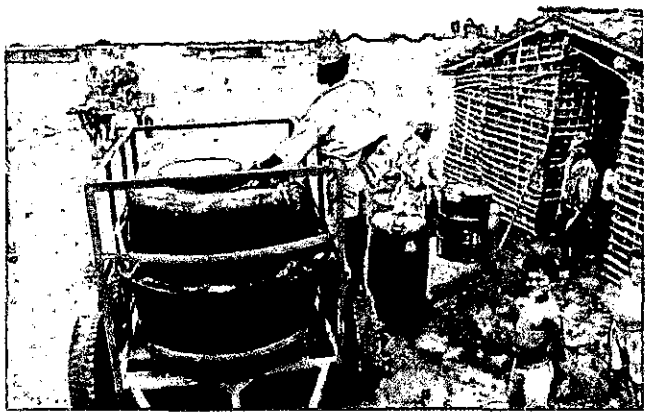
- Tax and limitations on exports
- Hay machinery tecnology
- Biodegradable advantages
- Erosion of tradicional markets
- New end uses
  - compósites
  - construction material
  - geotextéis
  - celulose
  - chemical

In the national and international organizations

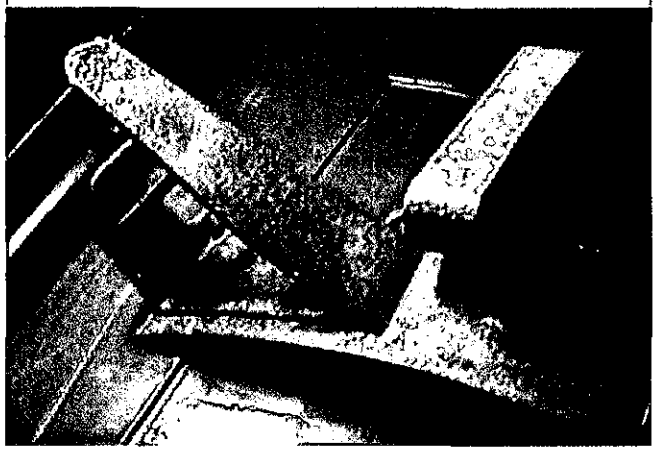
- Dissemination of Tecnologies
- Market information
- Spill action - no repetition
- New financial sources for projects

PEQUENO GALPÃO COBERTO COM TELHA DE FIBRA DE SISAL - Brasil

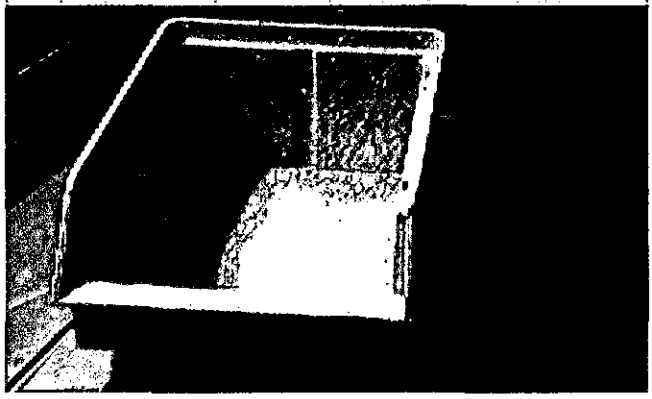
CONTAINER DE ÁGUA CONSTRUÍDO COM CIMENTO/ FIBRA DE SISAL MOSTRANDO CONDIÇÕES SÓCIOECONOMICAS NA ÁREA PRODUTORA DO SISAL - Brasil



Válvula de injeção baseada em fibra de sisal



Basculante de Caminhão feito de fibras naturais baseadas em Compósitos



Presentations by Ms. A. Orozco and Mr. J. Azcorra Torre, Mexico

- Experiences in Mexico -

Adopting Technology in Tequila Production: the potential relationship with sisal and henequen products

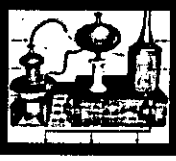
Aideé Orozco. Development & Innovation Manager.
Casa Herradura.
aideeorozco@herradura.com.mx

Project on product and market development of sisal and henequen products
International Dissemination Workshop
Tanga, Tanzania, November 17th-19th, 2004.

Content:

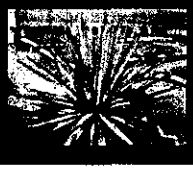
1. History:

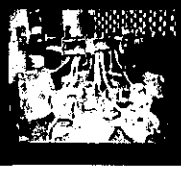
- Tequila was originally a non distilled beverage, used for ceremonial and religious purposes, B.C.
- *Mezcal wine*, the former name for tequila, was produced when Spaniards bring distillation knowledge, 1521.
- First tequila companies appeared, Cuervo 1795, Herradura 1870 and Sauza 1873.
- German botanist Dr. Weber, classified agave used for tequila production, as *Agave tequilana* Weber blue variety, 1902.


2. Facts and definitions:

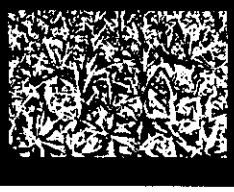
- Agaves belong to *Agavaceae* family. They need 6-8 years to mature and can be used as ornamental, food, fiber source and for beverage production.
- Different species of *Agave* are used in other beverage production: Mezcal (*A. potatorum*), Bacanora (*A. pacifica*), Sotol (*A. angustifolia*) and Pulque (*A. atrovirens*) .
- First Mexican official norm (NOM) for tequila, 1949.
- 87 Distilleries in 1910 and 109 in 2004 (105 in Jalisco).



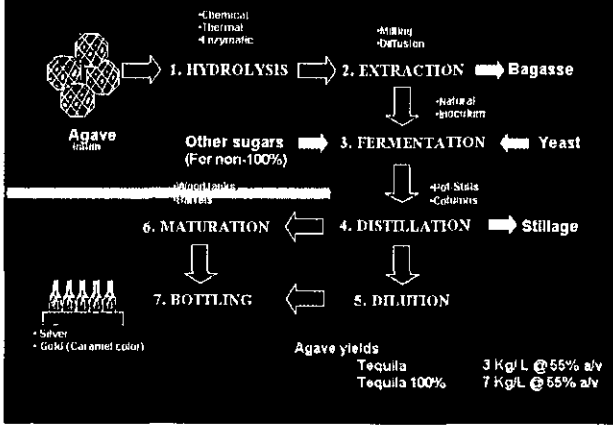


2. Facts and definitions (cont.):

- Tequila Regulatory Council (CRT), 1993.
- Tequila 100% is produced only with agave as a sugar source and Tequila, with up to 49% of other sugars (Cane and Corn) according to NOM. Origin denomination.
- Tequila silver (blanco), Gold (abocado) caramel color, Aged (reposado) 2 months and Extra-Aged (añejo) 12 months in oak tanks or barrels respectively.

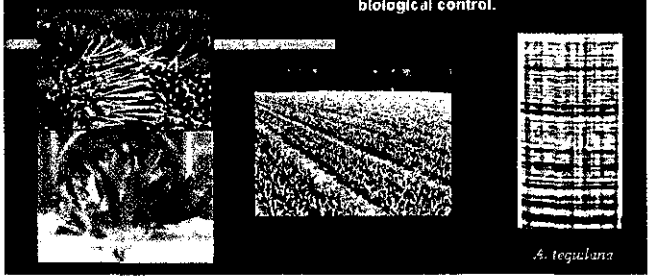

3. Process Diagram:



4. Agave cultivation:

1. Morphology used for *A. tequilana* identification.
2. Baby agave plants for sowing.
3. Use of agrochemicals and fertilizers for agave cultivation.

1. Genetic methods for *A. tequilana* identification.
2. Micro-propagated agave plants for sowing.
3. Organic agave cultivation and biological control.

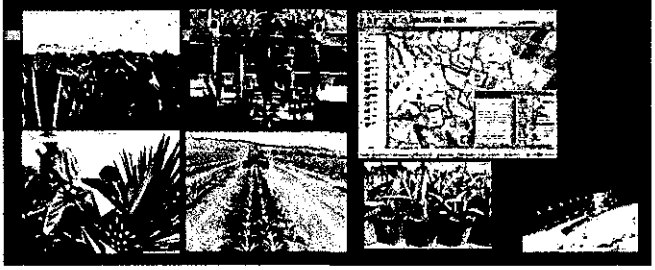


A. tequilana

4. Agave cultivation (cont.):

4. Inventory control by direct count of agave plants in fields.
5. Manual sowing and harvesting.
6. Harvesting by age and inulin content.

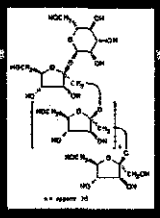
4. Remote satellite prospection for agave inventory control.
5. Mechanized agave sowing and harvesting (Micro-propagated).
6. Harvesting by phenology methods and inulin content.



4. Agave cultivation (cont.):

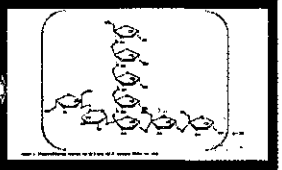
7. Inulin structure in Agave similar to Jerusalem artichoke.

7. New structure of polymer in Agave, named Agavin.



Inulin from *Jerusalem artichoke*

A. tequilana

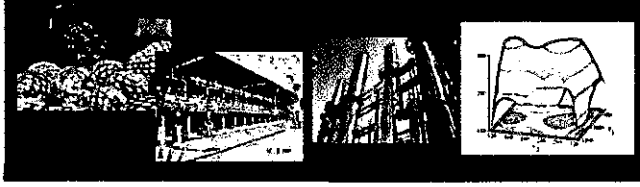


Agavin from *A. tequilana* Weber.
Mercedes Lopez, 2002

5. Production process:

1. Hydrolysis by cooking in ovens or autoclaves.
2. Sugar extraction by milling.
3. Batch, natural fermentation or inoculated yeast strain. Nutrient addition with no temperature control.
4. CO_2 vent to atmosphere.
5. Batch distillation in pot stills.

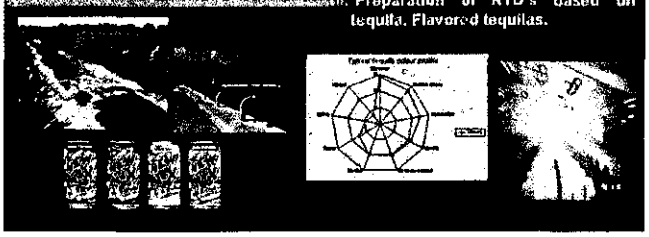
1. Hydrolysis using enzymes.
2. Sugar extraction by a diffusion band.
3. Yeast recycle, optimization of wort by RSM, high sugar and ethanol concentration resistant yeast strains. Temperature control.
4. CO_2 recovery.
5. Continuous distillation columns.



5. Production process (cont.):

6. Irrigation in agave fields for stillage disposal.
7. Bagasse composting for agave field fertilization.
8. Ageing in barrels in warehouses
9. Tasting panel for approval.
10. Dilution and bottling of tequila.

6. Stillage treatment anaerobic aerobic plants.
7. Thermal and electric energy from bagasse.
8. Warehouses with temperature and humidity control to reduce looses.
9. Sensory evaluation groups.
10. Preparation of RTD's based on tequila. Flavored tequilas.



6. New developments:

1. Traceability of tequila by CRT in production plants and in the market for authentication.
2. Traditional slow analytical methods for agave.
3. Agave→ tequila.

1. O^{18}/O^{16}, H^2/H^1, C^{13}/C^{12} Isotope relationship for authentication.
2. Use of NIR for agave analysis.
3. Alternative uses for agave plant: Inulin, Pectin, Waxes, Saponins.

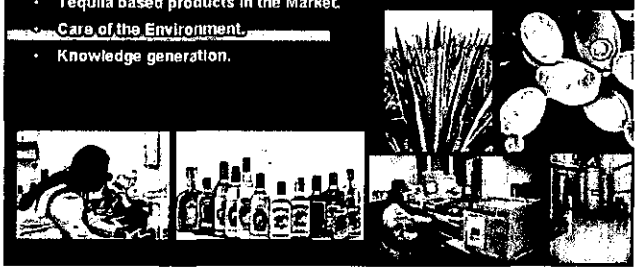
6. New developments (cont.):

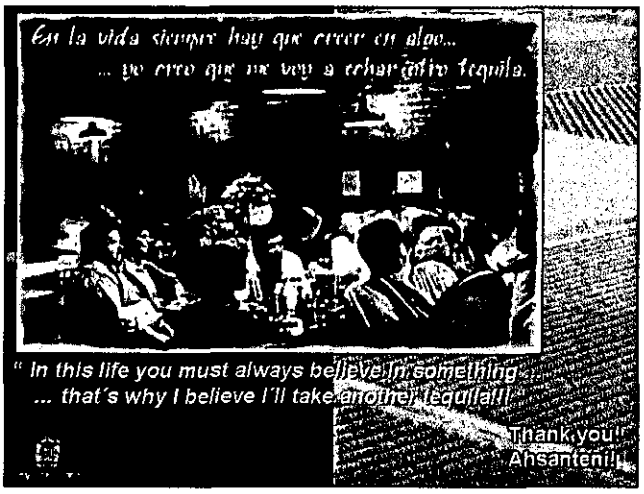
4. Use of only 20% of the agave plant.
5. R&D absent in most tequila companies.
6. Lack of studies of side-effects of tequila consumption.

4. Bio-refinery concept to process whole agave plant.
5. R&D departments in principal companies.
6. Quality, consistency and security in products (Ethyl carbamate, hangover compounds reduction, etc.).

7. Putting Technology to work:

- Health agave plants and no shortages and surplus.
- High quality products.
- Consistency in the product.
- Security in tequila consumption.
- Reduce costs in Agave and Tequila production.
- Tequila based products in the Market.
- Care of the Environment.
- Knowledge generation.





HENEQUEN HISTORY AND PERSPECTIVES IN MEXICO IN 2005

YUCATAN

AGAVES NATIONAL DISTRIBUTION

YUCATAN

HISTORICAL SUMMARY

•BEGINING OF THE HENEQUEN INDUSTRY IN 1830. In this year the Yucatan 's farmers were corn farmers or cow farmers, but many of them began to seed henequen in their fields, because of fiber demand of henequen Industry

•INCREASES OF THE MARKETS BECAUSE OF THE CIRUS HALL MC. CORMIK INVENTION IN 1878. The Mac Cormick machine (wicle bind feed cattle) needed more fiber production and Mexico through Yucatan increased the henequen areas and the production of baler twine

•YUCATAN REVOLUTION IN 1915. The Mexican Revolution wich took place in 1910 in other states of Mexico, in Yucatan wasn't until 1915 when Gral. Salvador Alvarado came to Yucatan and changed the labor relations between the landowners and henequen farmers (campesinos) of course decorticating workers too.

YUCATAN

HISTORICAL SUMMARY

•YUCATAN'S AGRARIAN REFORM IN 1937. The Goverment took the lands from the landowners and divided to given them to the commoners but the decorticating plants continued belonging to the landowners and the production fiber control were from the landowners.

•VARIOUS GOVERMENTAL OFFICES HAS THE CONTROL OF THE HENEQUEN PRODUCTION FROM 1937 TO 1992. The Goverment had an office wich controls the fiber production it had diferents names along this period for instance National Bank for commoners, Bank Rural, Henequen Trust, CORDEMEX etc.. the last henequen control office of the Goverment closed its doors in 1992 and since that year the henequen farmers were working like the parcelarians.

YUCATAN

HISTORICAL SUMMARY II

• THE GOVERNMENT LEAVES THE HENEQUEN CONTROL PRODUCTION IN 1993. Every henequen farmer was working his field and he was the owner like the parcelarian and no more. like commoner the goverment at this time left every action or responsability with the henequen Production Control.

•THE GOVERNMENT STARTS GIVING HELP LIKE INCENTIVES IN **1996.** Henequen farmers received some economic resources from the Goverment if they worked their henequen fields the best way.

•THE GOVERNMENT APPLIED ECONOMIC RESOURCES TO THE HENEQUEN FARMERS IN 7 PROGRAMS SINCE 2002. The Goverment in the same form (like incentive) gave economic resources to the Henequen farmers through, Nursering, line against the fire, land preparation, new seed, weed control, herbicide, fiber incentive.

YUCATAN

STAGES IN THE HENEQUEN LIFE

STAGE	DURATION	AGE
•NURSERY	2 YEARS	2 YEARS
•GROWING	5 YEARS	7 YEARS
•"MATEO"	2 YEARS	9 YEARS
•PRODUCTION	12 YEARS	21 YEARS
•DECADENCE	4 YEARS	25 YEARS

YUCATAN

VARIATIONS IN THE LAST DECADES

	1984	1994	2004
•MUNICIPIUMS	62	56	42
•HENEQUEN FARMERS	55,500	16,000	5,200
•AREA IN HAS.	250,000	90,860	24,600
•FIB. PROD. IN TONS.	67,000	24,294	5,000

YUCATAN

DECORTICATING PLANTS WORKING

GROUP	1994	2002	2004
PARCELARIAN	9	7	3
COMMONER	13	4	1
LANDOWNER	35	14	10
TOTAL	57	25	14

YUCATAN

PERSPECTIVES FOR 2005

• INCREASES THE HENEQUEN AREAS IN 40 MUNICIPIUMS

•INCREASES THE NUMBER OF THE DECORTICATING PLANTS IN OPERATIONS.

•GET EFFICIENT THE OPERATION OF THE DECORTICATING PLANTS.

•GET BETHER PLANEATION AND BETHER DISTRIBUTION OF THE ECONOMIC RESOURCES OF THE GOVERNMENT.

•HELP THE SCIENTIFIC INVESTIGATIONS SEARCHING HENEQUEN SUBPRODUCTS WITH HIGH VALUE , FOR INSTANCES THE INULINE.

YUCATAN

•FACTS.

•Nursery 100,000 plants/Ha

•Leaves/year/plant 21

•Fiber 23 Kg/1,000 leaves

•Density 3,500 plants/Ha

•Production 1.3 MT/Ha

•Cost of Production $5.5PESOS/Kg $477 US DLLS/MT

•Sell $650.47 US DLLS/MT

•Sell from Industry to Carpet Industry $2,601 US DLLS/MT

•Needs for internal Consumer in Yucatan/Year 25,000 MT

•Production/Year/Yucatan 5,000 MT

•Import Brasil, Tanzania, Kenia $500 US DLLS/MT + $100 US DLLS freight.

YUCATAN

• THE GOVERNMENT today show the campesino and the Industrial two basic idea, 1.- MARKET , Local and Global to take part and 2.- The Efficient Costs to Operation.

•The Horizontal Integration is part of the solution, involves strategic alliance with similary positioned institutions from different sector, offering diferentes skills and capabilities, the sum of wich make up the productive chain. The formula is Yon Win-I Win

•Thank you

Presentation by Mr. Y. Chongwen, China

"Planting and Production of Sisal in China"

Planting and Production of Sisal In China

Prof. Chongwen Yu
(Donghua University, China)

1.Planting

- Planting

Total 15000 hm^2 of sisal are grown in China, which produce about 45000 tons fiber per year, in the productivity around 2.8 tons/hm^2.

The main planting area of sisal in China are tropic and sub-tropic region, such as Guangxi (around 25000 tons), Guangdong(around 10000 tons), Hainan, Yunnan, and Guizhou provinces.

- Variety

The main variety in China is hybrid HL11648, which is original from East Africa.

- Profit for the Planting

Compare to the other crops, such as sugarcane, fruits (pineapple, banana) cassava, and so on, the sisal planting offer more profit and low requires to the fields, therefore, most poverty fields are now changed to planting sisal.

Classification of sisal fiber

- Long fiber(main production extracted from fresh leaves): used for production of yarn, twine, cordage, cloth(fabric),carpet and so on.
- Short fiber(noil or waste fiber during the extraction of fresh leaves): used for mattress, low grade yarn and fabric produced by jute processing system.
- Residuals:include the dregs and liquid during the extraction of fresh leaves

- Dregs are used for the fertilizer and feeding of pig, horse and sheep.
- Vegetable protein can be extracted from the liquid, used as shed agent for shedding hair from leather, and the saponin and hormone, such as hecogenin and tigoenin, can be extracted from the liquid.

2.Production of Sisal

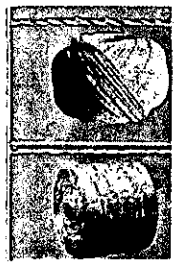
The production of sisal in China are:

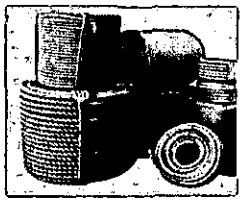
- Sisal yarn;
- Twine;
- Cordage(rope);
- Cloth(fabric):

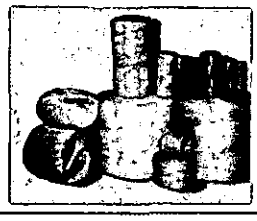
the new development of the cloth is to producing the buff, which can polish the metal and non-metal materials, instead the traditional buff made from cotton, with the advantage of saving energy, long life span, more smooth polish effect, and less powder pollution.

- Other application: mattress,paper making, colored fiber.

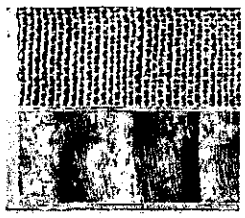
Twine and rope made by sisal

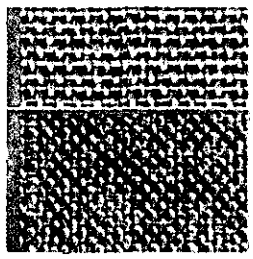


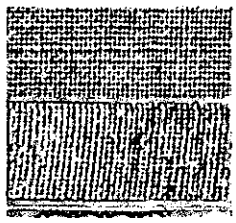


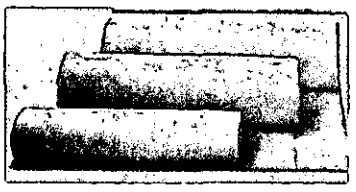


Sisal Cloth (fabric)

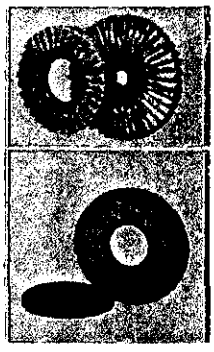


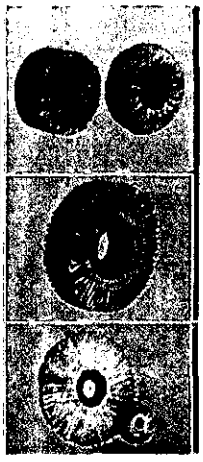


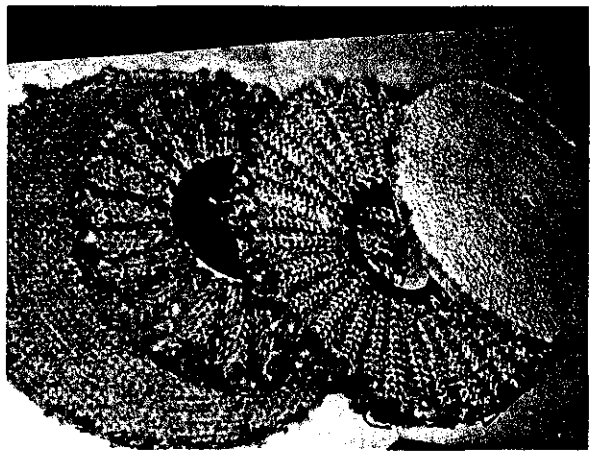




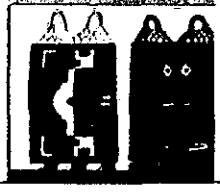
Buff made by sisal



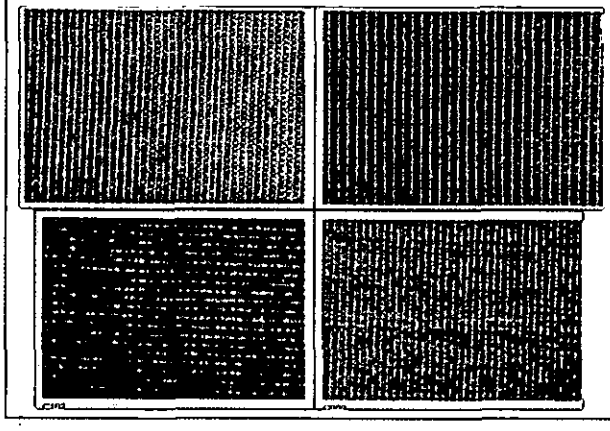


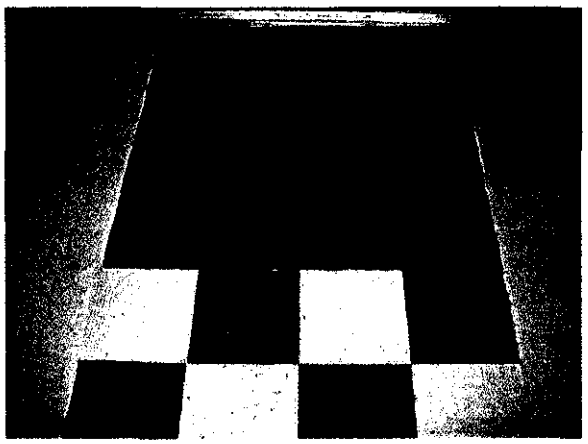


Craft made by sisal short fiber



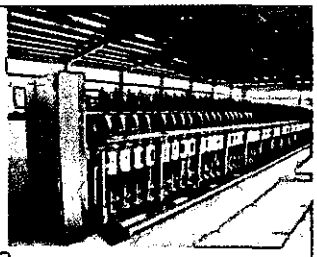
Carpet made by sisal





Slipper made by sisal

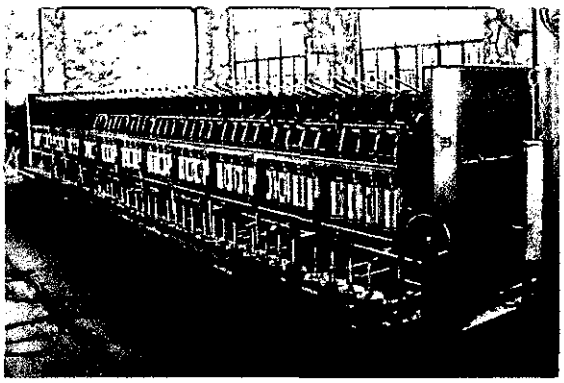
Also, some sisal processing machines are produced in China



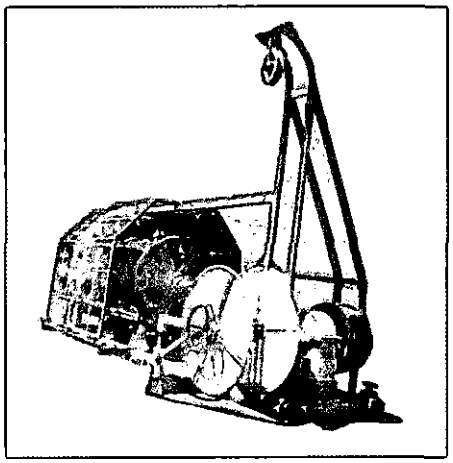
Carding and drawing machine

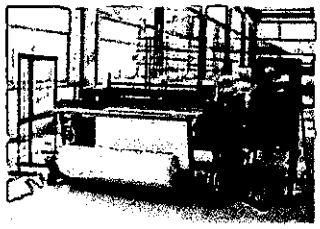
Spinning machine

Spinning machine

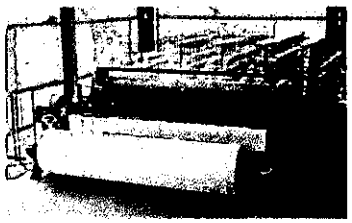


Rope-making maching





Weaving machine



3.Organizations

- Related Official Organizations in China:

Ministry of Agriculture;
China Bast and Leaf Fibers Textile Association.

- University:

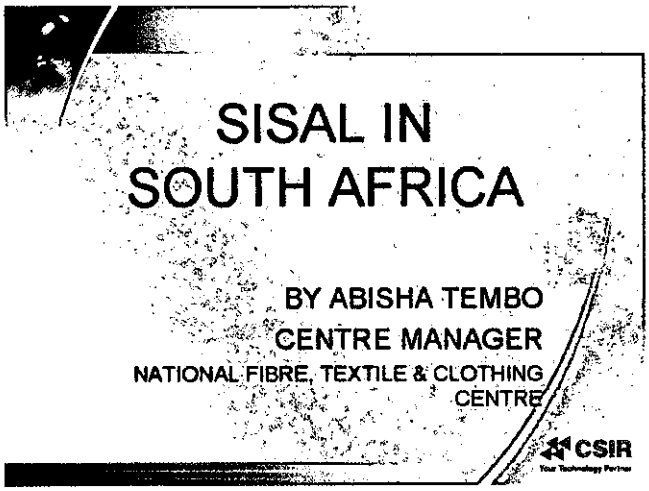
Donghua University
(formal China Textile University)

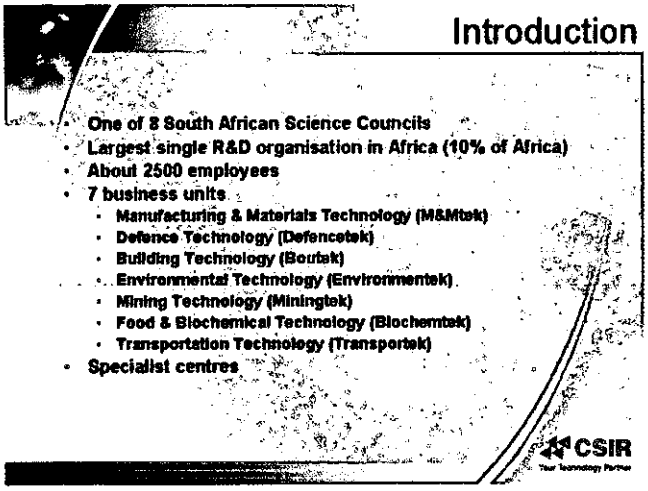
- Biggest Companies:

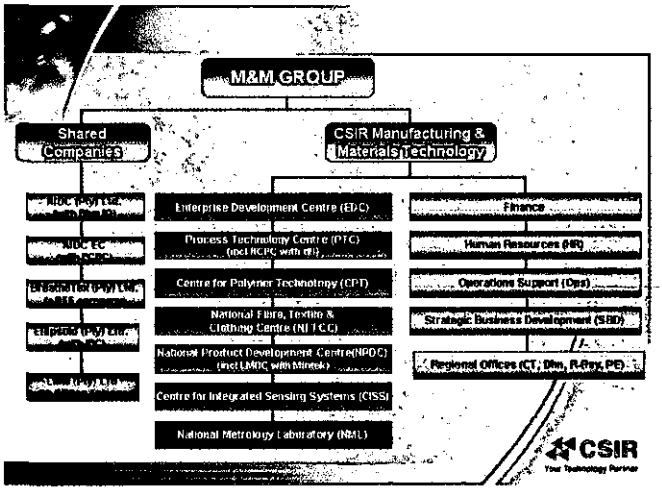
Dongfang Sisal Group Co., Ltd. Of Guangdong;
Guangxi Sisal Limited Liability Corp..

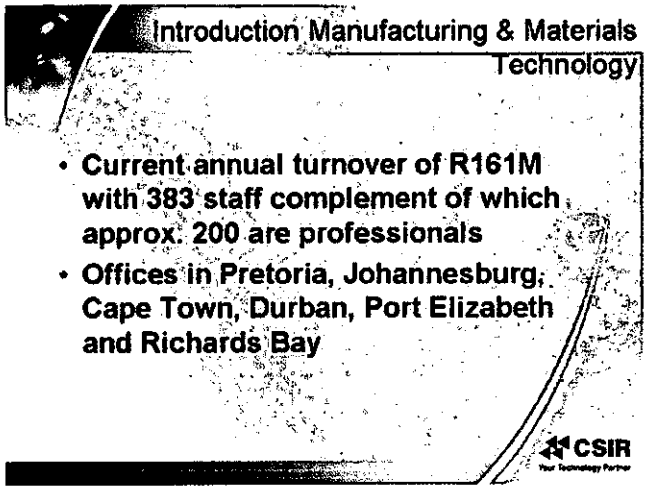
Presentation by Mr. P. Tembo, South Africa

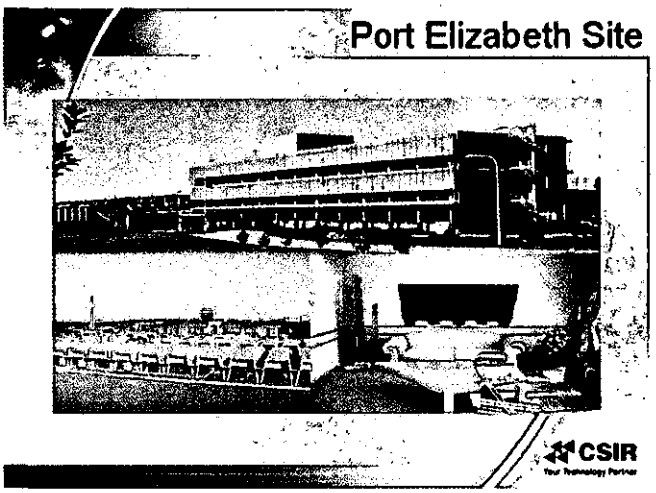
"Sisal in South Africa"











Vision

"A world-class Centre of Excellence for the establishment of globally competitive fibre industries"

Mission

"To develop cutting-edge technologies, expertise and innovative solutions for the fibre industry"

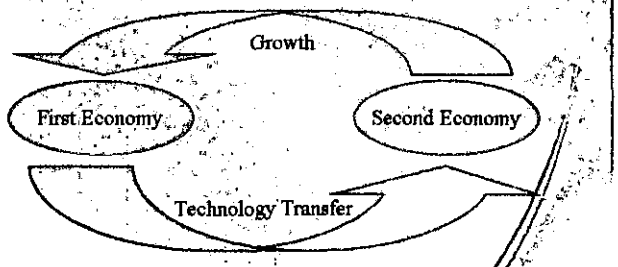
CSIR

Objective

"is to enhance the competitive capability of the fibre industry to compete in global markets and to ensure high investment returns, job creation, economic growth and also the empowerment of previously disadvantage individuals"

CSIR

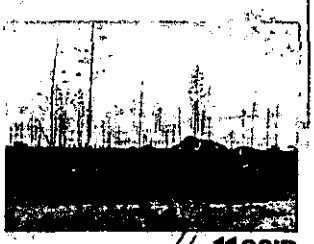
South African Economy



CSIR

1997 – Availability of fibre

- Sisal was the only locally available fibre at the time
- 26 Sisal estates in SA
  - 3 private estates, KZN
  - 23 state farms, Limpopo



- State owned farms not producing to full capacity
- SA imported sisal in spite of sufficient local capacity
- Replanting was behind schedule
- Refurbishment of equipment was urgently needed

CSIR

Background - Project history

- Originated in 1997 by Jürgen Schremp
- Project with social development emphasis

- Technology transfer to South Africa
- Project to coincide with localisation of W203 RH (Mercedes Benz C Class)

CSIR

1998 – Feasibility study on farms

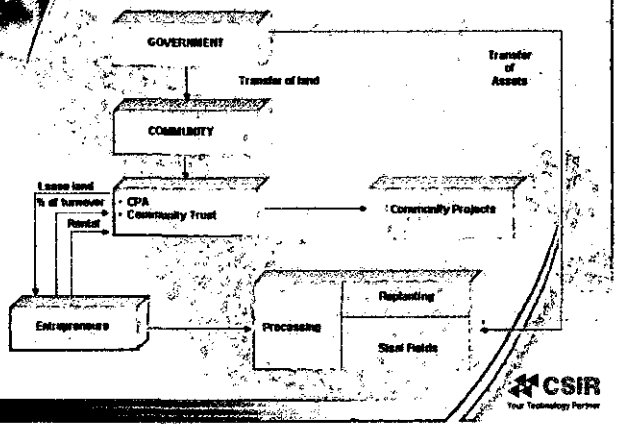
- An economic feasibility study was done to determine if farms were economically feasible
- Focus on three state owned farms
- Done by CSIR on behalf of DaimlerChrysler SA
- Done in conjunction with Limpopo Government

Results

- Production costs on state farms higher than sisal import price
- Some farms could be economically viable if operated independently
- Infrastructure had to be refurbished

CSIR

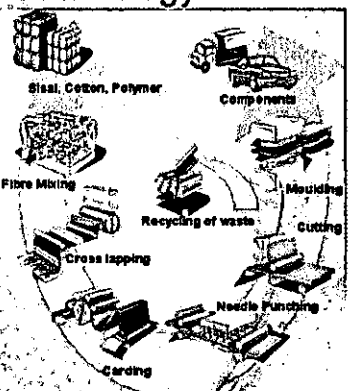
1999 – Commercialisation model



CSIR

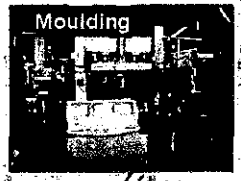
2000 - Technology Transfer

- Technology developed by Borgers AG for flax
- Adapted for sisal, rougher fibre
- Brits Textiles
  - Fleece production
  - Compression moulding
- NCI
  - Lamination
  - Finishing



CSIR

2000 – Technology Transfer (2)



CSIR

2001 – Alternative applications

Approach:

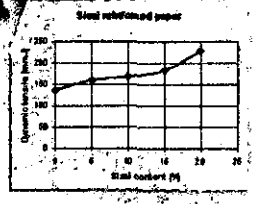
- Identify opportunity/market
- Identify entrepreneur / be approached by entrepreneur
- Evaluate technology, potential advantages, decide go / no go

Objective

- Stability of process chain
- Higher demand for sisal, sustainability
- Better utilisation of capital equipment

CSIR

2001 – Paper & chipboard



Tower Technologies

- Chip board replacement
- Lighter, stronger board possible

University of Stellenbosch

- Sisal reinforced paper
- Significant improvement in properties

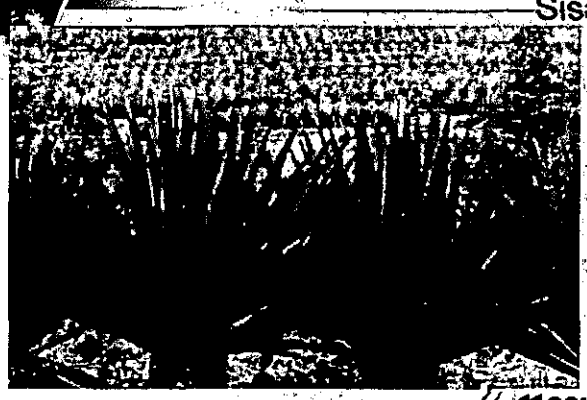
CSIR

OTHER PRODUCTS

- Handmade paper
- Slippers
- Sisal re-inforced crash helmet
- Table mats
- Geotextiles
- etc

CSIR

Madikwe Sisal



Overview

- A feasibility study on production of Sisal in the North West Province indicated that small scale Sisal production could be a viable business and has considerable potential for job creation.
- The recommendation was to establish a Sisal production and processing complex at the Madikwe farm.
- Revitalising sisal production was launched in Madikwe in 2002

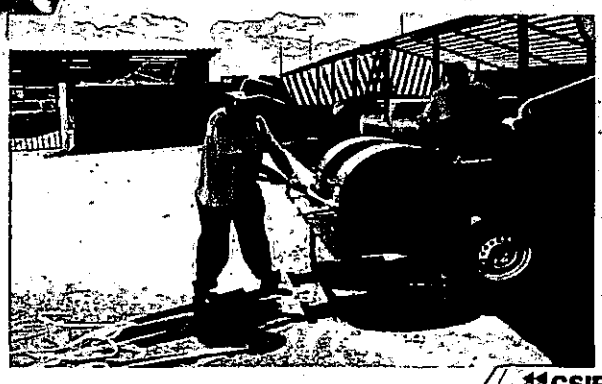
Progress to date

- New bulbil sisal nursery has been established.
- Diesel engine, water pump and pump unit as well as irrigation pipes were purchased using Poverty Eradication Funds (DST)
- People trained in all aspect of sisal production
- Sisal fibres tested by NFTCC

Cont'd

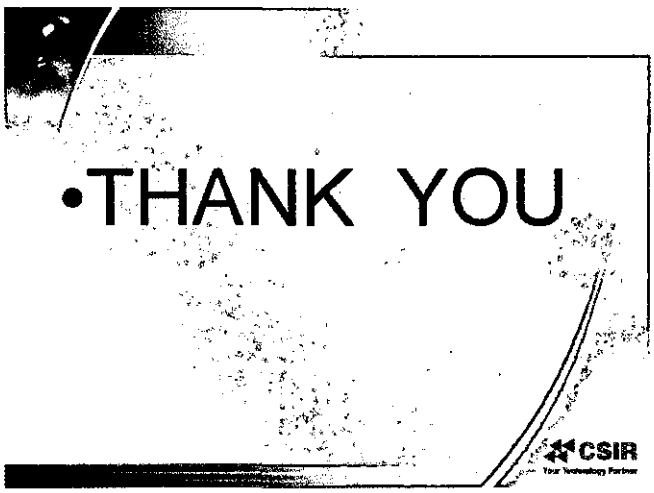
- Sisal based nonwoven and paper samples developed
- Needle punching line installed at Madikwe
- Handmade paper unit set up at Madikwe (DST)
- Warehouse renovations started (DST)
- Sisal Decorticator and paper handpress transferred to Madikwe (DST funded)

Double door sisal decorticator



Pending Activities

- Assist in all aspects of est. a new sisal plantation
- Build infrastructure for sisal production, processing and manufacturing SMEs
- Commission needle punching line & train people in nonwoven production
- Produce sisal based textiles and paper products


•THANK YOU
CSIR

Presentation by Ms. C. Valdés Torres, Cuba

"Development of Henequen Crop in Cuba"

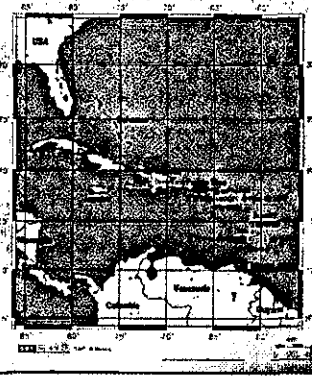
DEVELOPMENT OF HENEQUEN CROP IN CUBA.

CARIDAD VALDES TORRES

INTRODUCTION

GEOGRAPHICAL SITUATION

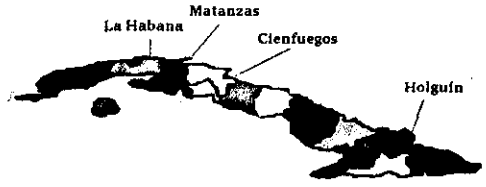
Geographic Situation: 19° and 23°
Surface: 110 922 km²
Agriculture area: 6.7 millions of ha
Population: 11 millions of habitants
Climate: Subtropical
Rainfall: 1 375 mm annuals with two seasons
Rain: From May to October
Dry: From November to April
Average temperature: 24°C
Atmospheric humidity: 60 to 80%



HENEQUEN

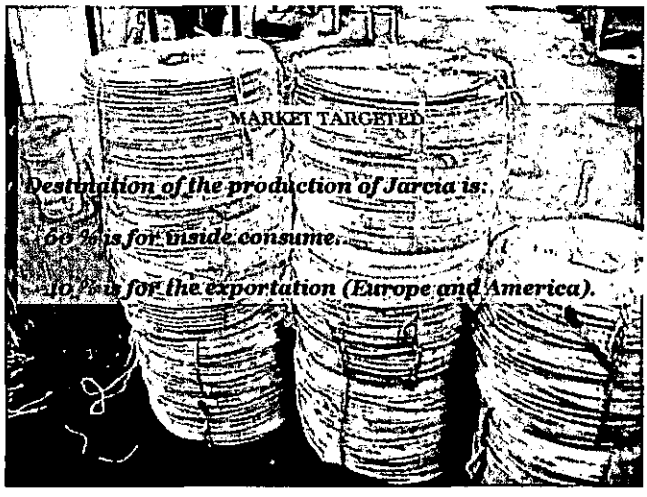
Among the crops of economic importance for Cuba, we have the textile fibers, and specially the henequen due do it technical-economic advantage and the benefits of this crop.

Henequen was introduced in Cuba in the second half of the XIX Century. Beginning in great scale plantations in Matanzas Province. After was established in Cienfuegos and Havana Provinces and later in Holguín Province. Around 4000 ha are dedicated to this crop of them 1000 ha for young plantation and the rest for production purposes.



MAIN CHARACTERISTICS OF HENEQUEN PRODUCTION

- *It develops well in land plane with superficial lime stones and pH from neutral to slightly alkaline.*
- *Seedlings of rhizoma or bulbils from nursery are used to established the permanent plantations.*
- *It can be planted anytime of the year, but it is preferable to do it during the rainy season to take advantage of soil humidity.*
- *Plantation design is of 3 x 1 m (about 3333 plants/ha).*
- *Weed control is by mechanical equipment activity and cattle can be used perfectly well to achieve this.*
- *The harvest is begun from 4 to 5 years after the plantation and the cut of leaves is doing each 9-10 months and left 14-20 leaves.*
- *Production crop is around 2000 ton of dry fibre.*



MARKET TARGETED

Destination of the production of Jarcia is:

60 % is for inside consume.

40 % is for the exportation (Europe and America).

RESEARCHES

- *Feasibility of employing bulbils as propagation form.*
- *Determination of seedlings size, plantation distance and weed control in nursery stage.*
- *Study of different cutting cycles.*
- *Determination of NPK levels in nursery stage.*
- *Determination of NPK Ca levels in production stage.*
- *Study of the subproducts of henequen as; Liquid detergent, pulp of animal food and others.*
- *Use of the biotechnology to develop of the henequen crop.*

PROJECTION

PRODUCTION

Enlarge areas for henequen to east part of Cuba by the characteristics of theirs soils and because is possible to increase new employs in those region.

RESEARCH

- *Validation of research results in fibers production areas.*
- *Get new clones that allow increase fiber yields.*
- *Improving the technology of henequen crop related with the use of pulp as manure in nursery, cutting cycle.*
- *Diseases studies*
- *Continue studying the subproducts of henequen crop.*
- *Increase and conservation of germplasm bank.*

The research studies are realized basically in the Horticultural Research Institute "Liliana Dimitrova" belongs to Ministry of Agriculture of Cuba. Other organizations research in alliances with:

- *The Ministry of Agriculture, among them are:*
- *University of Matanzas and Polytechnic Superior Institute "José Antonio Echevarria" belong to The Ministry of Superior Education.*
- *Laboratory Medicament "Mario Munoz" belongs to the Ministry of Health.*
- *Textile Research Center belongs to the Ministry of Light Industry.*
- *Henequen enter prises*

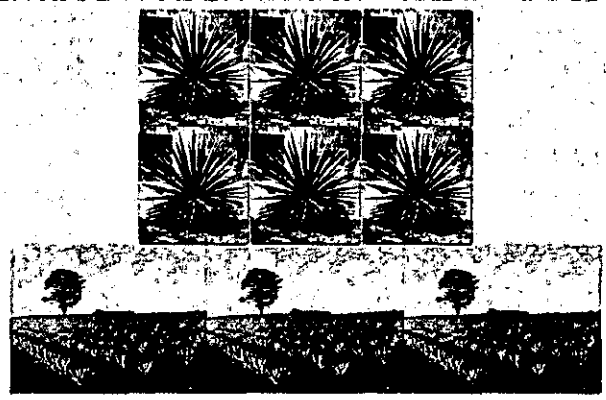
Cuba is opened to any collaboration and interchange of experience related to get henequen fibers and subproducts.

THANK YOU VERY MUCH

Presentation by Ms. M. Sanchez Osuna, UNIDO Project Manager, on 19 November 2004

"Achievements and the Way Forward"

SISAL GLOBAL PROGRAMME



ACHIEVEMENTS FIRST PHASE...

IMPROVED AGRONOMIC PRACTICES

TOWARDS THE COMPETITIVENESS OF THE SISAL FIBER IN THE PULP AND PAPER INDUSTRY

-Project teams in both countries cooperated in enhanced production systems towards increasing fiber yield per ha.
-Project teams established and operated the MTC laboratories
-MTC staff trained
-MTC babies to the field
-Fertilizers trials performed
-Alternative harvesting trials undertaken
-Smallholders farming systems

...ACHIEVEMENTS FIRST PHASE...

IMPROVED INDUSTRIAL PRACTICES

TOWARDS THE COMPETITIVENESS OF THE SISAL COMMODITY

--ANIMAL FOOD
--BIOGAS & ELECTRICITY

...ACHIEVEMENTS FIRST PHASE

IMPROVED INDUSTRIAL PRACTICES

TOWARDS THE COMPETITIVENESS OF THE SISAL FIBER IN THE PULP AND PAPER INDUSTRY

DEVELOPED AND TESTED TECHNOLOGIES TO OPTIMIZE FIBER EXTRACTION METHODS

-Encouraging results from leaves fiber
-Trials from bole fiber to be continued

FEASIBILITY STUDY... ON GOING

FOLLOW UP SUGGESTED ACTIONS

- **Continue the agronomic trials to determine the optimal parameters and economic feasibility**
- *Optimization of the selected fiber extraction technology for pulping purposes*
- *Continue R & D activities for commercial valorization of sisal wastes*
- *Establish the market outlets for the new products and develop strategies for penetrating such markets*
- *Disseminate the technology and market information from the project widely and promote commercial adoption of the new technologies*

SECOND PHASE

ALTERNATIVE SOURCES OF ENERGY

BIOGAS FOLLOW UP

- **--DEMONSTRATE THE VIABILITY OF THE PROCESS**
- **--DISSEMINATE THE EXPERIENCES**
- **--STUDIES FOR REPLICATION**

THIRD PHASE....

"NEW INITIATIVES"

- **--DEMONSTRATION, ASSIMILATION, ADDAPTATION OF TECHNOLOGIES (both soft and hard) FOR INTEGRATED UTILIZATION OF SISAL**
- **BOLE**
- **--fiber, inulin, solvents (alcohol), electricity cogeneration, special food additives, etc.**
- **LEAVES**
- **--Chemicals for the pharmaceutical and other industries, waxes, surfactants etc.**

Feasibility studies on the above

...THIRD PHASE

....."NEW INITIATIVES"

- **--Disseminate project experiences**
- **--Partnership establishment.**
- **--Continue the capacity building programmes**

ESTIMATED LOGISTICS AND FINANCIAL REQUIREMENTS THIRD PHASE

III-P- Programme formulation and negotiation:	*2005*
Plannod Duration:	*5 years*
Participating Countries:	*Global*
Aim at Dissemination Experiences:	*Global*

PROGRAMME PARTNERS

AT COUNTRY LEVEL

Farmers and industrialists
Manufacturing and commercial institutions
Public and private partners
Academia: R & D institutions, Universities
Consulting and engineering companies
Others

PROGRAMME PARTNERS

AT COUNTRY LEVEL

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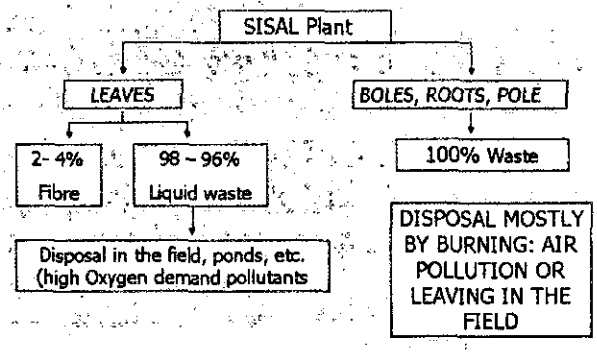
Others

TODAYS SISAL PROCESSING CHART

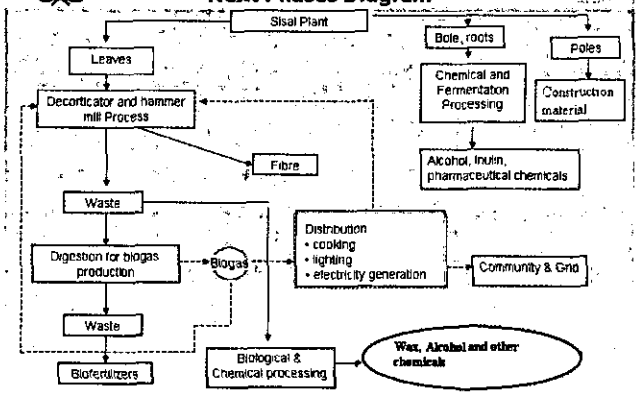


PROGRAMME PARTNERS

AT INTERNATIONAL LEVEL

NORTH – SOUTH cooperation
SOUTH-SOUT cooperation
MULTILATERAL DEVELOPMENT AND FINANCING ORGANIZATIONS
Manufacturing and commercial institutions
Public and private partners
Academia: R & D institutions, Universities
Consulting and engineering companies
Others

Next Phases Diagram



PRODUCT AND MARKET DEVELOPMENT OF SISAL AND HENEQUEN PRODUCTS

THANK YOU
&
SEE YOU ALL IN THE NEXT WORKSHOP!!!!

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