World Agroforestry Centre

TRANSFORMING LIVES AND LANDSCAPES

Overview, highlights and way forward for ICRAF in Southern Africa

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ABOUT THE WORLD AGROFORESTRY CENTRE

THE WORLD Agroforestry Centre/International Centre for Research in Agroforestry (ICRAF) is an international and inter-governmental organisation established in 1978 to promote agroforestry research in developing countries. ICRAF was created in response to a visionary study led by John Bene of Canada's International Development Research Centre (IDRC). The study coined the term "agroforestry" and called for recognition of the key role trees play on farms. During the 1980s, ICRAF operated as an information council focused on Africa. It joined the Consultative Group on International Agricultural Research (CGIAR) in 1992 to conduct strategic research on agroforestry at a global scale, changing its name from Council to Centre.

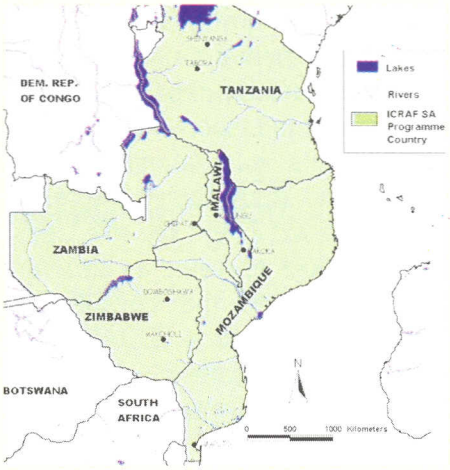
ICRAF is now recognised as the international leader in agroforestry research and development. The expanded scale of operation has necessitated adopting the name **World Agroforestry Centre,** the organisation's new brand name.

ICRAF'S PROGRAMME IN SOUTHERN AFRICA

- Activities begun in 1985 with diagnosis of the problems affecting agricultural production and the environment.
- ICRAF-SA has sites in 5 countries: Tanzania, Zambia, Malawi and Zimbabwe; expansion into Mozambique started in 2001.
- Regional Office is in Harare, Zimbabwe (since 1999).
- Common characteristics: Miombo ecozone; Part of the Zambezi river basin; Unimodal rainfall; maize and livestock are main land use systems.

ICRAF-SA PROGRAMME COUNTRIES

ICRAF-SA is focusing on selected sites in 5 countries of Southern africa (Malawi, Mozambique, Tanzania, Zambia and Zimbabwe). The sites were chosen using geometrics technology and other expertise.



PROBLEMS IN THE REGION

The problems affecting Southern Africa are in two Broad categories: Biophysical and Development.

■ Biophysical problems

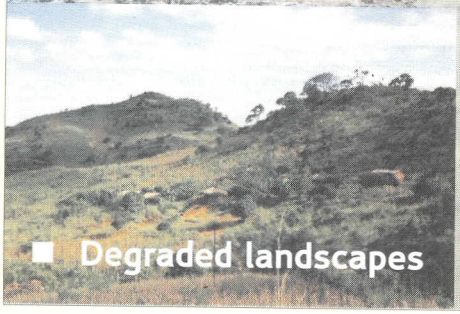
- Unimodal rainfall (long dry season 7-8 mths)
- Erratic rainfall and frequent droughts
- Declining soil nutrient capital
- Clearance of Miombo woodlands, loss of biodiversity

Socio-economic

- Widespread poverty
- High population growth (>2.5%); 70% rural
- Food insecurity (low agricultural productivity)
- Degradation of natural resources
- Illiteracy
- Disease (AIDS)
- Structural Adjustment Programmes (SAP)

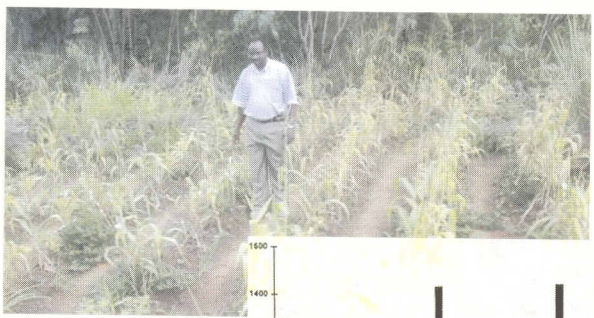
Land use problems

Clearance of the Miombo



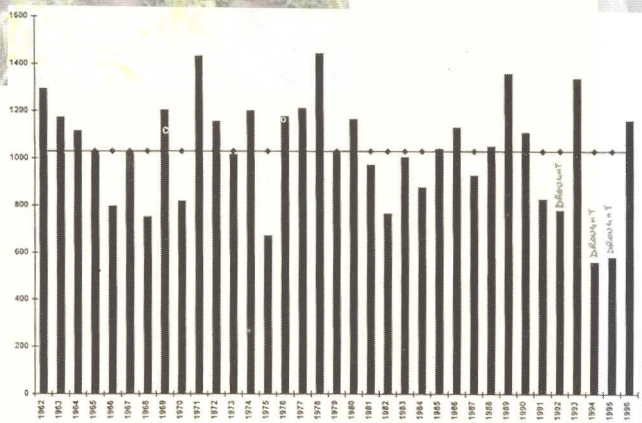
Degraded landscapes

High population density, intensive use of the land; continuous nutrient mining



Declining soil nutrient capital

Highly variable rainfall and frequent droughts



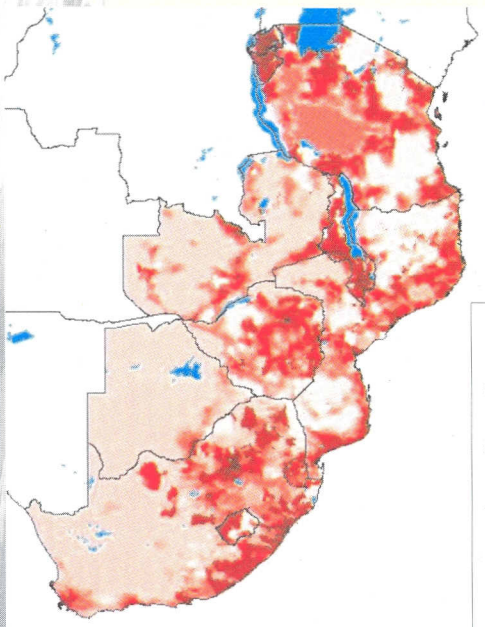
Annual rainfall recorded at Msekera from 1962 to 1996. The dotted line is the long term annual average rainfall.

Development problems

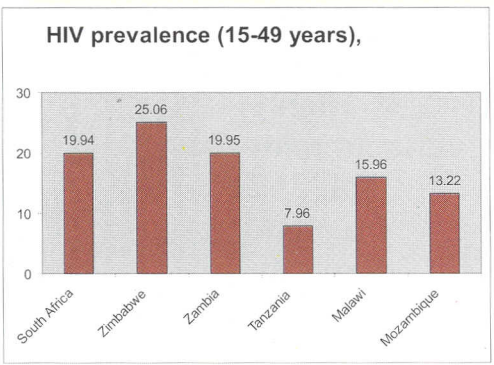
■ Underdevelopment

Development Indicator	Country					
	South Africa	Zimbabwe	Zambia	Tanzania	Malawi	Mozambique
Estimated population (millions) 1997	38.8	11.2	8.6	31.4	10.1	18.4
Estimated population (millions) 2015	43.4	13.6	12.8	47.2	15.8	25.2
Population density (per 1000 Ha, in 1996)	347	296	111	349	1046	227
Urban population as %age of total (1995)	49	32	43	24	13	34
Life Expectancy at Birth (years), 1997	54.7	44.1	40.1	47.9	39.6	45.2
Adult literacy % 1997	81.8	85.1	78.2	67.8	56.4	40.1
HIV prevalence (15-49 years), 1999	19.94	25.06	19.95	7.96	15.96	13.22
Food aid (1000 MT cereals) 1994/5	...	4	11	118	204	320
% labour force in Agriculture (1990)	14	68	75	84	87	83
Fertilizer use (1000 MT) 1994	832	171	59	40	36	7
Agriculture as % of GDP (1997)	5	19	16	47	36	31
Annual deforestation rate % (1990-95)	0.2	0.6	0.8	1	1.6	0.7
GNP per capita USD (1997)	3,210	720	370	210	210	140
External debt as % of GNP (1997)	20	58.5	184.6	97.2	89	232.9
% population below USD 1 a day (1989-94)	23.7	41	84.6	16.4	42.1	...
Traditional fuel as % of total consumption (1995)	4	37	73	91	90	91

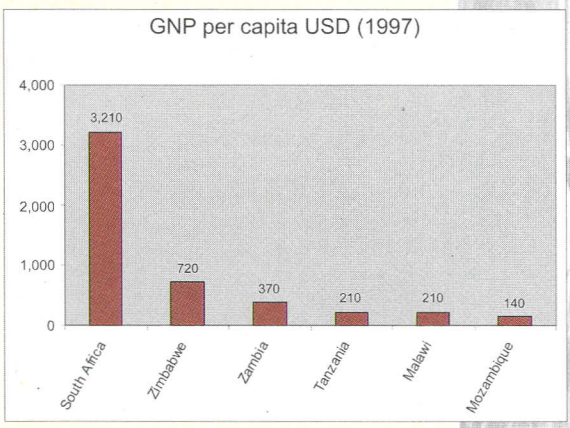
Sources: UNDP Human Development Report 1999, UNDP SADC Regional Human Development Report 1998, UNAIDS Regional HIV/AIDS statistics

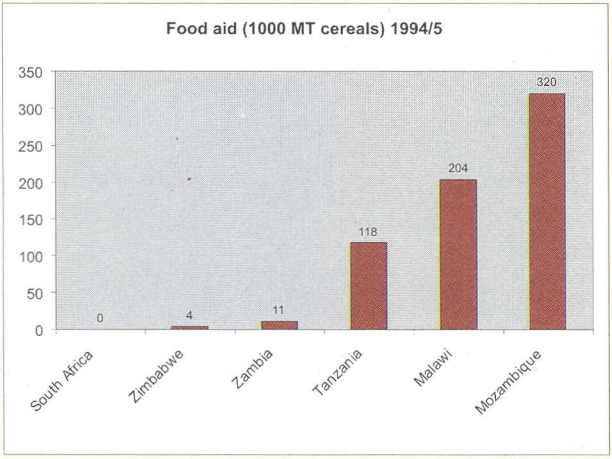


- High population density especially in Malawi
- High HIV prevalence cuts across the region



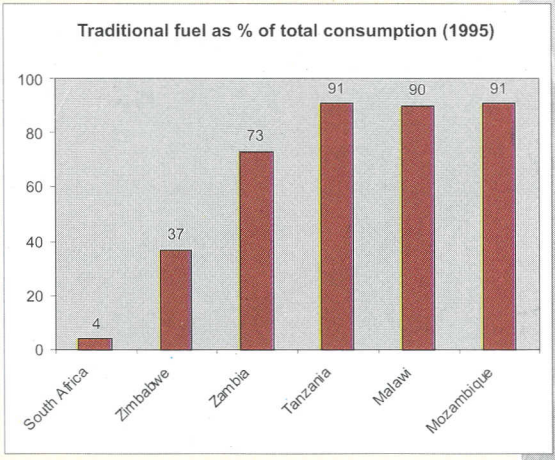
- **Severe poverty**



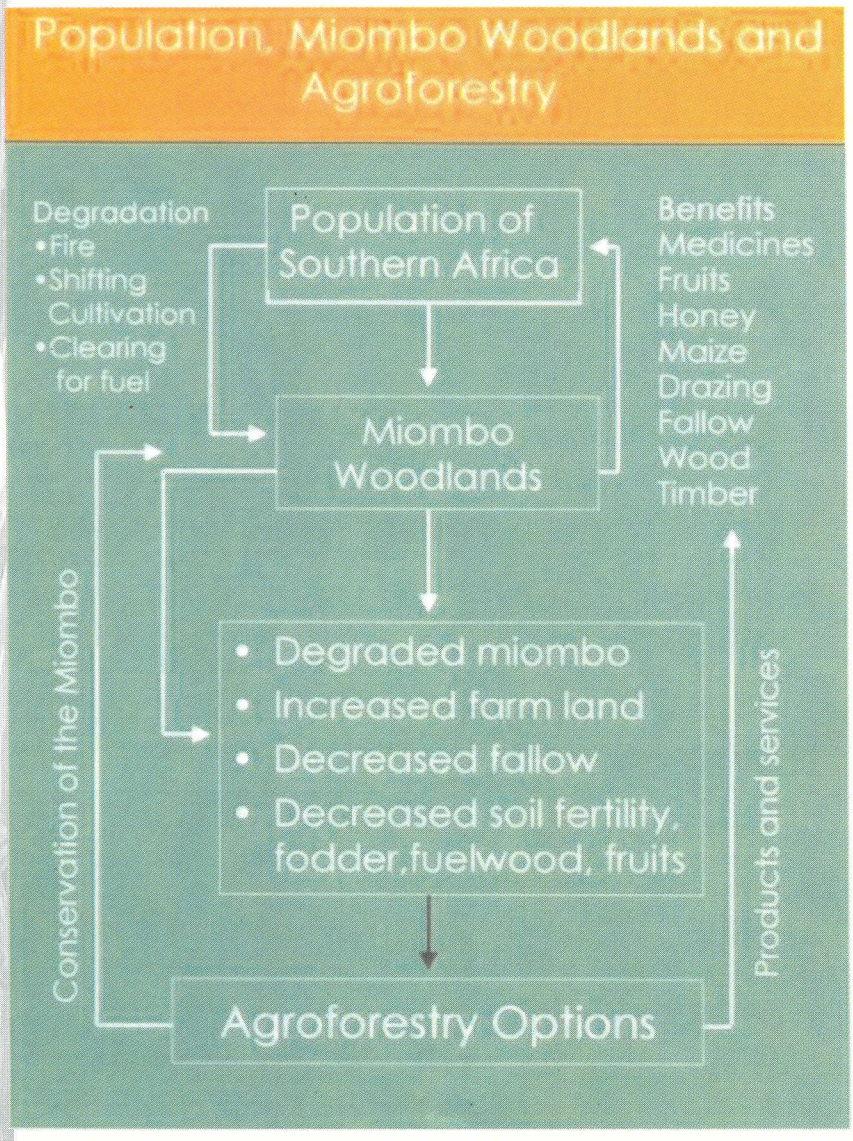


- **Lack of food self-sufficiency**

- **Over-reliance on traditional fuel sources, notably wood**



AGROFORESTRY OFFERS PRODUCTS AND SERVICES TO THE MIOMBO AND ITS INHABITANTS



VISION FOR THE SOUTHERN AFRICA PROGRAMME

To enable adoption of AF innovations by 0.4 million farm families in the region by 2006 and 2 million by 2010

How we expect to achieve this vision

ICRAF-SA will deliver:

Knowledge and techniques for improving soil quality, and producing fodder, wood and indigenous fruits

→ to

14 million small scale farmers in Southern Africa, specifically 0.4m farm families (FF) by 2006 and 2m FF by 2010

Outcome

Improved food production, income and better environment from adopting integrated innovations, including AF

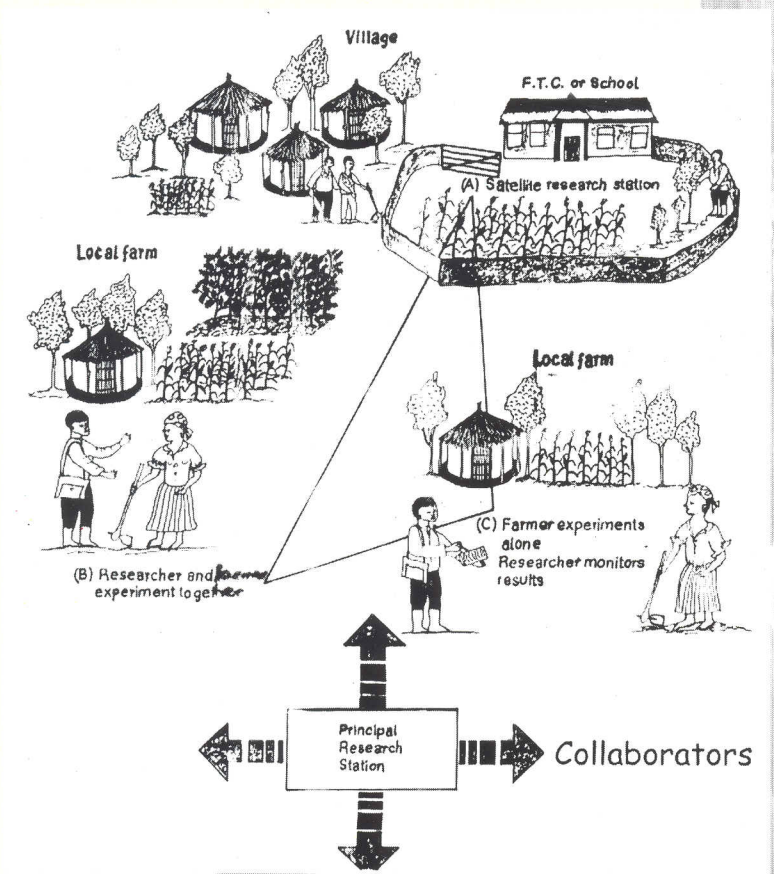
MISSION OF THE SOUTHERN AFRICA PROGRAMME

1. To increase adoption of diverse agroforestry innovations by small scale farmers.
2. To create functional and sustainable networks.
3. To improve the policy framework.
4. To improve farmer experimentation and participation in agroforestry development.
5. To create sustainable seed and germplasm production and delivery systems for agroforestry.
6. To improve the marketing of agroforestry products and services.

Defining elements of the regional strategy

1. **Strong technical focus:** high quality science is the basis for developing and delivering agroforestry options.
2. **Participatory approach:** Participation of farmers in all stages of the research-development continuum is being promoted.
3. **Wider ecological scope:** The focus is extended from the Miombo woodlands to other important ecosystems in the region (e.g. Acacia woodlands & Lake Victoria basin).
4. **Strong partnerships:** Collaborative alliances with partners to maximize effectiveness, efficiency and long-term sustainability.
5. **Capacity building and institutional strengthening:** Through development facilitators and by complementing ANAFE and national and bilateral efforts.
6. **Raising the profile of agroforestry** through campaigns to enhance public awareness and initiate dialogue with policy-makers.

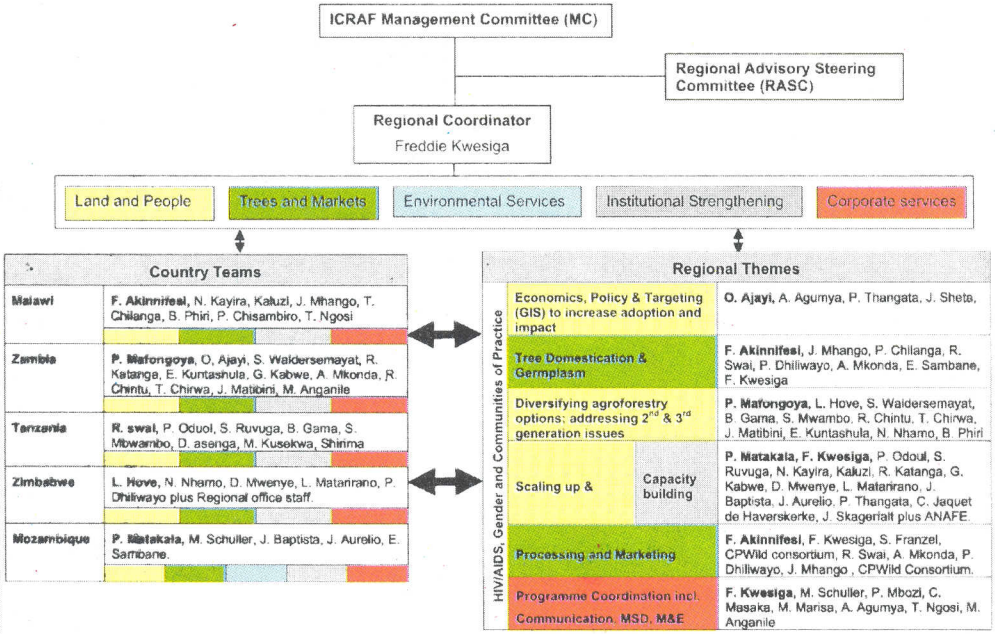
Participatory approach to research and development



Partnerships

- National Agricultural Research Stations (various kinds)
- Advanced Research Institutions
- International Centres
- Development Organizations
- Global Conventions (CBD, UNFCCC, etc)
- Universities in the "South"
- NGOs, CBOs, farmer organizations
- Private sector (including farmers)

The Organisation structure of ICRAF in Southern Africa



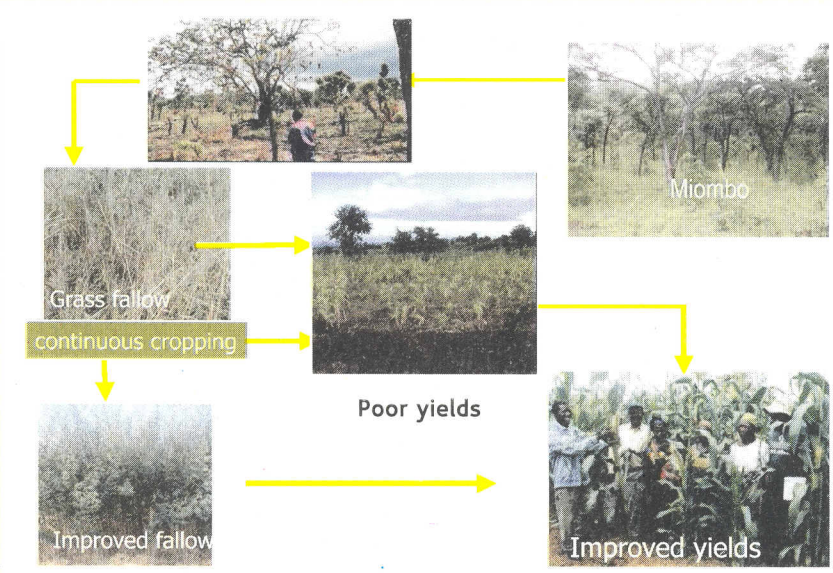
ACHIEVEMENTS IN THE LAST 5-10 YEARS - RESEARCH

A. AF is a priority on research agendas of all countries.

B. A range of AF options developed, tested and adopted:

1. Soil fertility improvement
   - Improved fallows
   - Relay cropping
   - Mixed cropping
   - Biomass transfer
2. Fodder banks and feeding management
3. Rotational Woodlots
4. Indigenous fruit trees
   - Domestication
   - Processing, marketing and policy

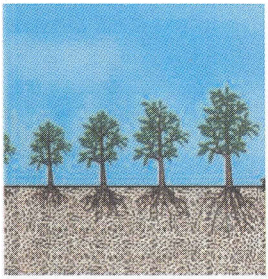
■ Improved fallows



Cycle: From indigenous to improved fallows.

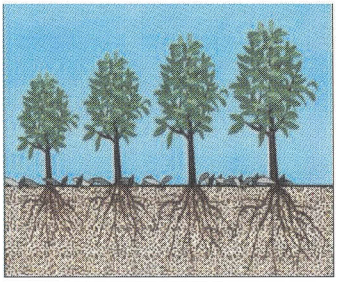
Improved fallows phases: research findings

Fallow establishment



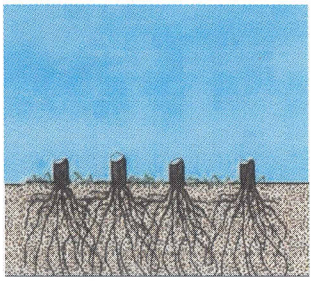
- Nursery raised bare rooted seedlings are cheaper yet as effective as potted ones.
- 2 weedings in establishment year + fire protection.
- 2 year fallow is most profitable.

Growth phase



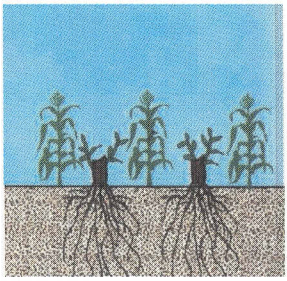
- Weed changes (grass to herbaceous plants).
- Increase in (nitrogen) N and SOM under Sesbania (25t/ha litter in 3 yrs).
- 90% roots in top 50cm reach 7.5m.
- Mesoplatys and nematode problems.

Clearance phase



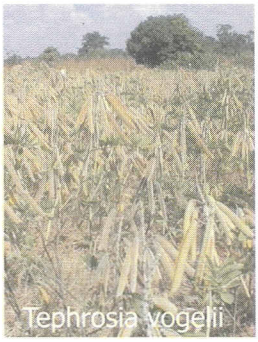
- Very high N in the soil.
- Reduced bulk density.
- Poor germination, zero tillage.

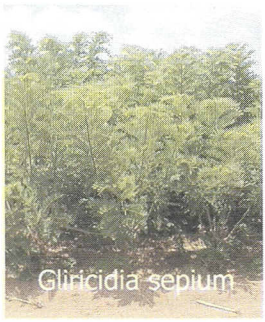
Cropping phase



- Cereal and legume recommended to prolong effect.
- Increased maize/sorghum yields.
- 1 - 5 years depending on fallow period.

Screening of species





Species/provenance screening

- Sesbania sesban
- Sesbania macrantha
- Tephrosia vogelii
- Cajanus cajan
- Senna siamea
- Gliricidia sepium
- Lucaenas

Understood effect of S.sesban on:

- Soil nutrients
- Maize yields
- Wood production
- Soil physical properties
- Water relations
- Pests

Conducted/developed:

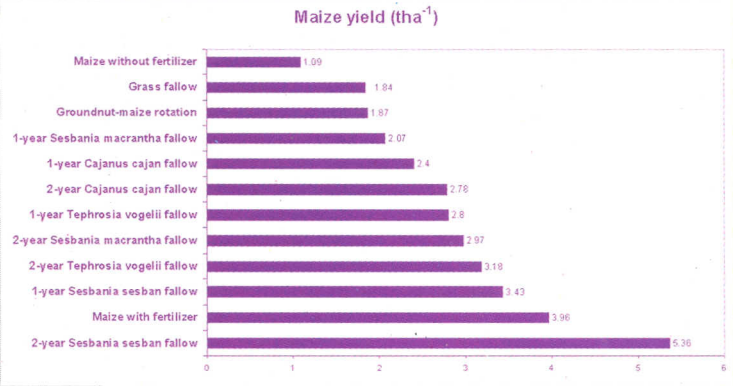
- Economic analyses
- Biophysical limits trial
- Seed supply strategies

Nutrient cycling

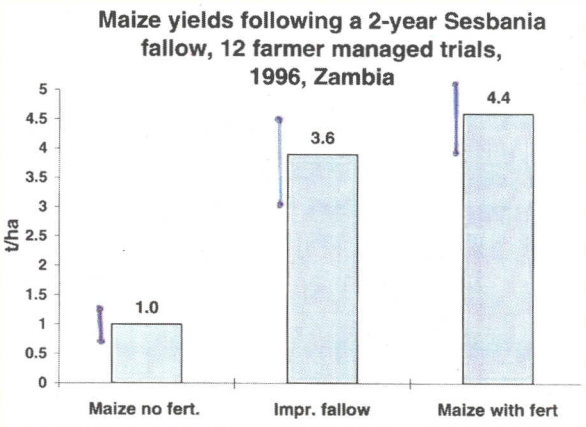
The potential of several AF options to improve N content for subsequent crop growth have been compared.

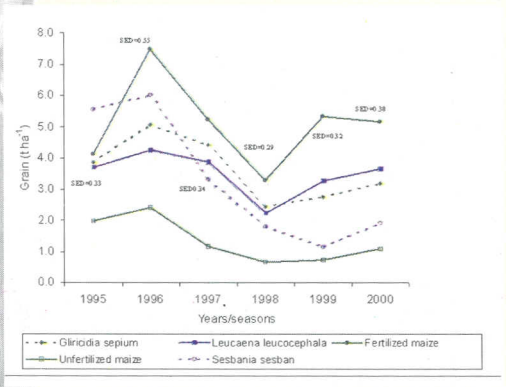
Option	Inorganic N (mg kg^{-1})		Aerobic N mineralization (mg kg^{-1} day^{-1})		N in light fraction SOM (mg kg^{-1} soil)	
	End of fallow	After 1 year	End of fallow	After 1 year	End of fallow	After 1 year
Sesbania sesban, 3-year fallow	23	22	0.51	0.82	28	89
Gliricidia sepium, 3-year fallow	18	16	0.30	0.54	20	77
Groundnut-maize-soybean rotation	18	10	0.22	0.32	20	34
Natural grass fallow, 3 years	11	12	0.44	0.50	20	43
Continuous maize, unfertilized	14	12	0.24	0.33	19	37

Maize yields from different production options



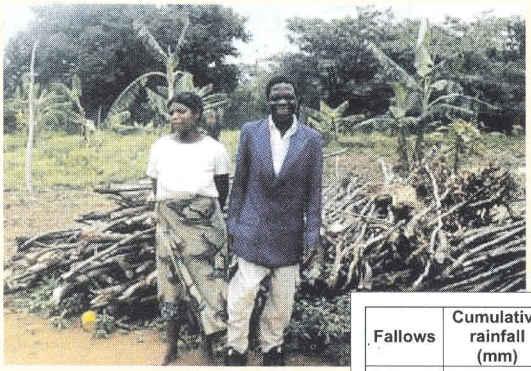
Maize yields: Sesbania improved fallows





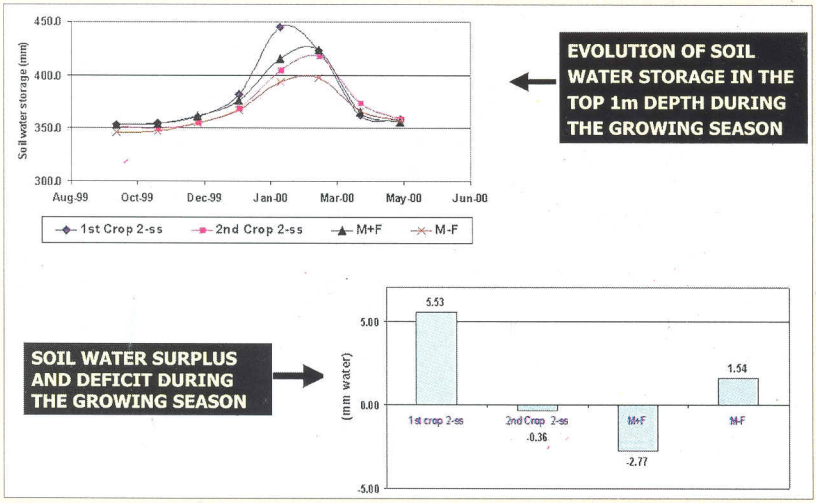
Maize grain yield after 3 year fallows for six seasons (1995-00)

Production of wood on farm



Fallows	Cumulative rainfall (mm)	Survival (%)	Height (m)	Root collar diameter (mm)	Stem wood biomass (t ha^{-1})
1-year fallows					
1992	826	95	2.6	21.5	3.2
1993	1337	100	4.3	33.6	10.1
1994	559	95	2.6	23.2	2.1
2-year fallows					
1992	1605	65	4.8	44.0	13.0
1993	2163	74	4.3	41.1	15.1
1994	1896	43	4.6	43.9	8.9

Water usage under improved fallows



Pests and diseases of *S. sesban* and *T. vogelii*

Surveys of insects damaging *Sesbania sesban* were conducted in Zambia and Malawi.

The major seedling pests were *Mesoplatys ochroptera, Exosoma* sp. and *Ootheca benningseni.*

Recommendations for management of *M. ochroptera* were developed.

In the Nursery:

- Plant early.
- Inspect and destroy egg masses.

In the field:

- Plant early.
- Transplant healthy seedlings.
- Clear older fallows before rains.
- Weed promptly.
- Fire-breaks around fallows.
- Plant resistant provenances.
- Use natural enemies.

Economic analysis of improved fallows

AF option	Management	Site	Net present value (US$ ha^{-1}) Time period (years)	Unfertilized continuous maize	Fertilized continuous maize	AF option
Improved fallow	1 year fallow 2 year fallow 3 year fallow	Chipata Zambia	6 6 6	307	1303	557 600 325
Relay cropping	7400 trees ha^{-1} 14800 trees ha^{-1}	Zomba Malawi	5 5	48	714	110 82
Biomass transfer	5 t ha^{-1} fresh b.mass 20t ha^{-1} fresh b.mass 5t ha^{-1} fresh biomass +half fertilizer rate	Chipata Zambia	6 6	237	398	177 -2 322
H.row i.cropping	Not fertilized	Chalimbana Zambia	7	447	1427	241

Boundary conditions for *Sesbania* sesban improved fallows

Where they work

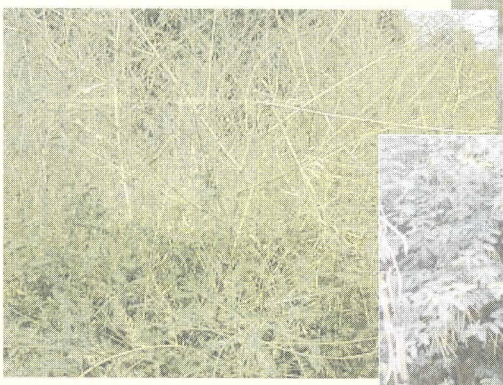
- N-deficient soils
- Land relatively abundant
- Maize/cotton/sorghum
- Striga areas
- Deep soils, pH > 4.5
- Rainfall > 600 mm/year
- Soils with at least 20% clay
- Socio-economics/farmer priorities*

Where they won't work

- Shallow soils
- Low P soils
- Frost
- Very sandy soils
- Nematode infested areas
- Very low rainfall
- Small land holdings < 3 ha
- Poor labour supply

Where/when *S.sesban* thrives/does not thrive

- Performance of *S. sesban* is poor in very sandy soils.
- *S.sesban* trees are vulnerable to browsing.



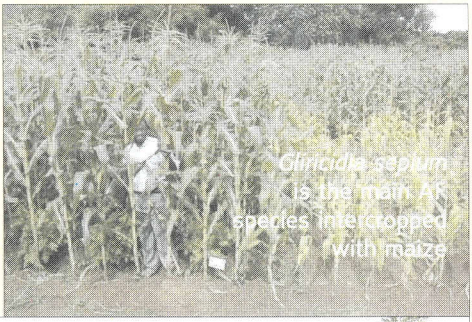
Vigorous growth during rainy season.

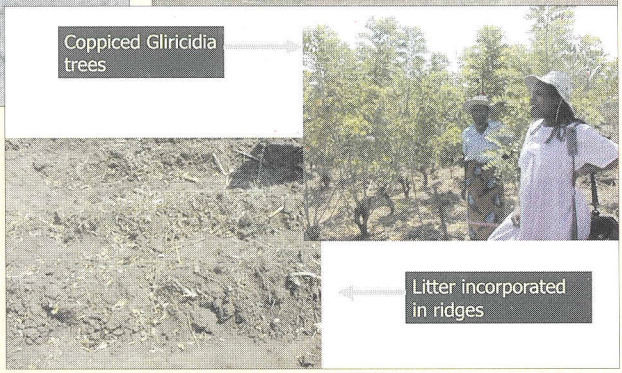
Seed supply strategies

- Initial strategy is to contract seed production to farmers and research institutions.
- Goal is for farmers to produce own seed and community nurseries.
- Need to breed mesoplatys resistant Sesbania seed.
- Collaboration with Seeds for Survival and DANIDA.
- Inadequate supply of seed remains a major constraint.

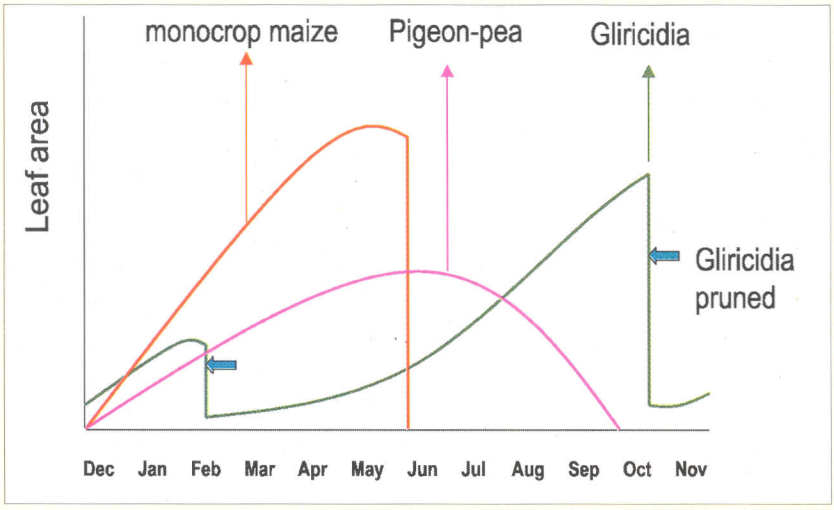
Mixed cropping

Introduced in densely populated areas where sizes of land holdings preclude fallows.

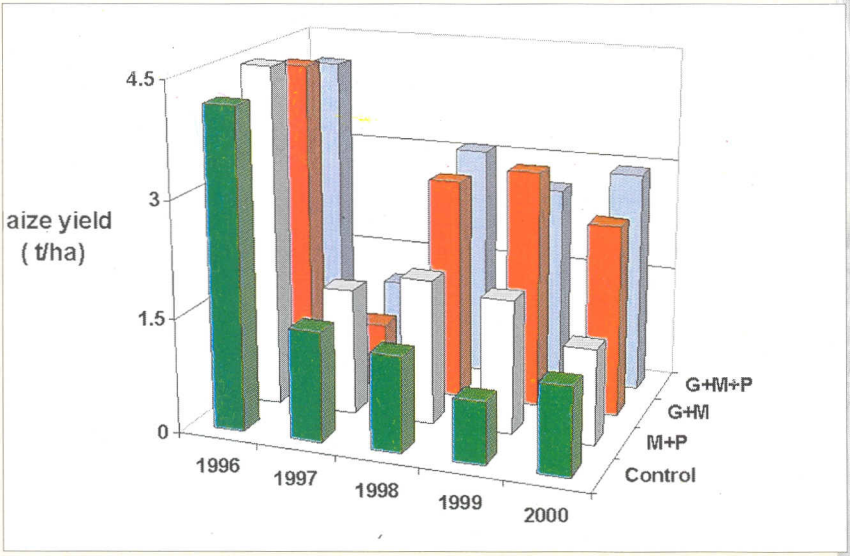




Management regimes: temporal complimentarity



Maize yield for 5 consecutive seasons with Gliricidia/ maize systems, Makoka, Malawi



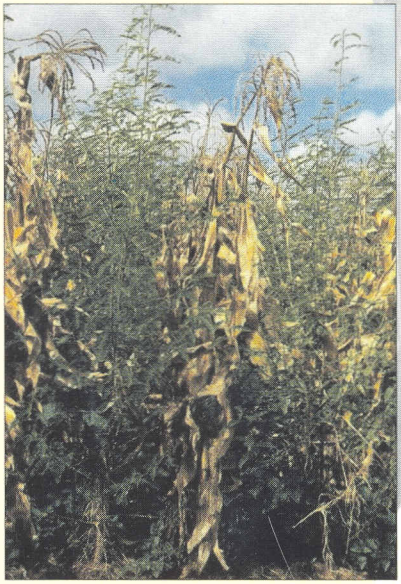
Below-ground (root) studies

In addition to above-ground studies, below-ground studies are important in understanding how the system works.

Comparison of soil water content under Gliricidia/ maize and sole maize during rainy season, 1999-00, Makoka, Malawi

The Gliricidia treatment stores more water than sole maize; i.e. it increases water infiltration even in a drought season.

Relay cropping



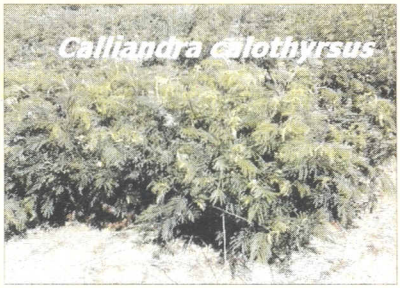
- Introduced in densely populated areas where plot sizes preclude fallowing.
- Multi purpose trees (MPT) used: *S. sesban, Cajanus cajan .*
- Maintains number of recommended maize plants per ha.
- Doubled maize yield in 2nd year (cf. unfertilized plot).
- Produces 1.7t/ha/yr of fuel wood.

Biomass transfer

- Species screening
  - *G. sepium, L. leucocephala, Sesbanias.*
  - Production 5-8 tonnes of leaf biomass/ha.
- High quality mulches have enabled farmers to shift/expand from maize to vegetable growing and increase rice yields in dambos.
- Dambos are prevalent in the region (1.2m ha in Zimbabwe).
- Opportunity for introducing live fences to protect the gardens.
- On-going research with peri-urban farmers around Chipata, Zambia, and Harare, Zimbabwe.

Fodder

- Several species and provenances screened:
  - *Acacia angustisima, L. leucocephala, pallida, Calliandra calothyrsus.*

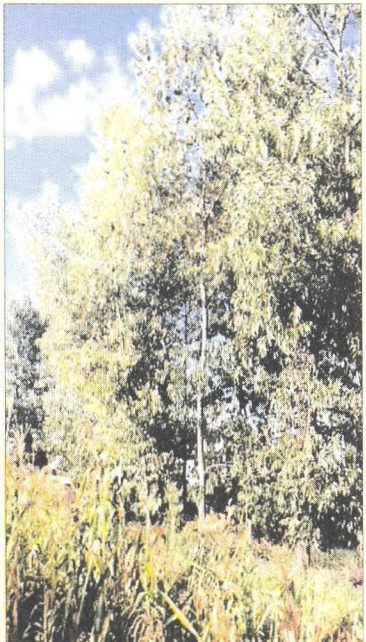


"These trees have sewn our pockets"
Zimbabwean farmer (1999)

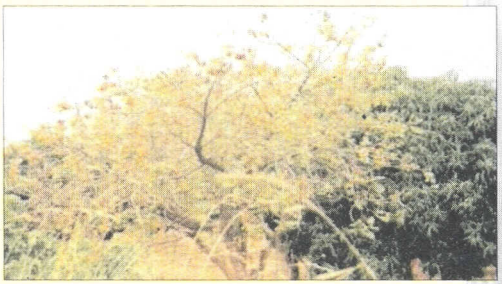
- Performance of promising ones evaluated.
- Feed rations of MPTs and other supplements evaluated (Ph.D study completed).
- Economic analysis underway.

Woodlots

- Screened species
  - *Acacias: crassicarpa, leptocarpa, polyacantha, julifera.*
- Tested them on-farm (60 farmers).
- Wood production of *A. crassicarpa*: 80-110 t/ha in 5 years.
- Economic analysis: Returns to land 6 X cf. continuous maize cropping.
- Adoption by tobacco farmers can save 8,675 ha of Miombo woodland/year in Tabora district.
- Greener landscape in Shinyanga.



Domestication and commercialization of indigenous fruit trees (IFTs)



"Hoya Villagers on the verge of starvation"

"More than 300 villagers in Hoya's Chief Kaitano area in low-lying Zambezi valley, where rainfall is unreliable, have run out of food and are now relying on wild fruits" __ *(The Herald, December 28, 1998)*

Achievements (domestication of IFTs)

- Ethnobotanical surveys:
  - What uses the farmers make of IFTs.
  - Problems in domestication faced by farmers.
  - Domestication strategy.
- Selection of preferred (priority) species.
- Funding from BMZ for domestication work.
- Greater understanding of propagation of priority species: *U. Kirkiana, S. Birrea.*
- Policy and marketing constraints of IFs.

The 6 species selected for domestication

Regional

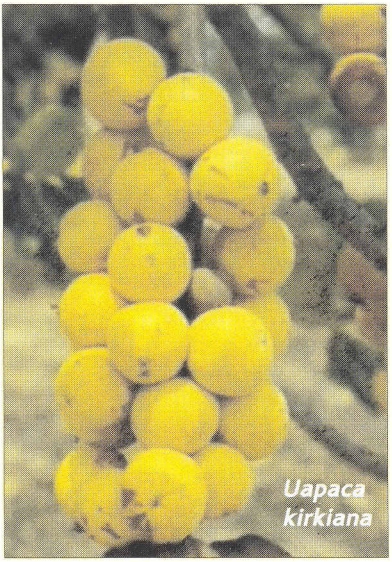
- *U. kirkiana*
- *P. curatellifolia*
- *S. cocculoides*
- *Sclerocarya birrea*

Tanzania

- *V. mombassae*

Zambia

- *A. boehmii*



Farmer identified traits for improvement

Tree Trait	% Count
Precocity	77
Tree size	20
Yield	2

Fruit trait	% Count
Fruit size	66
Taste	39
Pest	6

- ❖ All regional priority trees have a long juvenile phase (> 6 years).
- ❖ In Botswana, fruiting precocity of *S. birrea* has been reduced from 4-5 years to 1 year.

Domestication of IFTs: Germplasm

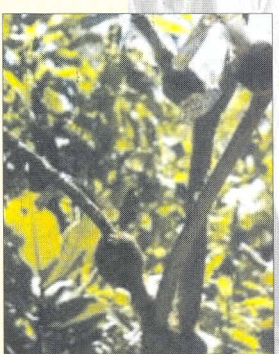
- Collected wide range of provenances from 5 SADC countries.
- Provenances being tested in 4 countries for growth outside the forest.

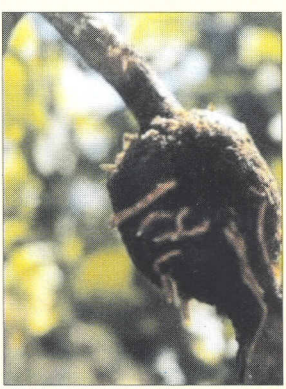
- Out of the 50 IFs in Miombo, farmers priorities have been synthesized.
- Next step is to establish what the market needs.

Propagation studies

Morphological and reproductive studies: sex ratio of *U.kirkiana.*

Tree Sex ♀	Mean no. of trees	Mean no. of stems	% sex composition	Mean tree diameter (cm)	Mean tree height (m)
Juvenile	127.5	179	60	03.6	1.4
Female	43.5	55	20	12.7	4.7
Male	42.0	59	20	12.8	4.5





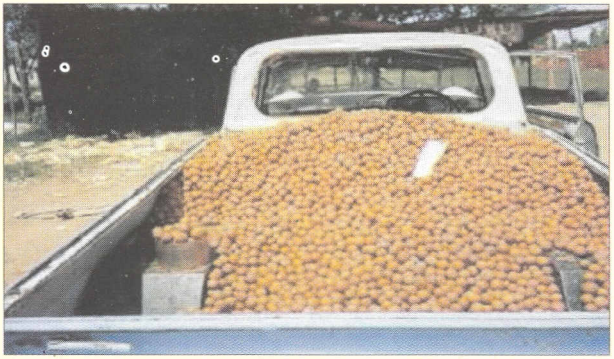
Vegetative methods *(Uapaca):*

- Root cuttings in soil beds under 50% shade.
- Root cuttings under glass house conditions.
- Air layering.
- Mound layering.

Vegetative Methods *(Z. mauritiana):*

- In-situ budding.

Processing and marketing of indigenous fruits (IFs)



- Adding value to IFs needs more research in processing and marketing.
- 2 Ph.D. students working on this.
- Women groups in Tabora are already processing IFs into jams and juices.
- Surveys with IDRC and CIAT surveys on indigenous processing methods being synthesized in Malawi and Zimbabwe.
- More work required: ICRAF has limited capacity.

Urban wholesalers in Harare, Zimbabwe.

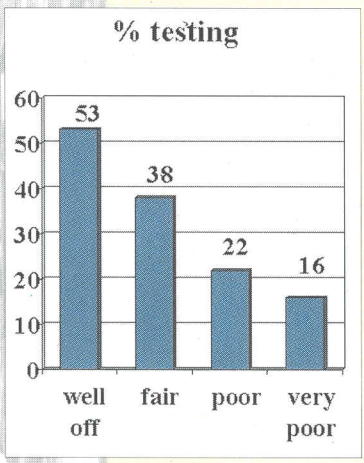
The way forward for our IFT work

- Build on current success and knowledge.
- Expand range of species.
- Merging farmer priorities with market demands (present and future).
- More understanding of consumer preferences for indigenous fruits;
- Policy research needed on access and control of the fruits and trees.
- Commercialization:
  - post harvest techniques
  - processing
  - marketing
  - fruit quality studies
- Use biotechnology to enhance early fruiting.
- Link with partners who have comparative advantage.
- Solicit more funding.

ACHIEVEMENTS IN THE LAST 5-10 YEARS - DEVELOPMENT

- Beginning to understand the adoption process and factors that favour adoption.
- Influenced policies to favour adoption of AF.
- Tested several dissemination strategies, by farmer-to-farmer exchanges. One farmer can reach 6-10 farmers/year (over 30,000 testing/adopted AF).
- Produced extension manuals on *S. sesban, T. vogelii* and Pests and diseases.
- Developed videos for extension with Zambia National Broadcasting Corporation.

Well-off and male farmers dominate testing of Improved Fallows in E. Zambia



Based on surveys of 4 pilot villages:

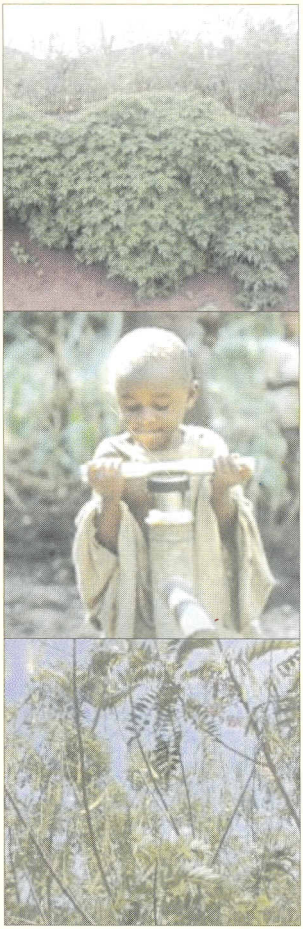
- 32% of males and 24% of females testing/using improved fallows.
- Well-off testing/using improved fallows more than poor.
- Participation of poor is very promising.

Wealth and gender: number of testers/adopters

Whereas the well-off and male dominate testing, females and the poor continue at the same or higher frequency.

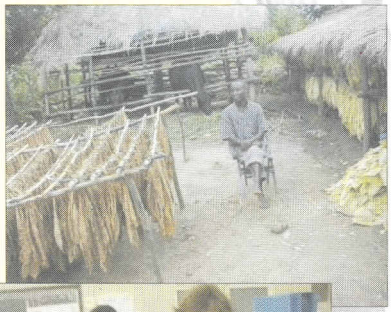
Percentage of testers who continue planting	
▪ Males	51%
▪ Females	58%
▪ Poor	59%
▪ Better off	58%

Year	1989	1992	1994	1996	1997	...2000	2002
No. of farmers	5	10	200	1.000	3.500	30.000	110.000



What the farmers are saying about research needs

- They want a diversity of species to include indigenous species and improved fruit trees.
- Introduce income generating activities.
- They want us to work with those who provide water (eg. CARE) and credit.
- They want seed and rhizobia available on a large scale.
- They are looking beyond maize:
  - they want improved dairy cattle.
  - markets and favourable policies for AF products.
  - want to be taught how to process and preserve what they harvest, i.e. indigenous fruits.



Raw fruits.

Processed fruit product.

ACHIEVEMENTS IN THE LAST 5-10 YEARS - INSTITUTIONAL STRENGTHENING

- Regional committees/meetings (Regional AF Committees, Regional AF Steering Committees, annual planning meetings).
- Strategic planning meetings with NARS eg. Department of Agricultural Extention in Zimbabwe.
- Resource sharing with partners (164).
- Donor coordination meetings.
- Conferences and workshops (eg. Status of knowledge on Improved Fallows, Indigenous fruits, etc.).
- Student attachments: Ph.Ds completed and on-going (9).
- Internal reviews.
- Community nursery and seed projects.
- Farmer exchange visits.

SUMMARY OF THE PRIORITY AREAS IN SOUTHERN AFRICA

- Soil fertility: Screening more AF species; quantifying resilience and the N fixed by species; pests and diseases;
- Fodder: species screening; fodder bank management; feed ratios.
- Woodlots: species screening; water relations; calorific values; tree management; and, farmer objectives.
- Germplasm, domestication and processing: germplasm demand and supply, processing and marketing of products.
- Policy, economics and impact assessment: policy research; profitability, risk buffering capacity and impact of options, characterization, Monitoring and Evaluation.
- Dissemination: Define reach, scaling up, monitoring; pathways; farmer empowerment; feedback to research, networks and partnerships strengthened.
- Coordination: funding, concept notes, Results Based Management, Monitoring and Evaluation, reporting, donor and government relations, public relations, staffing issues and implementation of Programme of Work and Budget (POWD).

High priority areas for AF options

- Integration of inorganic fertilisers with N-fixing trees.
- Planting of high value tress (exotic and indigenous).
- Integration of fodder trees in dairy feeding.
- Promotion of AF for soil and water conservation.
- Identification and development of niches for peri-urban and urban AF.
- Improvement of processing and marketing of a diversified set of AF products.

Geographical expansion

Geographically, the emphasis will be on scaling up in areas where research work has been on-going and to expand to new areas. We will use GIS to decide and ITK to confirm these choices.

Tanzania
- Lakeshore areas in Mwanza, Mara and Musoma.
- Expand within Tabora and Shinyanga.
- Southern Highlands region.
- Peri-urban areas of Dar-es-Salaam.

Malawi
- Densely populated Southern region.
- Niches in central and Lakeshore regions; Kasungu and in the North.

Zambia
- All districts in Eastern Zambia; niches in Central and Southern provinces.

Zimbabwe
- Niches in Mashonaland Central and East, Masvingo, Manicaland and Matebeleland.

Mozambique
- Start in Maputo and expand to Tete and Manica provinces.

Rest of SADC
- Collaborate with South Africa.
- Work with ANAFE to reach out to Swaziland, Lesotho, Namibia and Botswana.

In South Africa we wish to initiate scientific collaboration in the form of:

- technical exchanges.
- publications.
- student exchange, attachment and supervision.

Priority areas for collaboration with South Africa

1. Processing and marketing of indigenous fruits.
2. Product development.
3. Biotechnology and tissue culture: use them to enhance:
   - Performance of soil fertility replenishing AF species.
   - Control of pests and diseases (in AF species).
   - Desirable characteristics of IFT products, e.g. reduced fruiting period.
   - Uniformity in products.
4. Access to germplasm materials, e.g. for improved mangoes and grevillea.
5. Fodder research and animal production.
6. Exchange of experts and students:
   - Woodlots
   - Livestock
   - Biotechnology
   - N-fixation
   - Biometrics
7. Sharing spatial data (GIS and satellite image databases).
8. Modelling and prediction:
   - Land use/cover change
   - Climate change
   - Integrating biophysical and socio-economic models
9. How can we tap into SA's funding to the CGIAR?
10. Links to partners and sites in the region where SA is engaged in development.

FUNDING PARTNERS

ICRAF-SA works with, and acknoledges the invaluable financial support of, the following investors:

Partners	Portfolio
• Belgian Government (WOB)	Leverage funding, partnership and networking and JPOS.
• Canadian International Development Agency (CIDA)	About 50% support to research and development of AF options to 0.4 million farmers by 2006 through the *Agroforestry for Sustainable Development in the Zambezi Basin* Project.
• Dutch Government	Operational costs for a Junior Professional Officer (JPO) involved in social analysis in community-based natural resource management.
• European Union	Regional policy and carbon sequestration in Mozambique and leverage funding towards diversification of AF options across the region.
• Farm Africa	Diversification of AF options in Tanzania.
• Germany Development Services (DED)	Monitoring and Evaluation expert.
• Germany Federal Department for Economic Development (BMZ)	Domestication and commercialisation of indigenous fruit trees across the region.
• Governments of Malawi, Mozambique, Tanzania, Zambian and Zimbabwe	In-kind support through staff, infrastructure, facilities, tax rebates, etc.
• Rockefeller Foundation	Agroforestry policy and economic analysis and targeting AF options.
• Swedish International Development Agency (SIDA)	Training and capacity building and soil fertility research in Zambia.
• United States Agency for International Development (USAID)	Scaling up AF innovations in Malawi, Mozambique and Zambia.

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