

FINAL PROJECT REPORT



Gatsby Cub Tree Biotechnology Project (GCTBP)

FINAL TECHNICAL REPORT

SUBMITTED TO KILIMO TRUST

By

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List of Abbreviations

QPM	-	Quality Planting Material
NFP	-	National Forest Policy
FAO	-	Food and Agricultural Organization
GCF	-	Gatsby Charitable Foundation UK
GCM	-	Gatsby Club Members
NAFORRI	-	National Forestry Resources Research Institute
NARO	-	National Agricultural Research Organization
TBP	-	Tree Biotechnology Project
UGT	-	Uganda Gatsby Trust
SPGS	-	Sawlog Production Grant Scheme
UTGA	-	Uganda Timber Growers' Association
NAADS	-	National Agricultural Advisory Services
FFNC-MUK	-	Faculty of Forestry and Nature Conservation- Makerere University Kampala
JEANAM	-	Journal for East African
TBP	-	Tree Biotechnology Project
ATL	-	Aberdare Technology Limited
GMFL	-	Gatsby Micro-Finance Limited
IPM	-	Integrated Pest Management
BGC	-	Blue Gum Chalcid
GC	-	Grandis x Camadulensis hybrid
GU	-	Grandis x Urophylla hybrid
CN	-	Clonal Nursery

Acknowledgements

We wish to acknowledge our gratitude to Kilimo Trust for the support and guidance they have extended to the project during this phase. We further acknowledge the support and collaboration from partners, the wider forestry and tree planting community whose valuable contribution and participation has enabled the project to register some outcomes. The collaborators and partner organizations include GCF, GMFL, NaFORRI, FFNC- MUK, NFA, SPGS, NTSC Namanve and Kenya TBP.

Table 1: Project Completion Summary

Project Title:	Gatsby Cub Tree Biotechnology Project	
Grant Number	KT Ref: KT/016	
Lead Organization:	Uganda Gatsby Trust	
Project Leader:	Professor J. K. Byaruhanga	
Partner Organizations & names of key staff from each	Organization	Name
	Kilimo Trust- Funding agent	Dr. Steven Kimani
	TBP Kenya- Technical assistance	Mr. Benson Kanyi
	NaFORRI - carry out research role	Mr. J.F.O Esegu and Dr. J. Epila Ojala
	Gatsby Club Members- Distribution network	Club committees
	SPGS/ UTGA- Link the project to growers under the scheme	Mr. Paul Jacoveli, and Celia Nalwadda
	FFNC- MUK: Research and Development	Professor Joseph Obua and Dr. Philip Nyeko
	NFA	Mr. Isaac Kapalaga, Sector Managers
Project Purpose	Large Scale Production and Distribution of Tree Clones and Improved Seedlings through the Gatsby Club Network	
Location	Country & Districts	Sub-Counties/Division
	Uganda	
Start Date	June 2006	
End Date	June 2009	
Kilimo Trust financial contribution	US\$877,928	
Other donor financial contribution (specify donors and amount of funds)	Sida/SAREC- cluster innovations US\$5000	
Total Project cost	US\$877,928	

1. Executive Summary

1.1 Aims of the project

The following summary shows:

- The project results planned to be achieved by the project/ activities;
- The Project Purpose, which is expected to be accomplished as the out come of the achievements of the key results;
- The Overall Goals to which the achievement of the Project Purpose will contribute.

Overall Goals

1. Supply and quality of tree products and services improved to alleviate imminent wood scarcity.
2. Rural employment opportunities increased.
3. Improved environmental sustainability.

Project Purpose

1. Scale out the capacity to produce clonal tree planting material derived from the inter-specific tree breeding programme of Mondi South Africa.
2. Enhance production, and distribution of the clones and improved seedlings.
3. Promote clonal technology uptake and clonal forestry

1.2 Methodology used

1. Use of the Gatsby Club Network to reach out to the private sector. Creation of awareness among Gatsby Club members and the neighboring community about the proposed clonal tree project was top on the agenda.
2. Make the clonal facility at Kifu functional in order to generate the initial material for multiplication in order to expand Kifu and set up other clonal nurseries
3. Decentralize production by establishing low cost regional clonal propagation nurseries at specific locations
4. Establish private seedling and hardening nurseries at specific Gatsby club locations and franchise them to be run as commercial entities by the clubs or individuals.
5. Establish a microcredit scheme to finance the technology uptake.
6. Linking clubs with regional clonal nurseries
7. Training both club members and staff in basic nursery management practices and clonal propagation technology
8. Research to demonstrate the superiority, suitability, and refinement of the technology.
9. Link with other vital key players in the forest sector

1.3 Key outputs and outcomes realized

1.3.1 Key outputs

The outputs achieved by the project implementation are as follows:

- 3 functional regional nurseries were established in the west, central and eastern regions of Uganda and have so far produced one million seedlings and distributed 50% of them.
- The project has reached out to about 1600 households through club and other private nurseries, tree loan credit scheme, and through distribution of planting material
- 17 hardening club nurseries which have so far produced and sold 1,324,254 and 1,073,350 pine and eucalyptus seedlings respectively initiated and supported
- A loan scheme was set up and is in operation and over 200 growers and nursery operators have benefited
- Established linkages with SPGS, research institutions, and commercial tree growers
- Clonal trials have been evaluated and plantation guidelines using information from trials have been produced.
- Progressively introducing eucalyptus clonal forestry and its benefits to stake holders thru; supply of clones, information dissemination, and demonstrations.
- Four research papers have been generated and one has been accepted for publication in JEANUM.

1.3.2 Outcome

- Increase in forest cover by 1,763ha of plantation of which 367 ha are planted by clones. This is investment worth US\$ 2 billion made in plantation forestry (considering 600,000/= per ha. initial establishment costs.
- Gatsby club nurseries are able to access better markets and have won tenders to supply seedlings to the FIEFOC Project in the Ministry of water lands and environment. They supplied over one million seedlings worth US\$ 300 million in the period of 2008/2009.
- There is growing interest in nursery business and club nurseries have so far produced and sold 2.3 million seedlings generating about US\$ 400 million gross sales. Two people have already taken the initiative to establish clonal nurseries and have started producing clones
- About 373 individuals (80% women) both full-time and casual work in the clonal and club nurseries and trickle down effect in plantations averages over 4,500 jobs.
- Adoption and cultivation of the high valued clones is widely spreading; 307 farmers have planted clonal eucalyptus totaling to 367 ha. These include 17 women and 290 men. These farmers are distributed in 35 districts of Uganda(44% distribution by districts)
- Attitude change towards growing eucalyptus clones as against seedlings. The area planted by clones increased from 66 ha in last year to 301 ha in this year representing a 356% increase compared to 39% increase in eucalyptus seedlings over the same period.

- The project has attracted funding of US\$ 5000 from Sida/SAREC aimed at strengthening supply value chains by forming a forestry cluster innovation. We have started a pilot cluster initiative in Masaka

1.4 Conclusions, challenges and future strategy

1.4.1 Conclusions

Considering the out puts and outcomes generated, The Tree Biotechnology Project has already laid strong foundations for future scaling out of clonal technology and illustrates several key points that could benefit other similar development projects. The clones have finally reached the target group. The project focuses on a clearly defined limited supply of forestry products and services, in order to target resources and maximize impact. Such as increasing forest cover with improved germplasm. It has created mutually beneficial partnerships, between the public and private sectors, as the major strategy for delivering project benefits. It also combines a commercial objective with that of poverty alleviation, so as to minimize dependence on donor or government funding and create a self-sustaining production and distribution system with widespread impact.

1.4.2 Challenges

There is however some remaining challenges and opportunities and they include:

- Further decentralizing the distribution system to enhance downstream clone and seedling dissemination
- Involving the private sector in the production of clones
- Reducing nursery production costs to meet pricing expectations of poor rural farmers
- Initiating an appropriate micro-credit scheme for smallholder farmers to enable them access to planting materials in larger numbers
- Increasing the genetic base from the current ones
- Meeting the high demand for clones and seedlings as compared to current production.
- Organizing and making available the researched information on the socio economics and environmental aspects of eucalyptus to the major key players especially politicians and policy makers.

1.4.3 Lessons Learnt

The major lesson learnt from the project indicates that high participation of the community members at grass root level ensures Behavioral Change Communication that promotes and facilitates clonal technology utilization. Capacity building, networking and integration of groups and individuals are key opportunities to get intended results from the project. The other lesson is that the distance from nursery to the planter is a determinant factor for people to buy seedlings and plantlets, especially the small holdings.

1.4.4 Future strategies

Future activities should largely focus on increasing production, further decentralization of production, promoting extension and marketing activities, breeding more materials for trials and carrying product utility assessment. These require more private sector involvement and an enhanced budget to secure technology adoption and long-term impacts.

2. Background

The tree biotechnology project phase two commenced on the 1st May, 2006 and has lasted for three years. It succeeded phase one which was carried out from 2002 to 2005.

The project was conceived to alleviate imminent wood scarcity associated with the national wood production gap, then estimated at 10 million m³ per annum. The aim of phase one was to transfer and test the clonal technology in Uganda, to build capacity in clonal forestry technology and to commercialize it.

Gatsby Charitable Foundation (GCF) provided funding to NARO to establish a clonal nursery and tree trial sites based on superior clonal plantlets of 11 Eucalyptus hybrid clones and one pure grandis clone imported from Mondi Forests Limited, South Africa. In turn, NARO mandated NaFORRI to implement the project. This phase registered the following outputs:

- Successful technology transfer and field testing in 15 trials of 12 hybrid clones of eucalyptus
- A mini-clonal nursery was constructed at Kifu, in Mukono for clonal forestry back stopping.
- Development of some limited human capacity in form of technicians
- Growth measurements to determine the suitability of the clones over the various agro ecological sites of Uganda started and the initial results showed that the clonal trees indicated faster growth and had mostly been pest free in most of the sites.

Despite the achievements made by phase one a number of challenges were encountered. The major Challenges were:

- The irrigation system to the mother clones and misting chamber was not properly functional and had many inherent technical problems.
- The mini-clonal nursery which was supposed to produce material for expansion and deployment into the field was not operationalised reportedly due to lack of funds.
- Consequently it was not possible to commercialize the clonal eucalyptus technology
- There was a great need for more capacity building especially in the area of production and human resource.

Phase two succeeded phase one inheriting the above challenges alongside commercialization. The programme implementation for phase 2 was taken over by The Uganda Gatsby Trust. The objectives and activities of phase 2 were much wider in scope than those of phase one covering all aspects of clonal forestry transfer, testing, operationalisation of the Kifu clonal facility, mass

multiplication, distribution, commercialization of the technology/deployment and capacity building and skills development.

In phase 2 increased production, distribution and supply of clones and improved seedlings was expected through operationalisation and expansion of Kifu nursery; through establishment of other clonal nurseries; through setting up club nurseries in partnership with Gatsby enterprise clubs and through refining and standardizing production procedures.

A wide range of support services and opportunities is being offered by the project to the small scale nursery operators, Gatsby clubs, and the local rural communities at large and women specifically. These include but not limited to training, employment, planting material, business opportunities, and credit facilities.

2.1 Objectives of the project

The overall objectives of phase 2 were formulated as a result of the evaluation of phase one carried out in 2005 and modified during and after a review by Kilimo Trust of all the projects funded by it with the aim to fit their objectives into the Kilimo Trust Development Strategy. The following objectives were generally agreed upon.

2.2 Overall Goals

1. Supply and quality of tree products and services improved to alleviate imminent wood scarcity.
2. Rural employment opportunities increased.
3. Improved environmental resilience

2.3 Project Purpose

1. To scale out the capacity to produce clonal tree planting material derived from the inter-specific tree breeding programme of Mondi South Africa.
2. Enhance production, and distribution of the clones and improved seedlings.
3. Promote clonal technology uptake and clonal forestry

2.4 Specific objectives

1. To establish 4-5 low cost regional clonal propagation nurseries
2. To establish 42 hardening seedling nurseries by the year 2009 in partnership with Gatsby Enterprise Clubs and manage them as commercial entities
3. To link tree farmers to credit and skills so as to promote tree planting on a massive scale
4. Establish seedling distribution systems
3. Encourage locals to establish their own wood lots
4. Establish a sustainable marketing system for the tree harvests.

Table 2: Key project outputs, indicators and expected results

	Key outputs	Indicators	Expected results
1	4 Low cost regional clonal propagation nurseries established	<ol style="list-style-type: none"> 1. Number of operational low cost regional nurseries established 2. Regional location of CN 3. Number of clones produced 4. Number of people using technology and their geographical locations 5. Number of clones distributed and planted 	<ol style="list-style-type: none"> 1. Decentralized production of clones 2. The use of the cheaper tunneling technology which is easier to adopt and cheaper for small scale entrepreneurs tested 3. Local people introduced to clonal technology. 4. Knowledge of clonal nurseries is built up among the local community
2	21 hardening nurseries established	<ol style="list-style-type: none"> 1. Number of beneficiary clubs 2. Number of operational club nurseries 3. Number of seedlings produced and sold 4. Income generated from sales and number of beneficiaries 5. Number of club members trained 6. Number of jobs created 	<ol style="list-style-type: none"> 1. Access to quality planting material enhanced for the rural community 2. Increased planting using improved planting material. 3. Club members knowledge and skills in nursery management increased 4. Gatsby clubs and other private individuals get alternative source of livelihood from nurseries. 5. Human resource developed at the local level
3	Entrepreneurs linked to credit	<p>Number of people linked and benefited from credit</p> <p>Hectares planted under loan fund</p> <p>Number of nursery businesses run with loan funds</p>	<ol style="list-style-type: none"> 1. Private sector involvement in club nurseries increased. 2. Private nursery franchise businesses span off by the project 3. Gatsby clubs and individuals get alternative source of livelihood from nurseries. 4. Increased area of plantation due to facilitation under the loan fund.
4	Locals encouraged to establish their own woodlots	<p>Number of hectares planted by planting material from the project</p> <p>Number of people planting trees</p> <p>Number of woodlots established</p>	<ol style="list-style-type: none"> 1. Locals participate in tree growing and related forestry business 2. Tree cover increased 3. Better access to forest products & services 4. Community skills in woodlot management improved.
5	Seedling distribution systems established	<p>Number of distribution units established</p> <p>Number of growers reached as a result of the system</p>	<ol style="list-style-type: none"> 1. Wide geographical coverage attained 2. Improved access and affordability of improved planting material
6	Sustainable marketing system for the tree products	<p>Availability of market information to entrepreneurs</p> <p>Number of markets created</p>	Supply value chains supported.

	established	Quality of plantations improved	
7	Suitability of clones in Uganda established	<ul style="list-style-type: none"> • Number of trials established • Analyzed Data collected from clonal trials • Plantation guidelines rolled out • Scientific papers on performance of clones in the various agro ecological zones in Uganda, Integrated pest management and rooting improvement 	<ul style="list-style-type: none"> • Clones for recommendation and promotion identified on the basis of growth, disease resistance, form etc. • Improved performance in the nurseries in terms of rooting, feeding regimes, pest management etc. • Properties of clonal eucalyptus wood ascertained

3. Methodology

A 3 year implementation plan was developed to address the constraints identified during the first phase. The method adopted was: Use of the Gatsby Club Network to reach out to the private sector; creation of awareness among Gatsby Club members and the neighboring community about the proposed clonal tree project; make the clonal facility at Kifu functional in order to generate the initial material for multiplication in order to expand Kifu and set up other clonal nurseries; decentralize production by establishing low cost regional clonal propagation nurseries at specific locations; establish private seedling and hardening nurseries at specific Gatsby club locations and franchise them to be run as commercial entities by the clubs or individuals; establish a microcredit scheme to finance the technology uptake; link clubs with regional clonal nurseries; train both club members and staff in basic nursery management practices and clonal propagation technology; carry out research to demonstrate the superiority, suitability, and refinement of the technology; and link with other vital key players in the forest sector

3.1.0 Creation of awareness and Training of service providers

This included conducting a baseline survey and mobilizing the existing Gatsby clubs through workshops and meetings at club levels. This stage involved engaging community leaders, participatory rural appraisal within the Clubs which identified community needs, leadership strengths and gaps, community productive assets such as land, water, energy, human resources, physical and social infrastructure. The stage also included formation of Tree Committees within the Club Membership. These committees were trained so that they can in turn train others. A member-to member delivery system has been established through training farmers to offer extension to other farmers.

3.1.1 Gatsby Clubs/Rural Entrepreneurs

The Gatsby Club network has been useful in the project as an entry point and distribution network. The clubs work closely with management and other project partners in establishing the franchise nurseries for improved tree and seedling production and distribution to the rural communities. These also serve as holding/ hardening and distribution centers for the clones produced from the regional nurseries. They are prepared for the up take of clonal eucalyptus production.

3.1.2 Operationalise and Expand Kifu Clonal Nursery

At the beginning of phase 2 the Kifu nursery was not operational and had barely 1,700 ramets in poor state. The project had to revamp the ramets to allow initial production and expansion. The un attended ramets were rehabilitated and fed with fertilizers. The water system was rehabilitated, a 15KVA generator bought, a diesel engine pump for mother garden, a smaller pump for the misting house, humid chamber repaired, and drip lines reinstalled. Production was initiated and the mother garden planted with more hedges. This was the source of plantlets for the establishment of other Clonal nurseries.

3.1.3 The Regional Nurseries

A lesson was drawn from Kenya Tree Biotechnology (TBP), a pioneer tree biotechnology project in East Africa and Aberdare Technologies Limited (ATL). Both nurseries are centrally situated around Nairobi and Kabati (near Thika) creating distribution constraint, as the transportation costs to the distant rural locations of the interested farmers were very high. Further, improved seedlings cannot reach all the communities in need as most small scale farmers require small quantities which make it economically not viable to transport. Thus a decentralized system of production was adopted by establishment of regional nurseries one in each target region.

3.1.4 Establish private seedling and hardening nurseries at specific Gatsby club locations and franchise them to be run as commercial entities by the clubs or individuals.

The purpose of the club nurseries was to make supply of planting material efficient and sustainable, and to demonstrate to the Clubs that tree nurseries can be commercially viable and sustainable in a number of these locations as the market demand for saplings, as a source of timber and firewood for now and the future, increases. This finally makes easier the work of transferring the function of commercially managing these club nurseries to the clubs and individuals as a way of creating business opportunities and improving efficiency.

The project has facilitated the formation of a seedling distribution system, through establishment of hardening/distribution club nurseries. Ideally, these nurseries distribute the seedlings they produce but in addition set up a hardening unit for clones as well, to meet increasing demands as more farmers adopt the technology. An effective seedling distribution system will lead to enhanced

accessibility to improved tree seedlings, increasing the adoption of the improved tree seedlings and clonal trees by farmers.

3.1.5 Link up entrepreneurs/communities to sources of credit

Our baseline survey observed that the cost of improved tree seedlings hamper the uptake of technology. This is aggravated by the fact that there are no credit providers in place willing to extend credit to tree farmers, who have neither collateral nor a growers' association which could negotiate for such credit. The credit element would greatly enhance tree planting and the adoption of the technology and the subsequent socioeconomic impact. The Uganda Gatsby Trust received a loan fund of US\$150,000 designated for Community Tree Planting Development. These funds have been used for a number of loan programs to promote tree plantation development. The loan programmes include cash loans, seedlings in Kind, nursery infrastructure and seeds for raising nursery stock. All these activities are aimed at developing plantations.

The project has had a tree loan fund extended to farmers and willing nursery operators. These have been mainly linked to the Gatsby Microfinance Ltd. (GMFL), to which the loan fund was transferred for cash loan services.

GMFL has flexible terms of lending and the loan is usually negotiated in such a way as to encourage the formation of a revolving fund for the farmers. The micro-credit provider also monitors the fund and assists farmer groups with decisions on further disbursements.

3.1.6 The low cost clonal propagation technique

The clonal propagation technique developed and optimized by TBP Kenya and ATL is relatively cheap and very efficient with rooting percentages of over 70% being achieved within 4 weeks. The cuttings are obtained from clonal hedges planted directly into potted polythene tubes containing appropriate ratios of soil and sand mixture. The potted tubes are arranged in nursery beds constructed in a 50% shade and watered before inserting the cuttings. Once the cuttings are inserted they are watered thoroughly and the whole bed covered completely with a polythene sheet. The soil moisture content relative humidity and temperatures are monitored very closely and maintained at appropriate levels. Usually, the cuttings are watered only once a week but this may vary depending on season and location. Occasionally, the polythene sheet is removed to allow aeration and to monitor the cuttings. Broad spectrum fungicides are used to prevent cuttings from rotting.

Rooting is expected within 4 weeks after inserting the cuttings and once this has happened, the polythene sheet is removed to allow the cuttings to harden in 50% shade, for 2 weeks. Thereafter the cuttings are transferred to the open nursery beds for further hardening before transplanting in the fields. Fertilizers are applied to enhance the growth and performance of the rooted plantlets.

This technique was adopted for the decentralized production in the regional nurseries and this saves the project from the hefty investment required to set up the conventional mist chamber as is at Kifu. It is also suitable for the technology uptake by the private sector.

3.1.7 Train both club members and staff in basic nursery management practices and clonal propagation technology

Staff Training / Capacity Building

The two Regional Nursery Managers attended a two weeks training in clonal nursery technology at Karura - Nairobi from the 19th to 31st of August 2007. This training impacted clonal production technology knowledge which has enabled the managers to perfect their operations. Simon Ogwal got his training at SAPI in South Africa. The National Tree Seed Centre trained Nursery Supervisors and Club members in tree seedling nursery operations. A total of 40 club members and 16 nursery supervisors were trained.



Figure 1: Project Staff training at Karura, Nairobi; left centre is Epilili Samson and right centre is Mr. Murami

3.1.8 Research to demonstrate the superiority, suitability, and refinement of the technology.

Evaluation of growth performance of clones on the various sites is a prerequisite for the **subsequent commercial production and promotion of the clones.** Very often clone exhibit significant variation and genotype/ environmental interaction. Their evaluation therefore, allows both selection and ranking the clones for specific sites and generally for major agro-ecological zones in the country. There is however challenges that need to be addressed to continually improve on the clones and tree biotechnology in general. These include: Improving rooting to enhance large-scale production, managing pests and diseases which could be a menace in monocultures of single clones, determining physical and mechanical properties of clones,

recruiting land race Eucalypts to broaden genetic base, and assessing social economic impacts among other challenges. During this phase all these aspects were embraced

3.1.9 Link with other vital key players in the forest sector

The projects objectives were of a wide scope requiring multidisciplinary and multi-stakeholder approach in implementation. Specifically the clonal production, promotion and commercialization programme requires expertise in facilitation, willingness of participants to learn, time to allow trust building, quantitative and qualitative information (depending on tools used), and participation of key actors. This creates transparent and inclusive decision making, strengthened stakeholder networks and builds platform for reconciling different interests and reach consensus solutions. The project board drew membership from the Research institutions (NaFORRI), National Forestry Authority (NFA), National Agricultural Research Organization (NARO), the Faculty of Forestry and Nature Conservation Makerere University and of late enlisted membership from The Uganda Timber Growers Association (UTGA). The project also established linkage with The Sawlog Grant Production Scheme (SPGS) the leading promoter of Private Sector Commercial Forestry in Uganda. This strategic alliance would meet the various challenges.

4.1. Achievement of Development outputs

Output 1:

Establishment of low cost nurseries

Objectively Verifiable Indicators:

1. Decentralized production; 3 functional regional nurseries in the west, central and eastern regions of Uganda Regional location
2. 862,662 clones have been produced and 50% distributed
3. Number of people using technology and their geographical locations
4. Low cost tunneling technology has been adopted refined and utilized.
5. 2 private people developed interest and in clonal technology and took the initiative to set up their own nurseries

The project planned to establish 4 regional nurseries by the year 2009. Three low cost regional clonal propagation nurseries have been established. The deviation was as result of insufficient initial number of plantlets to establish mother gardens. The established nurseries have so far yielded the following results:

1. The project has decentralized the production of clones to the three regions of Uganda; Central, Eastern and Western regions.
2. The project has managed to produce 889,552 clonal plantlets and distributed over 50% of them already.

The table below gives the annual production figures for the project corresponding to the project period.

Table 3: Yearly Clonal plantlets production

Clonal Nursery	Produced in 2006-2007	Produced 2007-2008	Produced 2008 -2009
Kifu	26,492	102,256	158,332
Mbale	Nil	112,738	227,102
Kabarole	Nil	80,812	181,820
Total	26,492	295,806	567,254

3. There has been an increasing trend in the production of clones.
4. The project tested and adopted the tunneling technology which is easier to adopt and cheaper and can be used in the scaling out of the technology.
5. Knowledge of clonal nurseries is building up among the local community especially among the workers who have already acquired clonal eucalyptus propagation skills and great experience that they are able to tell the difference between individual clones.
6. Two individuals have started min clonal nurseries as result of the regional nurseries acting as show windows. This clearly demonstrates the dire of help to start clonal nursery businesses



View from the outside



View from the inside the worker displaying a rooted plantlet.

Figure 2: Improved rooting shade by Mr. Iduma in Soroti- Very innovative

Output 2:

initiate and support establishment of hardening club nurseries to produce and sell pine and eucalyptus seedlings and plantlets

Objectively Verifiable Indicators:

1. 17 hardening club nurseries were initiated supported.
2. The nurseries produced and sold **1,324,254** and **1,073,350** pine and eucalyptus seedlings respectively initiated
3. About 300 jobs have been created directly and indirectly
4. Number of club members trained in nursery practices



Figure 3: Pine seedlings ready for planting in Masaka Gatsby Club nursery (The good standards in the club nurseries shows readiness for clonal technology uptake)

The project planned to have 21 hardening nurseries by the 2009. By the end of the project period 18 hardening nurseries have been initiated in partnership with the Gatsby Enterprise Clubs. All these Club Nurseries were franchised and so far 11 of them have so far reported a profitable business

Table 4: Club nursery production and estimated areas planted after franchise

CLUB	Pine seedlings sold	Eucalypt seedlings sold	Resultant Ha of pine	Resultant Ha. of Eucalypt	Total Ha. Planted
Arua	50,000	12,410	36	5	41
Iganga	66,320	34,947	48	14	62
Hoima	107,038	34,050	78	14	92
Kabarole	74,768	146,100	55	58	113
Masaka	143,246	181,355	104	73	177
Jinja	40,600	32,800	30	13	43
Njeru	78,314	85,439	57	34	91
Masindi	128,100	39,934	93	16	109
Mbale	131,580	151,809	98	61	159
Soroti	93,600	25,500	68	12	80
Lira	23,850	0	17	0	17
Mbarara	76,630	52,790	56	21	77
Mubende	110,130	77,439	80	31	111
Mityana	96,600	151,027	70	60	130
Mukono	29,000	47,750	21	19	40
Kasese	49,250	0	36	0	36
Apac	25,228	0	18	0	18
Total	1,324,254	1,07 3,350	965	431	1,396

These hardening nurseries have born the following results:

1. A total of 1.3 million pine and 1.07 million eucalyptus seedlings have been produced and distributed.
2. A total of 1,396 ha of both Eucalyptus and pines have been planted.
3. The number of seedlings produced from the club nurseries increased from 893,564 last year to 1,073,321 seedlings representing a 20% increase in production.
4. Club members have gained more skills and confidence in nursery management
5. Gatsby clubs and other private individuals get alternative source of livelihood from nurseries
6. Employment opportunities have been created. About 300 jobs have been created directly at the nurseries and indirectly in plantations and support areas. The direct wage jobs are about 72 at an average of about 50,000/= which is equivalent to shillings 3.6 million per month. The casual jobs which are mainly piece rate include potting, soil mixing and sowing. On the basis of number of seedlings produced these translate into about shillings 10 million per season.
7. There is notable human development at the local level as a result of this project. Though not easily quantifiable, a number of workers have improved their nursery skills as a result of working with the project and training on the job.



Workers in a pine plantation



Workers at Kifu clonal nursery

Figure 4: Job opportunities for both men and women in both plantations and nurseries

Output 3:

A loan scheme was set up and is in operation

Objectively Verifiable Indicators:

1. 210 people linked and benefited from credit
2. 567 Hectares planted under loan fund
3. 18 club nursery businesses spanned off by franchising them
4. Total Amount disbursed
5. Recovery

The Uganda Gatsby Trust received a loan fund of US\$150,000 designated for Community Tree Planting Development. These funds were used for a number of loan programs to promote tree

plantation development. The loan programmes include cash loans, seedlings in kind, nursery infrastructure and seeds for raising nursery stock. All these activities are aimed at developing plantations.

Over 300 growers have benefited from the loan fund. Of these 6 are large scale growers, 65 are small scale, and the rest are Gatsby Club Members who are dealing in seedling nurseries. The growers have been able to plant a total of about 500 ha of plantations. The nurseries have the capacity to produce 600,000 seedlings annually, which can plant about 500ha per year. These have created an equivalent of 2,000 direct and indirect jobs.

Table 5: Apportionment of the loan fund into the various loan products

Loan product	Disbursement	Number of beneficiaries
GMFL cash loan	171,403,328	12
Seeds loan	27,100,000	13
Seedlings loan	28,042,005	65
Nursery infrastructure loan	97,192,500	237
Total	323,737,833	327

Output 4:

Locals encouraged to establish their own woodlots

Objectively Verifiable Indicators:

1. A total of 1,763.2 ha area planted by planting material from the project
2. 1,740 people have grown trees under the project

The objective under this output is to get as many people as possible involved in tree planting in order to increase the area under forest cover. The project implementation has resulted into a total overall planting of 1,763.2 ha. These include 367 ha of clones of clonal eucalyptus, 965.2 ha of pines and 431ha of eucalyptus seedlings. These areas have been planted by a total 1,740 growers. 307 growers of these have planted clonal eucalyptus and 1,433 growers have planted eucalyptus and pine seedlings. It is expected that this area will contribute to the socio economic and environmental problems associated with deforestation.

Table 6: Areas planted by the various species over three consecutive years

Species	Ha Planted in First year	Ha planted in second year	Ha planted in third year	Total ha planted in project period
Eucalyptus seedlings	111	134	186	431
Pine seedlings	115	339.2	511	965.2
Eucalypt clones	Nil	66	301	367
Total	226	539.2	998	1,763.2



Mr. Iduma at his pine plantation in Soroti.



Eight month old clonal euc. Planted by Fadsalt in Buikwe

Figure 5: Some growers show off the seedlings and clones which have been planted under project

Output 5:

Seedling distribution systems established

Objectively Verifiable Indicators:

1. Location of hardening nurseries

The project planned to have 21 nurseries especially where Gatsby Clubs exist. Eighteen nurseries have been established and these are distributed in 17 districts of Uganda. These nurseries have taken the planting material close to the planters thus reducing the burden on transporting and increasing accessibility to quality seedlings to the less privileged rural communities. The improved accessibility by farmers to improved planting material has led to 1,740 growers (mainly small scale) to have accessed seedlings and clones from the project and these cover about 35 districts of Uganda. The table below shows planting of clones per district.

Table 7: Planting of clones per district by end June 2009

District	Area planted (ha)	No. of growers involved	
		Men	Women
Arua	1.08	0	0
Bugiri	15	1	0
Buikwe	21.64	4	0
Bushenyi	1.9	2	0
Busia	0.64	2	0
Hoima	12.42	8	0
Iganga	8.9	3	0
Jinja	9.37	4	0
Kabale	6.66	2	0
Kabarole	12.19	20	5
Kaberamaido	0.2	1	0
Kaliro	0.16	1	0

Kampala	9.54	1	0
Kamwenge	1.4	1	0
Kayunga	1.08	2	0
Kiruhura	4.86	2	0
Kumi	0.4	1	0
Kyenjojo	6.1	5	0
Lira	1.36	3	0
Luweero	15.17	6	0
Manafa	0.9	1	1
Masaka	7.56	5	1
Mayuge	16.5	2	0
Mbale	31.27	138	4
Mbarara	1.76	3	0
Mityana	21.40	6	0
Mubende	46.48	12	0
Mukono	36.18	16	1
Nakaseke	0.18	1	0
Pallisa	7.5	2	0
Rukungiri	1.08	1	0
Soroti	5.64	14	1
Masindi	12.2	1	0
Tororo	31.08	38	3
Wakiso	17.4	7	3
TOTAL	367.2	316	19

4.2 Progress against research Outputs

Table 8: Research outputs, verifiable indicators and outcomes

Output	Objectively Verifiable Indicators:	Outcomes
Suitability and performance of clones tested	Reports generated from trials for survival, height and volume and girth increment	<p>-Plantation guidelines produced with the help of SPGS</p> <p>-A paper by Dr. Philip Nyeko of MUK (pests and diseases in Uganda) highlights diseases in clonal nurseries.</p> <p>-A paper on the performance of clones by Dr. Epila submitted for publication in JEANAM</p> <p>-Other papers though they did not qualify for publication have been written. They include a paper on IPM of pests, socio economic impact of clones on communities</p>
Integrated pest management of BGC	Surveillance reports on distribution and host resistance to BCG in clones	<p>-A paper by Peter Kiwuso of NaFORRI</p> <p>-A paper by Associate Professor Philip Nyeko</p>

	and nursery diseases and pests.	and Dr. Grace Nakabonge of MUK (Occurrence Of Pests And Diseases In Tree Nurseries And Plantations In Uganda) highlights diseases in clonal nurseries.
Recruitment of Eucalyptus land races into clonal forestry	Numbers selection made and planted in a Clonal Multiplication Area.	19 selections were made in the North and North west, 24 in the East and 20 in the South Western Uganda. Coppices were collected from selected trees and rooted in the nurseries and transplanted to the clone gene bank.
Effect of introduction of clonal eucalyptus on Socio-economic factors of the rural population of Uganda	Report and paper	Profitability land use changes and socio-economic impact of clonal eucalypts in Uganda is being evaluated as one of the NARO technologies for detailed impact studies to compare benefits versus costs of conducting research
Mechanical and Physical properties of wood tested	5 samples of clones GC 550,540,796 and GU 7 and 8 from 2 ecological sites have been collected and processed for 4 mechanical properties namely: bending, cleavage, shear and compression.	Tests are also being carried out on physical properties namely basic density.

5. Conclusion and Recommendations

5.2.1. General

Considering the out puts and outcomes generated, The Tree Biotechnology Project has already laid strong foundations for future scaling out of clonal technology and illustrates several key points that could benefit other similar development projects. The clones have finally reached the target group. The project focuses on a clearly defined limited supply of forestry products and services, in order to target resources and maximize impact such as increasing forest cover with improved germplasm. It has created mutually beneficial partnerships, between the public and private sectors, as the major strategy for delivering project benefits. It also combines a commercial objective with that of poverty alleviation, so as to minimize dependence on donor or government funding and create a self-sustaining production and distribution system with widespread impact.

In specific terms the project caused planting of trees that led to a forest cover of 1,763ha. This area has been planted by mainly small holder rural community and will contribute towards increasing supply of forest products and services. The families that have planted the trees will in future have easy access to firewood and the distances travelled by women and children to look for fire wood will be reduced and time saved can be used for other productive activities. In addition Access to

forest products from plantations reduces pressure from Natural forests and thus promotes biodiversity.

The seedlings and clones distributed are of proven and improved germplasm and this has greatly improved the quality of plantations in terms form, vigour, and likely to give better yields, quality forest product, shorter rotations hence better markets, better and quicker returns on investment.

The project caused generation of income through the creation of about 4,873 jobs in nurseries and plantations earning over US\$ 400 million annually. Silvicultural operations of managed forests approximately 1,763 ha of additional forest cover, which translates into an additional 5,289 jobs at the local level (at an average of 3 jobs per ha annually).

One hectare of trees planted can be valued at a cost of US\$ 600,000 investment. Therefore the project has triggered an investment worth US\$ 1 billion into plantation forestry.

Finally increased forest cover leads to improved environment and livelihood.

The project contributes to four of the Kilimo Trust Priority Themes; promoting efficient value chains, engaging the private sector, supporting technical and institutional innovations, and mainstreaming environmental sustainability.

The project positions itself in such a way that links nurseries to research and development and to tree farmers. Similarly, the introduction of superior clones, will likely lead to efficient production and later better markets.

The Gatsby clubs and other private individuals have been inducted into direct production of improved seedlings and to a lesser extent clones. In addition, the clones and seedlings have been availed to the public for use in plantations to produce the scarce forest products and services. The project has further sought partnership with the UTGA, which has become the main lobby group for policy change on commercial forestry. UTGA has now seconded one member to the Project Board.

The club nursery network forms a critical mass that is able to generate economies of scale. The club nurseries have been able to win supply tenders even to the projects under the ministry through joint supply agreements.

The tree cover generated under the project directly impacts on the environment through carbon sequestration, climate amelioration, water catchment let alone reducing pressure on the natural resources. Thus it contributes to mainstreaming environmental sustainability

Lessons learnt

The major lesson learnt from the project indicates that high participation of the community members at grass root level ensures Behavioral Change Communication that promotes and

facilitates clonal technology utilization. Capacity building, networking and integration of groups and individuals are key opportunities to get intended results from the project.

Way Forward

Future activities should largely focus on increasing production, further decentralization of production, promoting extension and marketing activities, breeding more materials for trials and carrying product utility assessment. These require more private sector involvement and an enhanced budget to secure technology adoption and long-term impacts. These are activities that are expected to yield the following outputs and outcomes.

- Increased production of QPM from the current annual production of 500,000 to 2 millions per annum by 2012
- Expansion of area under clonal plantations from the current 500 ha. to 4,500 ha by 2012
- 3 additional regional clonal nurseries established in the target regions and producing 500,000 seedlings annually;
- Mbale and Kabarole regional nurseries able to produce and sell at least 500,000 plantlets annually
- Trained staff, foresters, clonal nursery operators and tree growers;
- 40 private nurseries clonal nurseries established all over the country and producing 500,000 plantlets annually by the year 2012;
- The number of clonal hybrid growers increased from the 225 to 4,500;
- Capacity for clonal hybrid research enhanced and delivery of extension services to beneficiaries improved;
- Creation of over 4,500 farm holders and 9,000 seasonal jobs in clonal nurseries and plantations and over 30,000 jobs along the forest product value chain.
- Credit facilities accessed by farmers to promote tree growing and nursery business
- Management well facilitated and equipped to organize and deliver the planned outputs.

5.2.2. Partnership and Collaboration

Kilimo Trust: Provided funding for the 2nd phase which has enabled the successful implementation.

NaFORRI: Mandated by the project through agreement to undertake research work in the project. NaFORRI has conducted various project aspects to facilitate commercialization. It is represented on the Project Board and thus has participated in major decision making process.

FFNC- MUK: Trouble shooting. Represented on the Project Board and participated in major decision making process. Dr. Philip Nyeko has particularly been very useful in handling emergencies of disease outbreaks especially in the clonal nurseries.

SPGS: Provide a link to and promote Clonal forestry among commercial tree growers. Has also championed the publication of clonal plantation guidelines and facilitated growers' purchases uptake and has been very instrumental in its advisory role and linking the project to UGTA, the core advocate group.

NFA: Represented on the Project Board. The Authority also facilitated the project in terms of acquiring land in many of the project areas. The national tree seed center has done most of the training for our nursery supervisors and club members and has catered for all the pine and eucalyptus seeds requirements of the project.

Gatsby Clubs: These have been the major target group of the project. They have participated in all activities of the project towards generating most outcomes.

5.2.3. Economic Impact

The productivity of Ugandan forest is still below average; hence with the support of clonal technology through this project, sufficient number of high yielding clonal plants is being made available for regular planting in different agro-climatic zones. Productivity enhancement of plantation forests of Uganda using clonal technology shall definitely improve the economic conditions of target groups. Planting of high yielding clonal plants will increase the productivity considerably on a sustainable basis. This will generate extra income to various stakeholders including farmers.

The project created over 500 jobs in established nurseries and plantations; distributed plantlets to 1,740 small-scale farmers; and projects over 50,000 seasonal jobs on the new plantations silvicultural operations; firewood, charcoal and timber traders; harvesters and transporters. The project further facilitated spin off of 13 private nursery enterprises.

Economically, the envisaged benefits are;

- a) Increased rural household incomes;
- b) Creation of jobs in the rural areas;
- c) Potential generation of tax from increased volume trade;
- d) Enhanced economic value of marginal lands, towards which the afforestation is envisaged;
- e) Contribution to environmental conservation.

5.1.4 Financial benefits

Financial benefits from project to the community emanate from the direct employment of the unskilled and semi-skilled rural inhabitants working in the nurseries and plantations. For those who have taken on management of club nurseries, the benefit will come from net proceeds received from the sales. The planters will earn from sale of their final products. A Nursery employs 15 people at an average income of shillings 60,000 per month. With the establishment of 17 such nurseries by the end of project implementation, the nursery industry alone has generated over 500 jobs, of which 70% (78) are occupied by women. The plantations employ 3 to 4 people per ha per annum on average an average income of shillings 40,000 per ha. per year. At the establishment of about 1,763 ha over 5,000 jobs have been created by the project.

Clonal eucalyptus, being a fast growing and early maturing, would be an alternative to save firewood shortage. On average a clonal eucalyptus tree can give 0.371 m³ over a period of three years from the data collected from clonal trials (Epila, et al, 2006). Clonal eucalypts exhibit a uniform growth, hence uniform harvest/ felling. On average, 1 m³ of clonal eucalypts costs Ushs 20,000/= which implies that a tree of 0.371 m³ would cost Ushs 7,420/= at three years old. Therefore, in an acre of 1,000 eucalyptus trees, a farmer would get Ushs (1,000 x 7,420) 7,420,000/= in three years.

According to Dr. Epila, with the quoted volume above, a farmer could harvest the woodlot/acre once, store the wood and allow the stumps to coppice. Note that the coppices grow even faster than the original plant. Hence reducing on the frequency and duration of collection; increase on the quantity of fuelwood availability in a household. This saves time spent on firewood collection by women and children.

5.1.5 Environmental Impact

Reforestation with improved seedlings has increased the tree cover of the country. The trees have been planted in different geographical locations of the country which will greatly improve the environmental condition. The afforestation will contribute to the conservation of biodiversity and the environmental improvement of the project area and the globe through carbon sequestration.

5.1.6 Stakeholders

The project aims to create a self-sustaining production and dissemination system, driven by private enterprise. The beneficiaries targeted by the project are as follows:

- a) The primary beneficiaries are the commercial and subsistence tree growers and nursery operators who have gained access to improved varieties of pines, eucalyptus and clones for planting. The improved germplasm will greatly foster returns on their investments.
- b) The rural communities have had access to new job opportunities resulting from the project activities and outputs. For example the establishment of nurseries, silvicultural operations in plantations, and the medium- to long-term harvesting operations of forest products and by-

products are all potential opportunities jobs. Also plantations lead to increased supply and access to affordable wood products.

- c) Timber industrialists will be able to use the planting stock produced by the project to carry out reforestation work after logging so as to get adequate supply of raw material having high technological and commercial value.
- d) Down stream traders and processors and end users of tree products will benefit from increased availability, supply and improved customer tailored products.
- e) The country as a whole benefits due to the positive impact the reforestation project will have on the environment with increased reforested areas and fiscal revenues from the timber trade;
- f) Forestry protection law enforcers will benefit from reduced dependence on the natural forests as the plantations will provide alternative source of livelihood.
- g) The international timber market with the diversification of tree plantation products;
- h) The research community through the increasing biological potential of plantation forests.

5.1.7 Social Equity (gender roles, disadvantaged groups, access to resources)

The project mostly covers the research and development activities which will have social impact including poverty alleviation also, because the target beneficiaries and people living in and around the forests are directly/ indirectly dependent upon the forests products and services. More forest products will be available from the high quality planting material forests resulting into better economic returns and trade for forest products. Clonal eucalyptus growing potentially impacts on consumption of tree products by households. The main products that are currently derived by households from trees are firewood, building poles, charcoal and timber. Overall, firewood is considered the most important of these, followed by poles and posts. The socio economic baseline survey by NaFORRI revealed that the following social benefits could accrue from the introduction of clonal eucalypts growing:

Firewood is the main if not the only source of energy used for cooking in most rural households in Uganda. Reduced availability of firewood has critical socio-economic consequences for the rural poor, the national economy and the environment (World Bank), This is therefore an aspect of rural life upon which clonal eucalyptus can have far reaching impacts. The burden imposed by forest degradation on people's livelihoods - especially women and children - is exemplified by the sharp increase in the distance people have to travel to collect fire wood. According to the Uganda Integrated Household Surveys, the average distance traveled by households to collect firewood had increased dramatically between 1992 and 2000 from 0.06km to 0.73 km. The distance traveled is inversely related to the time members of the household can dedicate to other productive activities, and thus has a major impact on poverty. The clonal eucalyptus and improved seedlings have potential impact on the sources of tree products, distances to sources of the tree products, duration of collection expeditions and quantities of products collected and used by households.

Charcoal is used in most urbanizing areas as a source of energy for heating and cooking. It is also an important source of income for rural youths but is increasingly threatened by shrinking tree resources.

Charcoal is a highly commercialized tree product with most of it sold in the trading and urban centres. Few households use charcoal, bought either from local markets or individual producers within the villages. Due to increased scarcity of trees, charcoal burners now use any tree species they come across, which has resulted in decline in the quality of charcoal. Charcoal producers buy trees or use off cuts from trees felled for timber to produce charcoal. It is not used for household consumption but sold for income to people in trading centres. The business is mainly done by men and boys. Presently, there is growing shortage of trees for charcoal, in most districts and future supply of trees is not guaranteed due to increased demand as a result of urbanization. The price of charcoal increases as away from villages to urban centres; and range between 10,000/= per bag within the village, 15,000/= in the trading centre and 30,000/= in nearby towns. Clonal eucalyptus growing can increase the production that may lead to reduction in prices.

Building poles are used for roofing and wall support in traditional house construction. They are increasingly used in urbanizing areas as scaffolds in construction of storeyed buildings (scaffolding). Posts are mainly used for fencing livestock paddocks. Transmission poles are also urgently needed especially with the coming-up of the rural electrification programme. Clonal eucalyptus production therefore potentially impacts on the both urban and rural construction by providing poles and posts of good quality at an early age. The data collected from Abi clonal trial indicates that at four years, clonal eucalypt can provide transmission poles (Epila, et al, 2006).

Timber is the most commercialized tree product in most parts of Uganda. It is mainly used for house construction and making furniture. The timber used in households is purchased from timber dealers and some wealthier individuals convert their own trees to timber. The most preferred species are scarce due to over exploitation and slow rate of regeneration of most timber species. Fast growing clonal eucalyptus thus presents an opportunity for mitigating timber shortage in Uganda. There is an acute shortage of timber in most of the districts. Due to the scarcity of timber, people sometimes use it before it is fully dry. Attempts to address this will include planting clonal eucalyptus trees that are fast growing and provide a wide range of intermediate benefits. For example firewood and building poles in order to reduce pressure on the slow growing high quality timber tree species.

5.1.7 Sustainability

The management of private nurseries is a credible approach to sustainability in developing forest resources, as this means transferring the means of production to end-users. When this happens, sustainability is highly likely to be a reality. Continuity of project activities after project completion is ensured since by the end of the implementation, farmers and nursery operators will have acquired considerable knowledge and skills. Furthermore, training in basic business accounting through various project delivered courses will enable them to run financially viable operations.

Recommendation

The over-riding message from the case studies is that the most important promotional tool for any technology is demonstrable success. It is recommended that the project examine opportunities to support establishment of modest areas of plantation forest with a view to using these as a promotional vehicle for clonal technology adoption and development. The demonstration plantations should be structured according to the type of plantation scheme the various stakeholders intend to promote. These model plantations can be located on some of the progressive tree farms and monitored regularly to generate growth modeling, impact of good silviculture, disease etc.

Several key points are suggested:

- The model plantations should focus on quality rather than quantity. The core of the scheme should be to demonstrate the viability of producing financially viable, well managed plantations;
- The model plantations should have a strong research foundation. They should be founded on well-documented research trials and retain an experimental/research focus;
- The financial and business side of the plantations must be well-documented. A potential investor should be able to “open the books” to determine a project’s financial viability; and
- A demonstration forest should be founded on sound business principles, with well-defined market objectives and a detailed business plan.

6. Terminal Project Report Financial - Summary							
Title: Gatsby Club Tree Biotechnology Project							
Project Period: April 2006 - June 2009							
Total Grant: US\$ 878,000							
	1 APR 06 - 30 JUN 09		1 APR 06 - 30 JUN 09		1 APR 06 - 30 JUN 09		COMMENTS
INCOME:	ACTUAL		BUDGETED		VARIANCE		
	(shs)	(\$)	(shs)	(\$)	(shs)	(\$)	
KILIMO Grants:							
11th MAY 2006	959,400,000	533,000	953,280,000	529,600	6,120,000	3,400	
13th SEP 2007	483,000,000	280,000	448,000,000	280,000	35,000,000	-	
1st DEC 2008	68,177,850	34,963	140,000,000	70,000	(71,822,150)	(35,037)	
3rd FEB 2009	34,300,000	17,500	-	-	34,300,000	17,500	
26th JUN 2009	26,176,500	12,465	-	-	26,176,500	12,465	
Total Grants	1,571,054,350	877,928	1,541,280,000	879,600	29,774,350	(1,672)	
Regional Nurseries Sales :							
KIFU REGIONAL	85,728,200	42,864	164,004,400	82,002	(78,276,200)	(39,138)	It took a longer time than planned, at least a year, to set up the regional nurseries, especially Kifu, which was planned to be the multiplication centre for
KABAROLE REGIONAL	24,536,550	12,268	172,725,000	86,363	(148,188,450)	(74,095)	
MBALE REGIONAL	37,249,580	18,625	110,250,000	55,125	(73,000,420)	(36,500)	
				223,490	(299,465,070)		

	147,514,330	73,757	446,979,400			(149,733)	the clones. Hence, expected production in the first year did not occur until the second year, <i>circa</i> April 2008.
Royalties:							
CLUB NURSERIES	175,012,555	91,418	200,000,000	62,500	(24,987,445)	28,918	The drop in sales was due to franchisement of club nurseries starting April 2008.
	175,012,555	91,418	200,000,000	62,500	(24,987,445)	28,918	
Total Sales & Royalties	322,526,885	165,176	646,979,400	285,990	(324,452,515)	(120,814)	
OTHER CASH INFLOWS:							
LOAN INTEREST	15,347,697	7,674	366,000,000	183,000	(350,652,303)	(175,326)	The disbursement of loans was not as budgeted.
SAWLOG REFUND	-	-	675,000,000	337,500	(675,000,000)	(337,500)	The budgeted funds for this item were not received.
SubTotal	15,347,697	7,674	1,041,000,000	520,500	(1,025,652,303)	(512,826)	
TOTAL INCOME	1,908,928,932	1,050,777	3,229,259,400	1,686,090	(1,320,330,468)	(635,313)	
EXPENDITURE:							

KIFU REGIONAL	164,031,734	91,383	254,770,000	142,805	(90,738,266)	(51,422)	Initial budget proposal was for the establishment of 4 regional clonal nurseries in the first year but only 3 were eventually set up.
KABAROLE REGIONAL	115,177,100	62,131	141,638,000	78,519	(26,460,900)	(16,388)	
MBALE REGIONAL	124,437,693	67,260	125,580,000	70,490	(1,142,307)	(3,230)	
SubTotal	403,646,527	220,774	521,988,000	291,814	(118,341,473)	(71,040)	
					-		
CLUB NURSERIES	297,731,900	170,658	197,900,000	118,000	99,831,900	52,658	
SubTotal	297,731,900	170,658	197,900,000	118,000	99,831,900	52,658	
Other Tree expenses:							
WOODLOTS ESTABLISHMENT	81,000,000	45,000	261,000,000	135,000	(180,000,000)	(90,000)	The amounts received were less than budgeted funds.
TECHNOLOGY TRANSFER	7,050,000	3,920	85,000,000	45,000	(77,950,000)	(41,080)	The amounts received were less than budgeted funds.
FARMER TRAINING	27,000,000	15,000	38,000,000	20,000	(11,000,000)	(5,000)	
TRAINING (TECH & MGT)	14,039,000	7,250	47,000,000	25,000	(32,961,000)	(17,750)	
BOARD MEETINGS	39,573,000	22,322	37,800,000	21,000	1,773,000	1,322	
GENERAL	25,624,000	14,354	64,000,000	40,000	(38,376,000)	(25,646)	
MOTOR VEHICLE	45,000,000	25,000	54,000,000	30,000	(9,000,000)	(5,000)	Four-wheel drive utility vehicle UAH 122V was purchased in the first year.

MONITORING & EVALUATION & TRAVEL	44,662,500	22,331	190,400,000	99,000	(145,737,500)	(76,669)	The amounts received were less than budgeted funds.
PROJECT MANAGEMENT SALARIES	161,915,474	89,780	283,240,000	151,400	(121,324,526)	(61,620)	The budgeted remuneration levels were not implemented.
RESEARCH	115,893,000	61,050	170,000,000	90,000	(54,107,000)	(28,950)	The amounts received were less than budgeted funds.
SEEDS	43,300,000	21,650	48,000,000	30,000	(4,700,000)	(8,350)	
OVERHEADS	188,734,087	103,712	227,740,000	126,400	(39,005,913)	(22,688)	
LOAN FUND	303,403,484	160,702	630,000,000	324,000	(326,596,516)	(163,298)	The amounts received were less than budgeted funds.
SubTotal	1,097,194,545	592,070	2,136,180,000	1,136,800	(1,038,985,455)	(544,730)	
TOTAL EXPENDITURE	1,798,572,972	983,502	2,856,068,000	1,546,614	(1,057,495,028)	(563,112)	
NET SURPLUS / (DEFICIT)	110,355,960	67,275	373,191,400	139,476	(262,835,440)	(72,201)	

6. Annexes

Annex 1: List of Published and Unpublished Documents and Reports as Direct and Indirect Outputs

The following documents were formal outputs of the project:

1. **P.Kiwuso, D.Nkwasiabwe, and S.Byenek:** Introduction of *Eucalyptus* clones to Uganda. III. Preliminary study of pests and diseases. (Unpublished)

2. **J.F.O. Esegu, S. Namisi and J. Sekatuba:** Introduction of *Eucalyptus* clones to Uganda. II. Potential socio-economic impact. (Unpublished)

J.S Epila-Otara and J. Ndhokero: Introduction of *Eucalyptus* clones to Uganda. I. Site matching and selection. (Published)

References

Dr. Epila and Juma (2008): Introduction of *Eucalyptus* hybrid clones to Uganda forestry. I. Site matching and selection (unpublished).

SPGS plantation guideline no. 18 - may 2008 and SPGS issue no. 21.

Sarah B. Namisi, Jude Sekatuba, Francis Esegu, J.S. Epila Ojala, Moses Basoga, Paul Balitta and Richard Oluk (February 2007): Socio-economic Aspects of Clonal *Eucalyptus* Technology in Uganda: A Baseline study for Phase II (Draft Report)

Wakhusama, S. and B. Kanyi. (2002): Biotechnology in tree production: Crating a self sustaining production and dissemination system in Kenya. International Service for the acquisition of Agri-Biotechnology Applications (ISAA). Nairobi, Kenya.

Oballa, P., Chagala-Odera, E., Wamalwa, L., Oeba, V., Mutitu, E. and L.Mwangi (2005). The performance of *Eucalyptus* Hybrid clones and local landraces in Various agro-ecological zones in Kenya. International Service for the acquisition of Agri-Biotechnology Applications (ISAA). Nairobi, Kenya.

Associate Professor Philip Nyeko and Dr. Grace Nakabonge (October 2008): Occurrence of Pests and Diseases in Tree Nurseries and Plantations in Uganda- A Study Commissioned By The Sawlog Production Grant Scheme (SPGS)