



ENHANCING RURAL LIVELIHOODS IN MALAWI, TANZANIA AND MOZAMBIQUE

ANNUAL TECHNICAL REPORT: JULY 2006 TO JUNE 2007

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*A Program Implemented by Washington State University and Total Landcare
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EXECUTIVE SUMMARY

Enhancing Rural Livelihoods Project (ENRL) is being implemented by Washington State University and Total LandCare through a memorandum of agreement with funds from Philip Morris International for a period of 5 years. The aim is to enhance the livelihoods of rural communities in Malawi, Tanzania and Mozambique where most households live below the poverty line. The project began in November 2005 and has just completed its second year.

Purpose

The goal to improve rural livelihoods will be achieved through the following objectives:

1. Improve the economic use and management of natural resources on a sustainable basis with reduced soil and forest degradation focusing on the following:
 - Various forms of tree planting concentrated at the household level for ownership.
 - Sustainable management of natural woodlands.
 - Fuel-efficient tobacco barns and kitchen stoves to reduce wood consumption.
 - Planting local bamboo to replace wood for many products and uses.
2. Increase and diversify farm productivity to improve household food security, nutrition, and incomes through low-cost, sustainable systems of irrigation linked to good markets.
3. Enhance rural health standards by introducing safe water and sanitation.

TLC's Extension Approach

TLC uses an integrated demand-driven approach to address diverse needs with strong synergies to ensure impact and sustainability. TLC's principles focus on 1) empowering people to become self sufficient by transferring knowledge, skills and tools; and 2) building capacity and sustainability based on a policy of '*payment for goods and services*'.

Key Results to Date

1. Expansion of programs in Malawi based on TLC's extensive network and experience.
2. Official registration of TLC with the Governments of Tanzania and Mozambique.
3. Establishment of operational frameworks in all 3 countries to build a solid base for implementation and scaling up. This framework includes:
 - Recruitment of new staff at the management and field levels.
 - Procurement of offices, storage facilities, vehicles, motorcycles, equipment and supplies for forestry, irrigation and water programs.
 - Collaboration and support from Government Agencies and the Tobacco Industry.
 - Community sensitization and awareness about the project and related programs.
 - Assessments of needs and potentials on each project component.
 - Development of strategies and action plans for implementation.
4. Field results across all 3 countries:
 - 39,693 participating households in 1775 communities
 - 6,575,922 trees and bamboo seedlings planted
 - 1,227 ha of natural forest under management with 1,839,750 regenerating trees
 - 8,126 improved kitchen stoves constructed
 - 2,473 households involved with treadle pump irrigation and stream diversion
 - 24 shallow wells installed impacting 500-700 households
 - 118 households equipped with eco-pit latrines
 - 66 rocket barns, 78 pairs of draft oxen + equipment; 496 households using lime
5. Expenditures and commitments total \$1.494 million against a budget of \$1.515 million.

2006/07 WORKPLAN RESULTS

Introduction

This report describes activities carried out between July 1 2006 and June 30 2007. The original timeframe was changed to this period to coincide with tree and irrigation activities.

Project Organization and Management

Trent Bunderson and Zwide Jere oversee and manage the program in all 3 countries. TLC staff in Malawi also help with project setup needs in each country and provide assistance with field operations, training, accounting, reporting, monitoring and evaluation.

At the country level, programs are administered through a management unit comprising a project manager/administrator, field program manager, and accountant. At the field level, program activities are implemented through a network of field coordinators based in the districts where they operate. Each country is also testing the use of village-based extension volunteers to assist field coordinators to increase results and to promote sustainability.

Operational Set-up

1. Applications to register TLC in Mozambique and Tanzania as a non-profit, non-government organization were duly completed and submitted to the relevant authorities, who approved both applications in late September 2006. TLC was also granted permission to operate in the proposed district sites.
2. The organizational set-up in terms of staff recruitment, office and warehouse facilities was fully completed and operational in both Tanzania and Mozambique.
3. Local and dollar currency accounts were set up in Malawi, Mozambique and Tanzania to receive funds direct from WSU.

Delays in the registration process impacted the projects in both Tanzania and Mozambique in several ways. With no official status, TLC could not initiate any activity, including recruitment of staff and procurement of offices, vehicles and equipment. This affected the forestry programs in particular as nurseries could not be established in time for outplanting in December/January. In addition, procurement of vehicles in Tanzania was further impacted by delays in securing duty exemptions from Government and failure by Toyota Tanzania to honor these exemptions. This forced the need to hire 4x4 vehicles for 7 months to implement planned programs.

Funds totaling \$1,490,000 for the 2006/07 season were received in November 2006, which further affected forestry activities. Despite this delay, the recruitment of staff, establishment of offices and bank accounts, and procurement of vehicles, motor cycles and equipment facilitated operations, staff mobility and distribution of materials to project sites.

Procurement

A breakdown of procurements for each country is shown in **Table A**.

Collaboration with Other Stakeholders

During the 2006/07 workplan, TLC collaborated with several partners in each country to improve project implementation which included the following:

1. TLC held a meeting with PMI, Alliance One and Universal Leaf in Lilongwe to discuss modalities of integrating activities of ENRL with those of the tobacco companies in each country. In particular, it was agreed that TLC should operate in major tobacco growing districts/sites and that tobacco companies would help in the identification of farmer groups to work with. This is aimed at reducing duplication and conflicts in terms of extension delivery mechanisms.

Table A: Procurement Status Against Targets for 2006/07

Item	Unit	2006/07 Workplan					
		Malawi		Mozambique		Tanzania	
		Target	Status	Target	Status	Target	Status
Office Facilities and Capital Items							
Office Expansion/Construction	#	1	1	1	1	1	1
Office/Guest House Set Up *	#	N/A	N/A	N/A	N/A	1	1
Office Furniture	#	3	3	3	3	3	3
Warehouse Facilities	#	1	1	1	1	1	1
Computer, printer, accessories	#	N/A	N/A	1	1	2	2
GPS Units	#	4	4	1	1	1	1
Digital Cameras	#	4	4	2	2	2	2
Fax/telephone	#	N/A	N/A	1	1	1	1
4 x 4 Landcruiser **	#	2	2	1	1	1	1
7-Ton Truck	#	1	1	N/A	N/A	N/A	N/A
Motor cycles **	#	10	10	4	4	6	6
Mountain Bikes	#	20	20	N/A	N/A	N/A	N/A
Forestry Materials							
Sets of nursery seed/tubes/seed	#	1,200	1,200	150	150	150	150
Molds for Stoves	#	500	500	100	100	100	100
Demarcation/sign post for nat woodlands	#	1,000	Ordered	200	Ordered	500	Ordered
Irrigation Materials							
Treadle pumps (Kickstart MoneyMaker)	#	1,200	1,200	400	400	400	400
Delivery hoses (India)	30 m	1,200	1,200	400	400	400	400
Suction hoses (Malawi/Tz)	5 m	1,200	1,200	400	400	400	400
Input packs for treadle pumps	#	1,200	1,200	400	400	400	400
PVC pipes for stream diversion	6 m	100	100	20	20	N/A	N/A
Input packs for stream diversion	#	1,000	1,000	200	200	N/A	N/A
Water & Sanitation							
Hand Pumps for Shallow Wells	#	150	150	50	50	40	Ordered
Materials for Eco-Pit Latrines	# sets	600	600	400	400	400	400
ULT / AOI Programs							
Lime	MT	1,000	1,000	N/A	N/A	N/A	N/A
Improved Curing Barns	#	48	48	N/A	N/A	18	18
Draft-Oxen & Equipment	# prs	20	10	N/A	N/A	50	68

* TZ Offices built for \$5000 in the ATTT compound were replaced (with full cost recovery) due to space limitations. The new premises are fully equipped and also double as a guest house to save on accommodation costs for TLC Mw Staff.

** 1 Landcruiser per country & most motorcycles were purchased with 05/06 funds but were not delivered till 2006/07 due to delays in registering TLC

N/A = Not Applicable for this season

2. Tobacco companies in Mozambique and Tanzania continued support with field visits, transport and other logistics, as well as access to office and storage space. In Tanzania, ATTT also provided access to email and accounting services until TLC was able to secure its own office space and related services. In Mozambique, TLC is negotiating with Mozambique Leaf Tobacco to grant access to its wireless internet facility at Villa Ulongue, Angonia. In the interim, TLC is using a dial up system which is not as reliable.
3. TLC continued to assist Alliance One and Universal Leaf in the implementation of their tobacco forestry programs with the aim of improving skills, extension approaches, species selection, nursery operations, outplanting practices, tree management and harvesting. TLC is also supporting the companies with nursery and extension materials at full cost recovery. Recently, TLC translated tree nursery and agroforestry posters into Kiswahili for farmers in Tanzania.
4. TLC met with district, regional and provincial government authorities in each country a) to promote good collaboration and support, b) to improve understanding of existing policies and legal instruments that relate to project activities, and c) to brief all parties about project objectives and activities, which included taking officials to visit project sites.

Project Sites

Sites covered by the program include the following districts in each country:

Malawi:

- ◇ Rumphu & Mzimba (North);
- ◇ Kasungu & Dedza (Central);
- ◇ Machinga & Blantyre (South)

Tanzania: Urambo, Tabora, Nzega, and Uyui.

Mozambique: Tsangano, Angonia and Macanga Districts of Tete Province.

Staff Recruitment

The staff situation in each country is as follows:

Malawi: 1 Project Manager; 1 Accountant; 10 Field Coordinators; 2 Drivers; and 16 community workers.

Mozambique: 1 Assistant Project Manager; 1 Accounts Assistant; 4 Field Coordinators; and 1 Driver. TLC is currently recruiting a person to fill the position of Project Manager.

Tanzania: 1 Project Manager; 1 Field Program Manager; 1 Accountant; 7 Field Coordinators; and 1 Driver. The Project plans to recruit 14 community workers.

Implementation Activities

Activities to achieve project outputs are summarized under each result area as follows:

1. Improve the economic use and management of natural resources on a sustainable basis with reduced soil and forest degradation:

- Sensitizing and mobilizing communities, including setting up village committees to spearhead the implementation of each program.
- Training courses and demonstrations on all forestry interventions.
- Delivery of field supplies and inputs for tree nurseries.
- Conducting field days in successful villages.
- Facilitating in construction of improved wood stoves.
- Provision of technical support and materials for tobacco barns, oxen and liming.

2. Increase and diversify farm productivity to improve food security, nutrition, and incomes through low-cost irrigation systems linked to good markets:

- Assessment of irrigation potential in the target sites.
- Community sensitization and mobilization, including formation of irrigation clubs.
- Elaboration on criteria to guide farmer selection by irrigation club officials.
- Training of staff and farmers in the operation and maintenance of irrigation systems
- Distribution of irrigation inputs and signing agreements with qualifying farmers.
- Conducting demonstrations on various aspects of irrigation agronomy.
- Training farmers in product presentation and marketing.
- Conducting field tours to successful sites.

3. Enhance village and household health standards by introducing low-cost methods to provide safe water and sanitation:

- Community sensitization on general aspects of good health and sanitation.
- Assessment of old and potential sites for installing hand pumps on shallow wells.
- Training of village artisans in constructing concrete slabs for eco- pit latrines.
- Provision of materials for constructing slabs and lining shallow wells.

Highlights of Results to Date (All 3 Countries)

Table 1 summarizes results achieved in Malawi for 2006/07. The full complement of targeted activities were implemented in Malawi but at reduced scale in Mozambique and Tanzania for reasons mentioned above. This resulted in a late start of the planned forestry and irrigation activities which are time sensitive due to their seasonal nature.

Table 1: Summary of 2006/07 Field Results by Country

Program Component	Malawi	Mozambique	Tanzania	Total
Participation				
Districts (#)	6	3	4	13
Villages/Clubs (#)	1638	103	NA	1,741
Primary Societies (#)	NA	NA	34	34
Participating households (#)	31,466	1,854	6,373	39,693
Forestry Program				
Nurseries (#)	1,143	140	2	1,285
Bamboo Seedlings (#)	126,376	6,528	2,311	135,215
Tree seedlings (#)	6,522,143	239,442	31,389	6,792,974
Trees/Bamboo Planted (#)	6,303,958	238,264	33,700	6,575,922
Sustainable Mgt of Natural Trees/Woodlands				
Area under Management (ha)	952	26	249	1,227
Number of Regenerating Trees (#)	1,427,250	39,000	373,500	1,839,750
Improved stoves				
Villages (#)	420	58	38	516
Households (#)	7,406	628	92	8,126
Winter Irrigation				
Treadle Pumps				
Clubs (#)	149	27	45	221
Households (#)	1,108	245	222	1,575
Stream Diversion				
Sites/Clubs (#)	49	7	0	56
Households (#)	830	68	0	898
Water and Eco-Sanitation				
Shallow Wells with Hand Pumps				
Villages (#)	24	0	0	24
Households Impacted (#)	240	0	0	240
Shallow Wells Installed (#)	24	0	0	24
Eco-Sanitation Pit Latrines				
Villages (#)	14	1	0	15
Households Mobilized (#)	106	12	0	118
ULT / AOI Services				
Improved Tobacco Curing Barns (#)	48	0	18	66
Draft Oxen & Equipment (sets)	10	0	68	78
Lime Program (Households)	496	0	0	496

Organization of Results and Workplan for 2007/08

- Results for each country are documented separately below.
- Note that programs implemented by Alliance One and Universal Leaf on rocket barns, draft oxen and lime are consolidated after the country-specific reports.
- Financial expenditures are presented in the last section of this report.
- The **2007/08 Workplan and Budget** was submitted July 2 under separate cover.

MALAWI FIELD RESULTS

Table 2 shows results against targets with detailed narratives which follow.

Table 2: 2006/07 Field Results by Program for Malawi

	Target	Result	% Achieved
Participation			
Districts (#)	6	6	100%
Villages (#)	500	1,638	328%
Participating households (#)	12,500	31,466	252%
% Female participation		32	
Forestry Program			
Nurseries (#)	960	1,143	119%
Bamboo Seedlings (#)	250,000	126,376	51%
Tree seedlings (#)	5,750,000	6,522,143	113%
Outplanting & Conservation of Natural Trees			
Trees Planted (# all types)	6,000,000	6,303,958	105%
Homesteads/Farms/Boundaries (# trees)		2,393,761	
Communal Lands (# trees)		3,189,158	
Live Fencing (# trees)		44,297	
Roadside Planting (# trees)		191,885	
Stream Banks and Soil Fertility (# trees)		484,857	
Bamboo Planting (#)		120,476	
Fruit Trees (#)		18,944	
Live Barns (#)		6	
Natural Woodland Management			
Area under Management (ha)	100	952	952%
Number of Regenerating Trees	NA	1,427,250	
Improved stoves			
Villages (#)	120	420	350%
Households (#)	1,200	7,406	617%
Winter Irrigation			
Treadle Pumps			
Clubs (#)	100	149	149%
Households (#)	1,000	1,108	111%
Stream Diversion			
Sites/Clubs (#)	25	49	196%
Households (#)	250	830	332%
Water and Eco-Sanitation *			
Shallow Wells with Hand Pumps			
Villages (#)	80	24	30%
Households Impacted (#)	800	240	30%
Shallow Wells Installed (#)	80	24	30%
Eco-Sanitation Pit Latrines			
Villages (#)	50	14	28%
Households Mobilized (#)	600	106	18%
ULT / AI Services			
Improved Tobacco Curing Barns (#)	20		0%
Draft Oxen & Equipment	20		0%
Planters / Lime Program	2,200		0%

* Additional Hand-pumps en route from India, will be combined with next season's program.

Village and Household Participation

7 sites were selected in 6 Districts as follows:

- North: 1 site each in Rumphu and Mzimba
- Center: 2 sites in Kasungu; 1 site in Dedza
- South: 1 site each in Machinga and Blantyre

A total of 1,638 villages were involved in project activities benefiting 31,466 households (see **Table 2**). Results exceeded targets by 328% and 252% for village and household participation, respectively due to increased coverage by field coordinators, demands by communities and timely and adequate support from field coordinators and head office.

Training

The following training courses were conducted:

- A 4-day comprehensive irrigation training course for 38 TLC staff which included the 10 project staff. Topics covered included: irrigation policy; types of irrigation; high value irrigated horticultural crops; supply chains of irrigation equipment; soil fertility improvement & soil and water conservation; small earth dam construction; micro-financing and revolving funds; formation of farmer groups and associations; group dynamics; farmer training; workplan development; monitoring and evaluation.
- Field Coordinators organized courses for stakeholders to improve implementation. 15 1-day courses were held with 315 members of staff from government departments and NGOs.
- A 3-day irrigation course for 42 community workers/volunteers, of which 20 are under ENRL. Topics included: irrigation policy; assembly, use and maintenance of irrigation equipment; plot layout; river diversion; vegetable nursery management; crop husbandry; extension approaches; and smallholder micro-financing.
- Practical training courses and sensitization meetings for communities at selected villages in all district sites. Topics covered included leadership skills and group dynamics; development of village-based action plans; nursery management and outplanting; conservation of village forest areas; kitchen mud stoves; irrigation technologies and crop husbandry practices. A total of 274 courses were organized benefiting 11,229 farmers. In addition, 331 sensitization meetings were held reaching 34,596 villagers. Farmer courses were complimented with field days and demonstrations which totaled 29 and 444. Field days and demonstrations reached 3,368 and 11,628 farmers, respectively.

Forestry Program

1. Tree Nurseries and Outplanting

1,143 nurseries were established with 6,522,143 tree seedlings raised, of which 6,303,958 trees were planted, representing 105% of the target and 97% of the seedlings raised. 18,944 fruit trees were also planted as mother blocks to produce planting material for expansion. Species grown were citrus, mango, paw-paw and guava. In general, results on tree planting exceeded targets due to great interest by communities, commitment by field coordinators and a substantial increase in funding. In one area alone, villagers planted 2.5 million trees representing 40% of all trees planted under the project.

2. Planting of Local Bamboo

126,376 seedlings were raised from seed of which 120,476 were outplanted. Only 50% of the targeted seedlings were produced because planting bamboo from seed was new to some villages which raised skepticism about success. However, based on the performance of the outplanted seedlings most villagers have demanded more seed for the coming season.

3. Live Tobacco Barns

This practice involves planting trees to replace poles in building tobacco curing and grading barns. Use of live trees in this manner significantly reduces the need for poles, and hence reduces deforestation. Only 6 live barns were established due to limited exposure to this practice and but many more are planned for 2007/08.

4. Natural Tree Regeneration

This practice has enormous potential to increase the number and diversity of trees in rural areas due to the high inherent propensity for natural trees to regenerate. The advantages of this practice are: a) there is no need to undergo the high cost and effort of raising and outplanting tree seedlings; and b) high rates of survival and growth are assured due to well-established root systems of species well-adapted to the environment. Activities involved included identifying, demarcating, and managing village and individual forest areas. Management practices include harvesting dead wood, selective thinning of scrubby or malformed trees to give space for the development of the better stronger trees, and trimming shoots of young regenerating trees to promote vertical growth. Communities were also taught in the formulation by-laws to regulate the use of resources from the village forest areas. A total of 952 ha were demarcated against a target of 100. The number of regenerating trees in these areas was assessed at a conservative level, but will be quantified in more detail later after training in ecological inventory methods. The majority of villagers showed keen interest in this practice due to the multiple uses and benefits derived from natural woodlands. Hence, many more areas are to be designated for this purpose.

5. Improved Wood Stoves

7,406 households in 420 villages were using improved kitchen mud stoves vs. a target of 1,200 and 120. The results are having major impacts on livelihoods, especially women.

Irrigation Program

TLC is promoting 2 types of irrigation, namely treadle pump and river diversion. Results so far show significant impacts on the livelihoods of farmers in terms of food availability, improved nutrition and incomes. Below is a brief description of progress achieved under each system.

1. **Treadle Pump Irrigation:** 1,108 households in 149 clubs participated in treadle pump irrigation vs. targets of 1,000 and 100. 437 ha were irrigated under a variety of crops including maize, beans, paprika, onions, tomatoes, cabbages and leafy vegetables. The new 'Super MoneyMaker Plus' pump manufactured by Kickstart has proved very popular among farmers due to ease of operation and durability. Demands for this pump have increased greatly, including requests from Government agencies and NGOs.
2. **Stream Diversion:** 830 households from 49 sites were participating in stream diversion by June 2007. The sites include 60 km of canals and 64 ha under irrigated crops.

Safe Water and Ecological Sanitation

1. **Ecological Sanitation:** 106 households were using eco-sanitation pit latrines in 14 villages by the end of the reporting period. Results will increase as more effort is put in public awareness campaigns and training local artisans in the construction of dome-shaped concrete slabs for covering the pits.
2. **Safe Water:** 150 pumps were imported from India due to lower costs relative to pumps supplied by local vendors. More pumps were ordered than planned to save transport costs. 24 shallow wells were installed by June 2007 in 24 villages. TLC started rehabilitating existing hand dug wells that had reliable water but which were not properly protected. 126 new sites have been assessed for water quantity, quality, depth and reliability. Villagers are looking forward to this program as most of them have had no clean water for many years.

MOZAMBIQUE FIELD RESULTS

Table 3 shows results against targets with detailed narratives which follow.

Table 3: 2006/07 Field Results by Program for Mozambique

	Target	Result	% Achieved
Participation			
Districts (#)	3	3	100%
Villages (#)	250	103	41%
Participating households (#)	6,250	1,854	30%
% Female participation		25	
Forestry Program			
Nurseries (#)	400	140	35%
Bamboo Seedlings (#)	125,000	9,521	8%
Tree seedlings (#)	1,875,000	239,442	13%
Outplanting & Conservation of Natural Trees			
Trees Planted (# all types)	2,000,000	232,447	12%
Homesteads/Farms/Boundaries (# trees)		132,530	
Communal Lands (# trees)		18,960	
Live Fencing (# trees)		0	
Roadside Planting (# trees)		30,719	
Stream Banks and Soil Fertility (# trees)		50,238	
Bamboo Planting (#)		5,817	
Fruit Trees (#)		0	
Live Barns (#)		0	
Natural Woodland Management			
Area under Management (ha)	100	26	26%
Number of Regenerating Trees	NA	39,000	
Improved stoves			
Villages (#)	120	58	48%
Households (#)	1,200	628	52%
Winter Irrigation *			
Treadle Pumps			
Clubs (#)	30	27	90%
Households (#)	300	245	82%
Stream Diversion			
Sites/Clubs (#)	5	7	140%
Households (#)	50	68	136%
Water and Eco-Sanitation **			
Shallow Wells with Hand Pumps			
Villages (#)	40	0	0%
Households Impacted (#)	400	0	0%
Shallow Wells Installed (#)	40	0	0%
Eco-Sanitation Pit Latrines			
Villages (#)	30	1	3%
Households Mobilized (#)	400	12	3%
ULT / AI Services			
Improved Tobacco Curing Barns (#)	N/A		
Draft Oxen & Equipment	N/A		
Planters / Lime Program	1,000	0	0%

* Will increase as the program is still in progress this winter season

** Hand-pumps en route from India, will be combined with next season's program.

Village and Household Participation

5 sites were selected in 3 Districts as follows:

- Tsangano: 1 site
- Angonia: 3 sites
- Macanga: 2 sites

A total of 1,854 households in 103 villages participated in various project activities which represent 30% and 41% of the target, respectively (**Table 3**). Results are lower than planned due to the late start of activities which was affected by delays in the registration of TLC in Mozambique.

Training

The following training courses were conducted:

- A 3-day irrigation training course for 30 members of staff from TLC, NGOs and government. Topics covered included: irrigation policy; types of irrigation; high value irrigated horticultural crops; supply chains of irrigation equipment; soil fertility improvement & soil and water conservation; small earth dam construction; micro-financing and revolving funds; formation of farmer groups and associations; group dynamics; farmer training; workplan development; monitoring and evaluation.
- 2 1-day courses for 8 TLC staff on ecological sanitation and mud stoves.
- A 2-day course on forestry for 30 members of staff drawn from NGOs and government. 8 of these were TLC staff.
- Several practical training courses relating to project interventions were conducted to impart knowledge and skills on farmers in all the villages TLC is operating. Topics covered included leadership and management skills; development of village-based action plans; nursery management and outplanting; conservation of village forest areas; kitchen mud stoves; irrigation technologies and crop husbandry practices.

Forestry Program

1. **Tree Nurseries:** 140 nurseries were established with 239,442 tree seedlings (**Table 2**). Results are lower than targeted due to delays in the registration of TLC (see notes above) which limited time and resources to mobilize communities and nurseries for the season.
2. **Tree Outplanting & Management:** 232,447 trees were planted, representing only 12% of the target and 97% of the seedlings raised. Reasons for this are explained above.
3. **Planting of Local Bamboo:** Out of 9,521 seedlings raised, 5,817 were outplanted, representing 61% of the seedlings raised and only 8% of the project target. The main reason for the low achievement is that farmers are used to planting bamboo from rhizomes and hence are skeptical of using seed. However, given the performance of the outplanted seedlings, they are now convinced that use of seed is the best way to ensure fast growth.
4. **Natural Tree Regeneration:** A total of 26 ha were demarcated vs. a target of 100. There is high potential to scale up this intervention especially in Macanga district where natural woodlands are abundant. Efforts will focus on training villagers in management aspects and in the formulation of bye-laws. In the Tsangano and Angonia districts where the population density is high, the project will target bare hills and other degraded areas.
5. **Improved Wood Stoves:** 628 households adopted the technology in 58 villages. Reasons for the low achievement are explained above. However, demands for this technology are high due to the scarcity of fuel, especially in areas with high population densities.

Irrigation Program

There is high potential for both treadle pump and river diversion types of irrigation in the target sites. Despite a late start, good progress had been made with farmers responding well to the interventions. Results under each system are summarized below.

1. **Treadle Pump Irrigation:** The plan was to reach 350 households in 35 clubs in the 5 sites. The outcome of this was that 245 households were organized in 27 clubs representing 82% and 90% achievement, respectively. Just like the other activities, late commencement of the project and late recruitment of field coordinators affected the irrigation program.
2. **Stream Diversion:** The program has just been initiated with 68 households in 7 villages. There is great potential for river diversion both in terms of water availability and terrain. TLC plans to commit more resources on developing this technology in the district sites.

Safe Water and Ecological Sanitation

Implementation of this component of the project was hampered by delays in starting the project in Mozambique as stated above. However, good progress has so far been made with respect to procurement of 50 hand pumps from India for shallow wells. Site assessment and community mobilization have been done and installation will start in the coming month.

Regarding ecological sanitation, activities have started in 1 village where 12 households adopted eco-sanitation pit latrines. Field coordinators are currently mobilizing villagers and training artisans to scale up the program.

TANZANIA FIELD RESULTS

Table 4 shows results against targets with detailed narratives which follow.

Village and Household Participation

The Project covers 4 districts as follows:

- Urambo: Urambo North & South and Ussoke areas
- Tabora: Mabama and Tabora Central areas
- Nzega: Maki
- Uyui: Isikizya

A total of 34 Primary Societies were involved in various project activities benefiting 6,373 households (**Table 4**). Results exceeded targets by 164% and 102% for primary society and household participation, respectively. The success is attributable to a number of factors some of which included effective sensitization meetings, farmer to farmer extension and good collaboration with village leaders. This level of farmer organization forms a good basis to scale up the program in the coming year.

Training

The following training courses were conducted:

- 4 courses for the 9 field coordinators to provide orientation on project activities. Topics covered included: nursery management, tree outplanting and management; irrigation practices; crop management; construction of mud stoves; ecological sanitation and monthly reporting procedures.

- Field Coordinators organized 144 practical training courses for 3,328 farmers. Topics covered included development of village-based action plans; nursery management and outplanting; conservation of village forest areas; kitchen mud stoves; irrigation technologies and crop husbandry practices. In addition, various demonstrations were conducted to impart knowledge and skills to farmers in various technologies. A total of 201 demonstrations were conducted involving 9,600 farmers.

Table 4: 2006/07 Field Results for Tanzania Program

	Target	Result	% Achieved
Participation			
Districts (#)	4	4	100%
Primary Societies (#)	25	34	136%
Participating households (#)	6,250	6,373	102%
% Female participation		55	
Forestry Program			
Nurseries (#)	228	2	0.9%
Bamboo Seedlings (#)	125,000	2,311	1.8%
Tree seedlings (#)	1,375,000	31,389	2.3%
Outplanting & Conservation of Natural Trees			
Trees/Bamboo Planted (# all types)	1,500,000	33,700	2.3%
Homesteads/Farms/Boundaries (# trees)		16,002	
Communal Lands (# trees)		14,440	
Live Fencing (# trees)		947	
Roadside Planting (# trees)		0	
Stream Banks and Soil Fertility (# trees)		0	
Bamboo Planting (#)	125,000	2,311	1.8%
Fruit Trees (#)		0	
Live Barns (#)			
Natural Woodland Management (ha)	200	249	125%
Number of Natural Trees Regenerating (#)	NA	373,500	
Improved stoves			
Villages (#)	120	38	32%
Households (#)	1200	92	8%
Winter Irrigation			
Treadle Pumps			
Clubs (#)	40	45	113%
Households (#)	400	222	56%
Water and Eco-Sanitation			
Shallow Wells with Hand Pumps			
Villages (#)	40	Hand pumps for shallow wells have been ordered from India. Work to start soon. Mobilization of villagers on eco-sanitation underway.	
Households Impacted (#)	400		
Shallow Wells Installed (#)	40		
Eco-Sanitation Pit Latrines			
Villages (#)	30		
Households Mobilized (#)	400		
ULT / AI Services			
Improved Tobacco Curing Barns (#) *	71	18	26%
Draft Oxen & Equipment	30	72	240%
Planters / Lime Program			

* Rocket barn program scaled down for research & development with some funds sent to Malawi

Forestry Program

As mentioned earlier, results in Tanzania were far below the target because nurseries could not be established in time for outplanting due to delays in TLC's registration process and funding.

Details on results are provided below:

1. Tree Nurseries, Outplanting and Management

Only 2 nurseries were established with 31,389 tree seedlings (**Table 4**). This low level of achievement was due to the limited time available to raise seedlings, which normally should start in July and August. It is remarkable that the project was able to recruit staff and mobilize operations in October to produce even this low number of seedlings.

All the 31,389 seedlings were outplanted with high survival rates due to timely planting with the first rains. Generally, farmers responded very well to the program but they need time to understand and appreciate TLC's village-based extension approach vs. the top-down approach promoted in the past by the Tobacco Companies. In fact, the changes needed are far more difficult to accomplish than starting from ground zero. However, with the management structure now firmly in place with well qualified staff, offices, vehicles and field supplies, results will improve greatly during the 2007/08 season.

2. Natural Tree Regeneration

Natural tree regeneration has the greatest potential for producing wood given the abundance of land and strong control by the village governing structure.

During the short period available for implementing project activities, 249 ha of natural woodlands were identified and demarcated, including 2 hills in Mbola village. Leaders of primary societies are responsible for mobilizing communities to manage the woodlands in terms of selective thinning, trimming shoots of young regenerating trees and developing bye-laws to regulate resource utilization.

Villagers have expressed strong interest in the practice because of the lower effort and cost for establishment and management (see reasons cited under Malawi).

3. Planting of Local Bamboo

Only 2,311 seedlings were raised with all them outplanted. The result is very low due to the reasons mentioned above.

4. Improved Wood Stoves

92 households in 38 villages were using improved kitchen mud stoves which is 8% of the target. Sensitization and mobilization of villagers is continuing and better results are expected within the coming months.

5. Tree Trial at Tumbi Agricultural Research Station

A tree trial was established at Tumbi Agricultural Research Station to evaluate the potential of other tree species for the future.

The design was a randomized block design with 3 replications of each species with and without fertilizer. **Figure 1** shows the design and layout of the trial. Tree survival and growth rates at the age of 5 months were recorded and were analyzed statistically by multi-variate analysis with results in **Table 5** (see details in **Tables 5A-5C** and **Figures 1-3**).

Key points are summarized below:

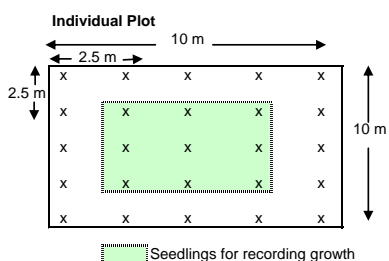
- Nursery seedlings were outplanted very young due to delays in starting the project (see comments in the introduction). Despite this, the trees are thriving well.
- The trial is being managed very competently with timely weeding and pruning practices.
- No plots received chemical treatment against termites or other insect pests.
- Mortality was very low; replacement of the few seedlings that died was done only in the 1st month after planting. No further replacements will be done in the interest of assessing the survival ability of each species.
- Application of fertilizer has shown no visible effects on tree performance to date. No additional fertilizer will be applied next season.
- Survival rates were high (94-100%), but mortality from termites is expected to increase for certain species during the dry season, especially *Acacia crasscarpa*.
- Analysis of growth rates showed strong differences between tree species (see **Table 5**).
- An overall ranking of species was performed by combining individual rankings for survival, height and basal diameter. Although it is far too early to draw any conclusions, it is encouraging that the 3 species currently recommended for both TLC and ATTT programs are all in the top 5 - *Senna siamea* (2), *Acacia polyacantha* (4), and *Albizia lebeck* (5).
- Two other species show excellent potential: *Albizia saman* ranked 1 in every category, and *Terminalia mantaly* ranked 3. This is a naturalized species originally from Madagascar and commonly planted in the Tabora region, mainly as an ornamental.
- The trial at Tumbi will continue for the life of the project to identify other promising species for the program. In addition, a new trial is proposed at TLTC's Urambo Seed Farm where other promising species will be evaluated against the top 5 here.

Table 5: Overall Tree Survival and Growth Rates, Tumbi Trial Tanzania, May 2007

Tree Species	Origin	Overall Rank	Survival %	Basal Diameter Cm	Height Cm
<i>Albizia saman</i> (rain or saman tree)	<i>S. America</i>	1	100.0	1.69	98
<i>Senna siamea</i> (cassia) *	<i>India / SE Asia</i>	2	99.3	1.56	56
<i>Terminalia mantaly</i> (mantaly) *	<i>Madagascar</i>	3	100.0	1.24	54
<i>Acacia polyacantha</i> (white thorn)	<i>Indigenous</i>	4	99.3	1.19	90
<i>Albizia lebeck</i> (woman's tongue) *	<i>India / SE Asia</i>	5	99.3	1.05	63
<i>Acacia crasscarpa</i> (crasscarpa)	<i>Australia</i>	6	94.0	1.16	82
<i>Acacia xanthophloea</i> (fever tree)	<i>Indigenous</i>	7	99.3	1.14	50
<i>Faidherbia albida</i> (winter thorn)	<i>Indigenous</i>	8	98.0	0.85	63
<i>Azadirachta indica</i> (neem) *	<i>India / SE Asia</i>	9	98.7	0.98	52
<i>Tectona grandis</i> (teak)	<i>India / SE Asia</i>	10	98.0	1.32	26
<i>Albizia procera</i> (tall albizia)	<i>India / SE Asia</i>	11	100.0	0.66	26
<i>Balanites aegyptiaca</i> (torchwood)	<i>Indigenous</i>	12	99.3	0.52	33
<i>Albizia glaberrima</i> (lowveld albizia)	<i>Indigenous</i>	13	98.0	0.84	41
<i>Acacia nilotica</i> (scented thorn)	<i>Indigenous</i>	14	96.7	0.59	31
Overall Means		7	98.6	1.06	55
Effect of Fertilizer	No significant effect on survival or growth ($p>0.1$)				
Species Differences	Strong significant difference between species ($p<0.01$ to $p<0.0001$)				

* Naturalized species in Tanzania

Figure 1: Tree Trial Design and Layout, Tumbi Tanzania



- Species in Full Trial**
- 1 *Acacia crassiparva*
 - 2 *Acacia nilotica*
 - 3 *Acacia polyacantha*
 - 4 *Acacia xanthophloea*
 - 5 *Albizia glaberrima*
 - 6 *Albizia lebbeck*
 - 7 *Albizia procera*
 - 8 *Albizia saman*
 - 9 *Azadirachta indica*
 - 10 *Balanites aegyptiaca*
 - 11 *Faidherbia albida*
 - 12 *Senna siamea*
 - 13 *Tectona grandis*
 - 14 *Terminalia mantaly*

- Code**
- AC
 - AN
 - AP
 - AX
 - AG
 - AL
 - APR
 - AS
 - AZ
 - BA
 - FA
 - SS
 - TG
 - TM

- Species for Observation**
- Acacia galpinii* (AGP)
 - Terminalia superba* (TS)
 - Milletia excelsa* (ME)
 - Acacia gerrardii* (AGD)
 - Bamboo (B)

- Plots for species observation
- Boarder/filler plots
- Treatment plots

Instructions for Trial Layout / Management

- 1 Plot layout is a randomized block design with blocking on fertilizer
- 2 3 replications (plots) per species (i.e., 3 plots per species / treatment)
- 3 Each plot measures 10 m x 10 m with seedlings spaced 2.5 m x 2.5 m
- 4 Pit size is 30 x 30 cm
- 5 25 seedlings per plot; 150 seedlings per species Total seedlings: 2100 Tubes: 2450
- 6 Total plots = 14 species x 6 plots = 84 plots; Total Area = 0.84 ha
- 7 Identify a site that is flat with uniform soils (avoid depressions and anthills)
- 8 No plots should receive any chemical treatment against termites.
- 9 Keep plot weed free 1 m around the seedling, and make a basin to catch rainfall
- 10 Select 6 Plants in central portion of each plot for measuring height and basal diameter (see shaded part of plot above)
If there are less than 6 surviving plants, select the 6 nearest plants to the center of the plot for the measurements

REP 3				REP 2				REP 1			
BLOCK 6		BLOCK 5		BLOCK 4		BLOCK 3		BLOCK 2		BLOCK 1	
AG Filler Plot	BA 3071	AN 2070	AZ 2057	APR Filler Plot	SS 1043	SS 3042	AL 3029	AX 2028	AP 2015	AL Filler Plot	
AX 3084	APR 3072	TG 2059	SS 2058	AC 1056	SS 1043	SS 3042	AL 3029	APR 2027	TM 2016	AS 1014	BA 1001
AL 3083	AN 3073	BA 2058	TM 2059	BA 1055	AX 1044	APR 3041	AG 3030	TG 2026	AG 2017	SS 1013	AC 1002
FA 3082	SS 3074	AG 2067	FA 2060	AP 1054	AS 1045	AP 3040	TG 3031	B		AN 1012	AZ 1003
TM 3081	BARE - ANTHILL OR DEPRESSION			FA 1053	AZ 1046	AZ 3039	AN 3032	AZ 2025	SS 2018	AX 1011	TG 1004
AS 3080	BARE - ANTHILL OR DEPRESSION			AX 1052	AL 1047	FA 3038	AS 3033	AL 2014	AC 2019	TM 1010	AG 1005
AG 3079	AZ 3075	AL 2066	AP 2061	TG 1051	TM 1048	AX 3037	TM 3034	AS 2023	BA 2020	AL 1009	FA 1006
TG 3078	AC 3076	AG 2065	APR 2062	APR 1050	AG 1049	BA 3036	AC 3035	FA 2022	AN 2021	AP 1008	APR 1007
FA Filler Plot	AP 3077	AS 2064	AX 2063	FA 5	AS - Filler Plot					TS	AGP
								TS	ME		ADG

Table 5A: Tree Survival Rates for each Species at 5 Months, Tumbi Trial Tanzania (May 2007)

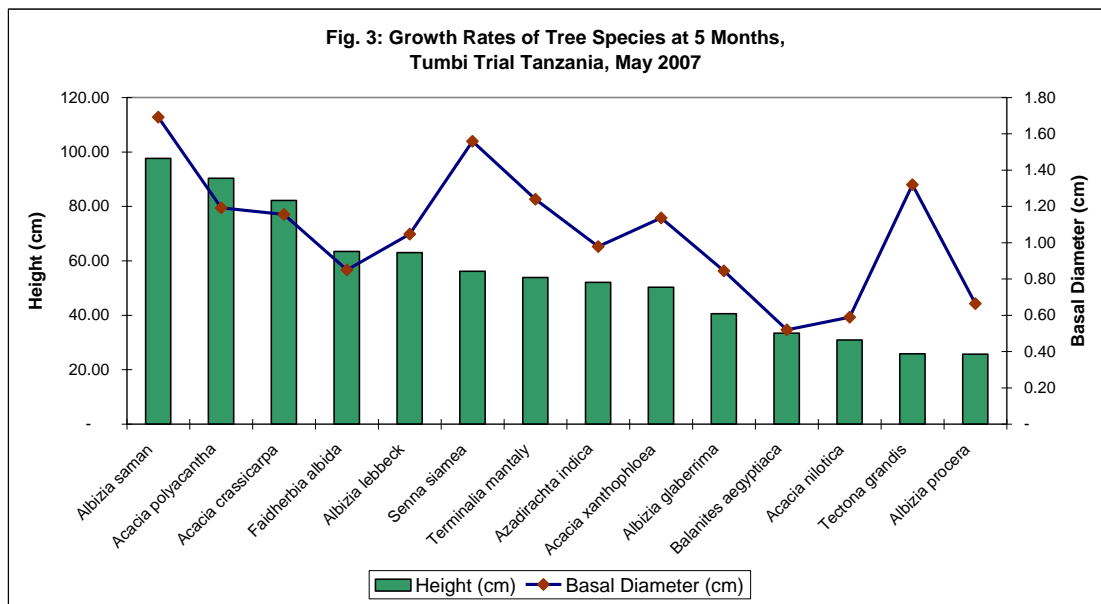
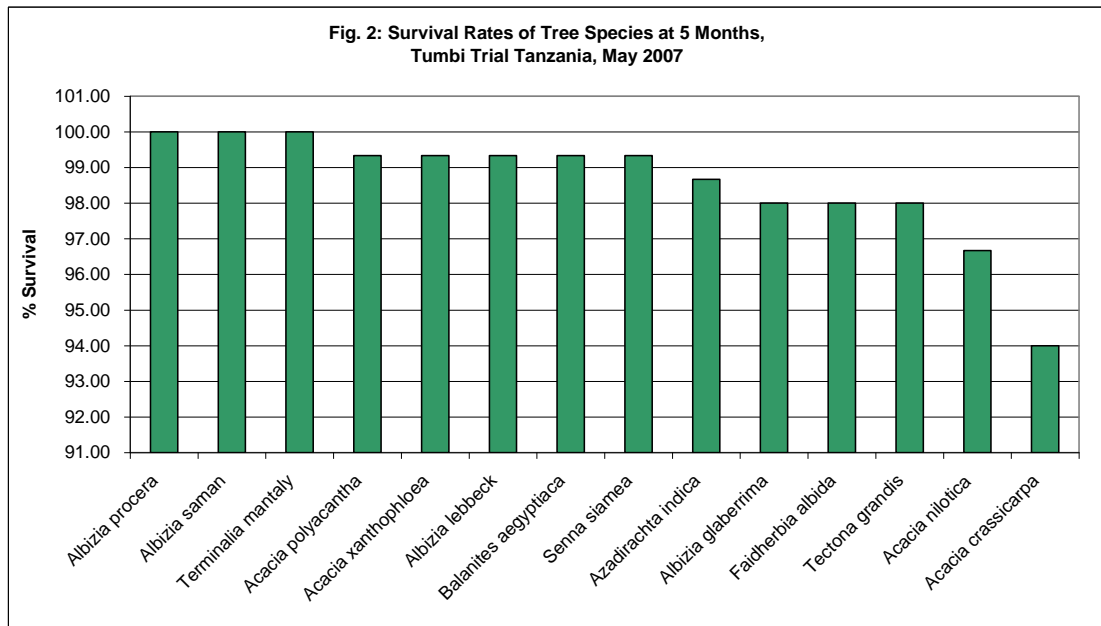
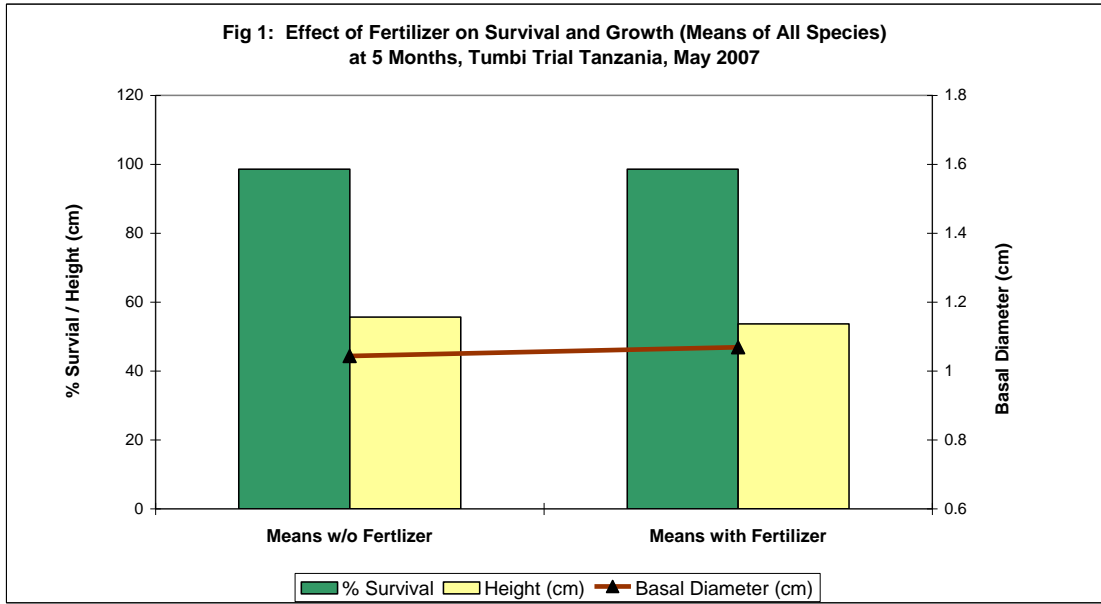
Tree Species	MEAN SURVIVAL %									
	No Fertilizer				With Fertilizer				Overall Mean	Rank
	Rep 1	Rep 2	Rep 3	Mean	Rep 1	Rep 2	Rep 3	Mean		
<i>Albizia saman</i>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.00	1
<i>Albizia procera</i>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.00	2
<i>Terminalia mantaly</i>	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.00	3
<i>Senna siamea</i>	100.0	100.0	100.0	100.0	100.0	96.0	100.0	98.7	99.33	4
<i>Balanites aegyptiaca</i>	100.0	100.0	100.0	100.0	100.0	100.0	96.0	98.7	99.33	5
<i>Albizia lebbeck</i>	100.0	100.0	96.0	98.7	100.0	100.0	100.0	100.0	99.33	6
<i>Acacia xanthophloea</i>	100.0	96.0	100.0	98.7	100.0	100.0	100.0	100.0	99.33	7
<i>Acacia polyacantha</i>	100.0	100.0	100.0	100.0	100.0	96.0	100.0	98.7	99.33	8
<i>Azadirachta indica</i>	100.0	100.0	92.0	97.3	100.0	100.0	100.0	100.0	98.67	9
<i>Tectona grandis</i>	96.0	100.0	100.0	98.7	100.0	100.0	92.0	97.3	98.00	10
<i>Faidherbia albida</i>	100.0	100.0	96.0	98.7	100.0	92.0	100.0	97.3	98.00	11
<i>Albizia glaberrima</i>	100.0	100.0	96.0	98.7	96.0	100.0	96.0	97.3	98.00	12
<i>Acacia nilotica</i>	100.0	100.0	92.0	97.3	96.0	100.0	92.0	96.0	96.67	13
<i>Acacia crassicarpa</i>	88.0	88.0	100.0	92.0	96.0	100.0	92.0	96.0	94.00	14
Means	98.9	98.9	98.0	98.6	99.1	98.9	97.7	98.6	98.57	
Effect of Fertilizer	No statistical difference between fertilized and non-fertilized plots (p>0.1)									
Difference between Species	Analysis shows a significant difference between species (p<0.01)									

Table 5B: Tree Basal Diameter for each Species at 5 Months, Tumbi Trial Tanzania (May 2007)

Tree Species	MEAN BASAL DIAMETER (cm)									
	No Fertilizer				With Fertilizer				Overall Mean	Rank
	Rep 1	Rep 2	Rep 3	Mean	Rep 1	Rep 2	Rep 3	Mean		
<i>Albizia saman</i>	1.7	1.7	1.7	1.7	2.1	1.8	1.3	1.7	1.69	1
<i>Senna siamea</i>	1.7	1.3	1.3	1.4	1.6	1.8	1.7	1.7	1.56	2
<i>Tectona grandis</i>	1.2	1.3	0.9	1.1	1.6	1.4	1.6	1.5	1.32	3
<i>Terminalia mantaly</i>	1.4	1.3	1.2	1.3	1.2	1.5	0.8	1.2	1.24	4
<i>Acacia polyacantha</i>	1.3	1.3	1.7	1.4	0.6	1.0	1.4	1.0	1.19	5
<i>Acacia crassicarpa</i>	1.0	1.2	1.1	1.1	1.2	1.3	1.2	1.2	1.16	6
<i>Acacia xanthophloea</i>	1.1	1.2	1.4	1.2	0.7	1.3	1.0	1.0	1.14	7
<i>Albizia lebbeck</i>	1.2	0.9	1.1	1.1	1.3	0.9	0.9	1.0	1.05	8
<i>Azadirachta indica</i>	0.9	0.9	1.0	0.9	0.8	1.3	1.1	1.0	0.98	9
<i>Faidherbia albida</i>	1.0	0.8	0.9	0.9	0.8	0.8	0.8	0.8	0.85	10
<i>Albizia glaberrima</i>	0.8	1.0	0.8	0.9	0.9	1.0	0.6	0.8	0.84	11
<i>Albizia procera</i>	0.4	0.7	0.5	0.5	0.9	0.7	0.8	0.8	0.66	12
<i>Acacia nilotica</i>	0.7	0.6	0.4	0.5	0.7	0.6	0.6	0.7	0.59	13
<i>Balanites aegyptiaca</i>	0.4	0.6	0.6	0.5	0.6	0.5	0.4	0.5	0.52	14
Means	1.05	1.04	1.03	1.04	1.08	1.13	1.00	1.07	1.06	
Effect of Fertilizer	No statistical difference between fertilized and non-fertilized plots (p>0.1)									
Difference between Species	Analysis shows a significant difference between species (p<0.0001)									

Table 5C: Tree Heights for each Species at 5 Months, Tumbi Tree Tanzania (May 2007)

Tree Species	MEAN HEIGHT (cm)									
	No Fertilizer				With Fertilizer				Overall Mean	Rank
	Rep 1	Rep 2	Rep 3	Mean	Rep 1	Rep 2	Rep 3	Mean		
<i>Albizia saman</i>	90	91	109	97	125	93	77	99	98	1
<i>Acacia polyacantha</i>	93	95	126	105	39	84	105	76	90	2
<i>Acacia crassicarpa</i>	86	87	68	80	74	92	86	84	82	3
<i>Faidherbia albida</i>	76	62	79	72	53	62	50	55	63	4
<i>Albizia lebbeck</i>	63	53	72	63	88	47	55	63	63	5
<i>Senna siamea</i>	66	42	50	53	54	64	61	59	56	6
<i>Terminalia mantaly</i>	66	51	58	58	49	67	33	50	54	7
<i>Azadirachta indica</i>	53	50	52	52	49	54	54	52	52	8
<i>Acacia xanthophloea</i>	57	55	51	54	43	47	50	46	50	9
<i>Albizia glaberrima</i>	35	44	40	40	46	50	28	41	41	10
<i>Balanites aegyptiaca</i>	26	39	40	35	34	35	27	32	33	11
<i>Acacia nilotica</i>	39	31	25	32	34	31	26	30	31	12
<i>Tectona grandis</i>	21	24	15	20	43	28	25	32	26	13
<i>Albizia procera</i>	10	26	21	19	37	30	30	32	26	14
Means	56	54	58	56	55	56	50	54	55	
Effect of Fertilizer	No statistical difference between fertilized and non-fertilized plots (p>0.1)									
Difference between Species	Analysis shows a significant difference between species (p<0.0001)									



Irrigation Program

The target for the year was to supply treadle pumps to 400 farmers in 40 clubs. By the end of June 2007, 117 farmers in 45 clubs were involved in treadle pump irrigation representing 29% and 113% achievement, respectively (**Table 4**). Farmers are growing a variety of crops ranging from maize, beans, tomatoes, onions, cabbages, okra, watermelon and cucumber. Results are much lower for farmer participation due to the late start of the program as highlighted above. Interest among farmers indicate that achievements will increase over the season.

Due to unreliable water flow in most rivers and the type of terrain, river diversion was found not suitable for the area. In this regard, resources will be redirected towards the promotion of treadle pump irrigation.

Safe Water and Ecological Sanitation

1. **Safe Water:** The plan for the 2006/07 workplan was to establish 40 water points in areas where there are water problems. Already, 40 pumps have been ordered from the supplier in India. Field Coordinators have identified the sites. The objective is to supply safe clean water and water for raising tree seedlings. The shallow wells are intended to be dug later in the season which is the ideal time to establish the natural water table.
2. **Ecological Sanitation:** The main activity was to sensitize villagers on the importance of good sanitation. Villagers were organized and artisans trained in constructing slabs. It is expected that building of the slabs and installation will be scaled up in the coming months.

ROCKET BARNS

Introduction

The introduction a new fuel-efficient flue-cured barn, known as the "Rocket Barn" is being implemented by Alliance One and Universal Leaf in Malawi and Tanzania with partial funding support from PMI. TLC is facilitating the administration and financial aspects of the program in the interest of reducing deforestation by saving wood.

Below is a summary of discussions about the current status of rocket barn program and plans for next season based on meetings between PMI, TLC, PROBEC, UNIVERSAL and AOI. Stakeholders attending the meetings and discussions are listed by date below:

March 10th: 1st Meeting at Nature's Gift:

PMI: Roque Basso
ProBec: Peter Scott, Christoph,
TLC: Zwide Jere, Trent Bunderson
AOI: Jim Henderson, James Munthali, Brush Baker, Chris Bishop, Ron Ngwira
LLTC: Tamanda Chidzanja

March 10th: 2nd Meeting at LLTC Guest House No. 1:

PMI: Roque Basso;
TLC: Zwide Jere, Trent Bunderson
Universal: Geoff Anderson and Lee Scott (Agronomy Director USA)

March 13th Meeting

ProBec: Peter Scott;
TLC: Trent Bunderson

March 20-22nd Trip to Tanzania

TLTC/ATTT: Colin Blair & Paulo Ratke;

TLC: Trent Bunderson

March 26th Meeting

ProBec: Peter Scott ;

TLC: Trent Bunderson; AOI: Jim Henderson, Ron Ngwira

LLTC: Tamanda Chidzanja

March 29-30th Trip to Tanzania

ProBec: Peter Scott;

ATTT: Paulo Ratke

April 4th Meeting

ProBec: Peter Scott; TLC: Trent Bunderson, Paul Garside

April 20th Meeting

ProBec: Peter Scott; TLC: Trent Bunderson; AOI: Jim Henderson, Ron Ngwira

LLTC: Tamanda Chidzanja

June 5th Meeting, Tanzania

TLTC: Colin Blair, Tony Calavrias, Peter Mkufya

AOTT: Makengo

ATTT: Anthony Rowan

TLC: Trent Bunderson, Zwide Jere, G. Siyeni, M. Banda, R. Mkufya, B. Omolo

Overview of Rocket Barn Program

1. Construction of Barns in Malawi

Barns under Research at Nature's Gift:

- 11 Rocket Barns, 2 Conventional Barns: Approx. \$10,000 – TLC to Reimburse ProBec
- Research Equipment: \$12,794 (paid)
- Design of Data Analysis Software: \$4,000 (approved but not delivered)
- Outstanding balance for AOI contribution to these barns: \$2,858

Barns with Farmers:

AOI: 18 Incomplete Barns
Claim submitted: \$9,104 (approved with report on location, status and needed work to complete the barns)

Universal: Unspecified number of Incomplete Barns
Claims submitted: \$10,700 (\$10,000 approved with report on numbers, location, status and needed work to complete the barns).

Total Costs: \$34,756 + \$4,000 for the data software to be purchased next year

2. Construction of Barns by ATTT in Tanzania

11 Rocket Barns with original furnace design and vertical feed of wood with modified vents
7 Rocket Barns with modified furnace vents plus horizontal feed.

Total Costs: \$28,710 (Includes all costs except bricks – i.e., building materials, labor, staff allowances, mason costs, transport, and chainsaw).

The location, size, furnace design, and tobacco company responsible for these 18 barns is shown in **Table 6**.

Table 6: Construction and Location of Rocket Barns in Tanzania, 2006/07

S/No.	Region	Area	Primary Society	Company	Dimensions	Furnace
1	Tabora	Mabama	KALOLA	TLTC	3.5m x 10m	Vertical
2		Mabama	UGOWOLA	TLTC	3.5m x 10m	Vertical
3		Mabama	WAKASUBI	TLTC	3.5m x 10m	Horizontal
4		Ulyankulu	JAFARY DEWJI	AOTTL	3.5m x 10m	Horizontal
5		Sikonge	ONE BARN	TLTC	3.2m x 6.25m	Horizontal
6		Sikonge	ONE BARN	AOTTL	3.2m x 6.25m	Horizontal
7		Tabora Central	MIGUNGUMILO	TLTC	3.5m x 10m	Vertical
8		Tabora Central	IBIRI	AOTTL	3.5m x 10m	Vertical
9		Ulyankulu East	KASIMANA	AOTTL	3.5m x 10m	Vertical
10		Nzega	ONE BARN	TLTC	3.2m x 6.25m	Horizontal
11	Urambo	Nguruka	MGANZA	TLTC	3.5m x 5 m	Vertical
12		Urambo North	NSANJO	TLTC	3.5m x 10m	Vertical
13		Ussoke	IGEMBENSAVILO	TLTC	3.5m x 5 m	Vertical
14		Ussoke	SIPUNGU	TLTC	3.5m x 10m	Horizontal
15		Urambo	SEED FARM	TLTC	3.5m x 10m	Vertical
16		Kaliua	USINDI	AOTTL	3.5m x 10m	Vertical
17		Urambo South	IMALAMAKOYE	AOTTL	3.5m x 10m	Vertical
18		Urambo North	JUHUDI	AOTTL	3.2m x 6.25m	Horizontal

3. Costs of Research Trials in Malawi Conducted by Peter Scott, Probec

- Salary of Researchers: \$ 40,000 from ProBec/GTZ
- Research Equipment: \$ 12,794 (paid by PMI - see above)
- Miscellaneous Costs: \$ 9,105 Contribution by AOI Malawi

4. Preliminary Results on Wood Consumption

P Scott, Probec Malawi: Despite multiple requests for a full report, nothing has been submitted to date. A mid term report was prepared April 20th but no electronic copy was sent for inclusion in this report. The mid-term report and meetings mentioned in the introduction indicate various modifications in the design of barn dimensions, furnace, vents, and channels.

Preliminary results on fuel-use efficiencies with wet wood from pine are as follows:

- 250 Stick Traditional Barn: 15 kg wood to 1 kg cured tobacco
- 250 Stick Venturi Conventional Barn: 6 kg wood to 1 kg cured tobacco
- 250 Stick Modified Rocket Barn: 3-4 kg wood to 1 kg cured tobacco

Tanzania: Visiting tobacco leaf experts from Brazil and Philip Morris indicated that the quality of cured tobacco in the rocket barns was outstanding. An evaluation of fuel efficiency is presented in **Table 7A & B** based on data compiled by Paulo Ratke of ATTT, Emmanuel Soko and Colin Blair of TLTC.

Analyzes of these data by Trent Bunderson indicate that small conventional flue barns use an enormous amount of wood equal to 26 tons or 43 m³ of dry wood per ton of cured tobacco. This strongly supports continued work to improve and scale up the use of rocket barns as their adoption by farmers **will dramatically and immediately reduce deforestation.**

The importance of this potential impact cannot be over-emphasized as there is no time lag and associated risks of raising and managing trees from seedlings to maturity.

Other observations include the following:

1. It is difficult to compare the different types of barns for several reasons:
 - ◇ Barns were of different size
 - ◇ Wood used came from different species with varying hardness and moisture content
 - ◇ Dates of curing were different (difference in weather conditions)
 - ◇ Leaf position and reaping no. varied
2. Despite the above difficulties, the following observations suggest greater wood-use efficiency of rocket barns relative to the other barns as follows:
 - ◇ Brazilian barns of the same size used 76% more wood (9.2 : 5.2 kg)
 - ◇ 630 stick Brazilian barns used only 17% more wood (6.1 : 5.2 kg)
 - ◇ Conventional 200 stick barns with flue pipes used 4 times more wood (26 : 5.2 kg)
 - ◇ Conventional 150 stick barns with flue pipes used 2.9 times more wood (20.4 : 5.2 kg)
 - ◇ Conventional 150 stick barns with brick channels used 2.6 times more wood (13.5 : 5.2)
3. Other Observations and Recommendations
 - ◇ Larger barns used 51% **less** wood than smaller ones (see Brazilian 480 vs. 630)
 - ◇ Conventional barns with brick channels used 50% **less** wood than ones with flue pipes
 - ◇ Wood used from Blue gum is 23% heavier than Senna (627 vs. 508 kg/m³)
 - ◇ Wood used from Indigenous trees is 7% heavier than Blue gum (672 vs. 627 kg/m³)
 - ◇ Standardize barn size, type of wood, and curing times for definitive comparisons
 - ◇ Research should include 480 – 600 stick barns to assess wood and cost savings
 - ◇ Promote rocket barns with a minimum capacity of 480 sticks for cost and wood efficiency, targeted at bigger farmers with the resources to fill these barns.

Table 7A: Summary of Curing Experiments with Different Barns, Urambo Seed Farm (2006/07) ¹

Barn Type	Test No.	Start Date	End Date	Total Days	No. of Tiers	Spacing (cm)	Leaf position	Reaping No.	Quality of cured tobacco	No. of sticks per barn	Kg Tobacco Cured		Leaf Wet: Dry Ratio	Wood Used		Kg per M ³ of Wood	Wood : Tobacco Ratio		Split	Wood Species
											Wet	Dry		Kg	M ³		Kg	M ³		
Rocket Barn (Vertical 480 stick)	1	15/2/07	23/2/07	8	4	25	Leaf	7	Good	480	1,872	259	0.14	1,425	2.9	491	5.5	11.2	No	Senna
	2	26/2/07	3/5/07	7	4	25	Leaf	9	Good	480	2,400	420	0.18	1,739	2.8	632	4.1	6.5	No	Gum
	3	3/10/07	17/3/07	7	4	25	Leaf	11	Very good	480	1,680	312	0.19	1,850	2.8	661	5.9	9.0	yes	Gum
	Mean			7.3	4.0	25.0	Leaf	9.0	Good-V. Good	480	1,984	330	0.17	1,671	2.8	595	5.2	8.9		
Brazilian 480 stick	1	2/2/07	2/8/07	6	3.5	25	lugs	4.5	Good	472	1,728	222	0.13	2,400	3.5	686	10.8	15.8	No	Indigenous
	2	19/2/07	26/2/07	6	3.5	25	Leaf	7	Good	490	2,515	270	0.11	1,959	3.2	612	7.3	11.9	No	Gum
	3	27/1/07	2/4/07	7	3.5	25	lugs	4	Good	441	1,940	155	0.08	2,018	3.0	673	13.0	19.4	No	Senna
	4	22/2/07	3/2/07	7	3.5	25	Leaf	8	Very good	481	2,150	313	0.15	2,180	3.4	641	7.0	10.9	No	Indigenous
	5	13/1/07	18/1/07	5	3.5	25	Priming	1	Good	439	1,043	101	0.10	1,320	2.5	528	13.1	24.8	No	Gum
	6	24/2/07	3/5/07	8	3.5	25	Leaf	9	Very good	470	2,357	447	0.19	1,703	3.6	473	3.8	8.1	No	Senna
Mean			6.5	3.5	25.0	Leaf	5.6	Good-V. Good	466	1,956	251.3	0.12	1,930	3.2	602	9.2	15.1			
Brazilian 630 stick	1	20/1/07	28/1/07	7	4.5	25	Lugs	2.5	Good	630	2,348	221	0.09	1,680	3.5	480	7.6	15.8	No	Senna
	2	25/1/07	2/3/07	7	4.5	25	Lugs	3	Very good	608	2,377	332	0.14	1,536	3.2	480	4.6	9.6	No	Senna
	3	27/1/07	2/2/07	6	4.5	25	Lugs	3	Good	630	2,892	328	0.11	2,149	3.4	632	6.6	10.4	No	Gum
	4	28/1/07	2/6/07	8	4.5	25	cutter	4	Good	630	2,460	284	0.12	2,380	3.5	680	8.4	12.3	No	Indigenous
	5	2/4/07	2/12/07	7	4.5	25	cutter	5	Very good	630	2,460	441	0.18	2,268	3.6	630	5.1	8.2	Yes	Gum
	6	28/2/07	3/10/07	9	4.5	25	Tip	10	Very good	630	3,065	554	0.18	2,268	3.6	630	4.1	6.5	Yes	Gum
Mean			7.3	4.5	25.0	Tip	4.6	Good-V. Good	626	2,600	360.0	0.14	2,047	3.5	589	6.1	10.5			
Conventional 200 stick (Flue pipes)	1	1/9/07	15/1/07	5	5	25	Priming	1	Good	173	519	48	0.09	1,701	2.7	630	35.4	56.3	No	Gum
	2	1/11/07	17/1/07	6	5	25	Priming	1	Good	200	464	44	0.09	1,612	2.6	620	36.6	59.1	No	Gum
	3	16/2/07	23/2/07	7	5	25	Leaf	7	Very good	200	740	108	0.15	1,440	3.0	480	13.3	27.8	No	Senna
	4	17/2/07	23/2/07	6	5	25	Leaf	5	Very good	189	756	117	0.15	2,040	3.0	680	17.4	25.6	No	Indigenous
	5	20/1/07	25/1/07	5	5	25	Priming	2	Good	195	636	66	0.10	1,104	2.3	480	16.7	34.8	No	Senna
	6	27/1/07	2/2/07	6	5	25	Lugs	3	Good	180	826	54	0.07	1,972	2.9	680	36.5	53.7	Yes	Gum
Mean			5.8	5.0	25.0	Lugs	3.2	Good-V. Good	190	657	72.8	0.11	1,645	2.8	595	26.0	42.9			
Conventional 150 stick (Flue pipes)	1	2/10/07	17/2/07	6	3	25	Smoking leaf	6	Good	180	575	99	0.17	1,827	2.9	630	18.5	29.3	Yes	Gum
	2	3/11/07	17/3/07	6	3	25	Tip	11	Very good	135	473	101	0.21	1,820	2.9	628	18.0	28.7	No	Gum
	3	18/3/07	25/3/07	7	3	25	Leaf	6	Good	135	641	74	0.12	1,820	2.9	628	24.6	39.2	Yes	Gum
Mean			6.3	3.0	25.0	Leaf	7.7	Good-V. Good	150	563	91	0.17	1,822	2.9	628	20.4	32.4			
Conventional 150 stick (brick channels)	1	2/10/07	17/2/07	7	3	25	Leaf	6	Very good	180	667	108	0.16	1,512	2.4	630	14.0	22.2	Yes	Gum
	2	3/11/07	17/3/07	6	3	25	Tip	11	Very good	135	470	101	0.21	1,424	2.3	630	14.1	22.4	No	Gum
	3	18/3/07	26/3/07	8	3	25	Leaf	6	Very good	135	675	128	0.19	1,606	2.6	630	12.5	19.9	Yes	Gum
Mean			7.0	3.0	25.0	Leaf	7.7	V. Good	150	604	112	0.19	1,514	2.4	630	13.5	21.5			

¹ Data compiled and provided by Paulo Ratke ATTT and Emmanuel Soko and Colin Blair TLTC.

Table 7B: Summary of Curing Experiments on Rocket Barns with Farmers and at the Urambo Seed Farm (2006/07) ¹

Primary Society	Test No.	Number of Sticks	Estimated Kg of Cured Tobacco	Wood Usd		Wood : Tobacco Ratio		Condition of Wood	Observations
				M ³	Kg ¹	M ³	Kg ¹		
Kalola	1	410	283	2.1	1,431	7.5	5.1	Dry	Native wood, very hard. Quality of tobacco is excellent. Vertical furnace.
Kasimana	1	390	269	1.9	1,277	7.1	4.7	Dry	Native wood, very hard. Quality of tobacco excellent.
Juhudi	1	436	301	1.8	1,223	6.0	4.1	Dry	Native wood, very hard. Quality of tobacco excellent. Horizontal front furnace.
Sipungo	1	296	204	2.1	1,384	10.1	6.8	Dry	Native wood, soft. Quality of tabacco is good. Horizontal front furnace.
Sipungo	2	341	235	1.9	1,243	7.9	5.3	Dry	Native wood, soft. Quality of tabacco is very good. Horizontal front furnace.
Imalamakoi	1	440	304	1.9	1,191	6.3	3.9	Dry	Blue gum, hard wood. Quality of Tobacco is the best. Vertical furnace.
Imalamakoi	2	454	313	2.4	1,613	7.7	5.1	Dry	Native hard wood. Quality of tobacco is the best. Vertical furnace.
Imalamakoi	3	440	304	2.9	1,949	9.6	6.4	Dry	Native hard wood. Quality of tabacco is very good. Farmer delay to increase temperature. Vertical furnace.
Ussoke	1	262	181	2.1	1,317	11.6	7.3	Dry	Blue gum, hard wood. Quality of Tobacco is good. Vertical furnace.
Seed Farm	1	480	259	2.9	1,425	11.2	5.5	Dry	Senna spp. Very hard. Quality of tobacco is good. Vertical furnace.
Seed Farm	2	480	420	2.8	1,739	6.5	4.1	Dry	Blue gum, hard wood. Quality of tobacco is good. Vertical furnace.
Seed Farm	3	480	312	2.8	1,850	9.0	5.9	Dry	Blue gum, hard wood. Quality of tobacco is poor. Vertical furnace.
Mean / Barn		409	282	2.3	1470	8.4	5.4	Dry	Hard wood. Good to excellent quality tobacco.
Range		262-480	181-420	1.8-2.9	1191-1949	6-11.6	3.9-7.3		

¹ Data compiled and provided by Paulo Ratke ATTT and Emmanuel Soko and Colin Blair TLTC. Estimates on kg of tobacco cured and kg of wood used calculated by T Bunderson based on Urambo Experiments in Table 7A.

5. Farmer Feedback on Rocket Design

TLC discussions with selected farmers indicated great interest in the rocket barn (fuel and cost savings) but there was a need to modify the furnace design to reduce risk of fire above the furnace and to allow use of longer lengths of wood (1.5 - 2 m vs. 0.5 m). The new furnace in Tanzania required huge amounts of labor to cut the indigenous hardwood in small 0.5 m pieces – this is simply not practical with hand labor using an axe.

Rocket Barn Field Program – AOI Malawi (Information from Ron Ngwira)

The program started with a few issues and constraints that hindered the success of the scaling up initiative. These include: incomplete design work, lack of materials and trained skilled masons, plus an overall late start.

1. Training

Training of builders was conducted jointly between Probec, Limbe Leaf and Alliance One Malawi Limited. Training of builders was done in two regions Mpherembe and Kasungu. Probec provided the trainer of trainers from two external engineering outfits. Alliance one sent 10 builders to each course representing a total of 20 masons trained for one week each. The training was overall problematic with inadequate construction material and untrained trainers. However the training was completed.

2. Barn Construction

The trained masons commenced building 18 barns of which only two were completed and one was actually used. Households therefore benefited from only the one completed barn.

Since the barns are still undergoing modifications and trials, it was a blessing in disguise that the program was not implemented to the initial intended scale. The new design and change from Dedza bricks is welcome; it also reduces costs. The new scale up will be much better having started earlier with a dedicated team of skilled masons and master mason. This shall guarantee success in the 2007/08 season.

Rocket Barn Report – LLTC (Information from Tamanda Chidzanja)

1. Introduction

After successful results from the initial Rocket barn trials at Mpale Scheme, it was decided to extend the practice for testing with smallholder farmers. Although the program started late in the season, it attracted the attention of farmers from all parts of the region due to the expected savings fuel and transportation costs for the same quality of tobacco.

2. Selection of Farmers, Barn Number and Location

Rocket barns were viewed by LLTC to function as a reward and motivation for growing good tobacco farmers. The selection of farmers to become the first beneficiaries of the technology was based on the following criteria:

1. Farmers who are dedicated, hard working and profitable growers of tobacco.
2. Farmers able to understand the impact of the technology on their livelihoods, tobacco in particular relative to their other old barns.
3. Farmers with the ability to supplement the materials needed for construction, i.e., separate from the specialized needs for the channels, furnace, chimney, and vents (see farmer contributions under **Table 8B**).

Table 7C shows the number, location and names of farmers and contractors who helped build the barns. The aim was to build 26 barns over a wide area to expose many farmers to the technology. Choice of site was also based on accessibility for easy monitoring and supervision.

Table 7C: Number and Location of Rocket Barns with Names fo Farmers and Contractors

Area	Barn No.	Location	Farmer's Name	Contractor
KSVP North	1	Chulu	MR CHING'ANYI	Mr Jembe
	2	Linyangwa	FRIDAY PHIRI	Mr Juma Kasalika
	3	Mpasadzi	BOSTON SOKO	Mr Muyande
	4	Mpasadzi	MR CHIRWA	Mr Moses Mzima
	5	Kasungu	C.O. MWENDA	Mr Jembe
	6	Linyangwa	MALISAWO BANDA	Mr Juma Kasalika
	7	Chitdzenje	HARRY KASESE	Lucinano Solomon
	8	Chulu	HARISSON GUNDE	Mr Jembe
	9	Mphungu	Mc ALEX MPANGO	Eneya Zimba
	10	Kasungu	MR THENGO	Eneya Zimba
KSVP South	1	Santhe	CHARLES B CHIKONJE	Dyson Bwereke John Kolonolio James Mgwebe Anthony Lungu
	2	Kamphulu	PETER FOLOMA	Dyson Bwereke
	3	Kamphulu	SICHO S BANDA	Gibson Kabuluzi
	4	Mpale	EDWARD MKOMBA	Mackson Pyson
	5	Mpale	ENOCK G KAMBADZO	Smiler Mwale
	6	Mpale	GRAFUDE BANDA	Joseph Mwangala
	7	Kapelula	PEARSON B BANDA	Kawaye Phiri
	8	Santhe	LYFORCE C MWALE	Training Program
	9	Santhe	S C GZEZA	Training Program
	10	Santhe	MALENGA S BANDA	Training Program
Kabwafu Project	1	Chitukuko	JOHN KUMWENDA	Mathews Shaba
	2	Kaswadongo	DAVIE CHISI	Mathews Shaba
	3	Tokatoka	PHILLIP MBWEWE	Champhley Mumba
	4	Titemwanenge	RICHARD TCHONGWE	Tyson Nyirenda
	5	Titemwanenge	JUSTIN CHIRWA	Watson Mdhuli
	6	Chipolopolo	ALICK NKHOMA	Tyson Nyirenda

Training

All building contractors were trained by LLTC, including 10 other builders from Alliance One International and a Brazilian agronomist working for ATTT in Tanzania. Training focused on the following:

- Barn measurements
- Barn construction
- Chimney, firebox, furnace construction
- Tier poles – size and number
- Roofing design and materials

A total of four barns were constructed during training: 3 in Santhe and 1 in Kabwafu before the builders were sent to help with constructing farmer barns.

The size of the trial rocket barns were as follows:

Barn Type	Length (Inside)	Width (Inside)	Height (Inside)	Combustion Chamber (Soft Bricks)	
				Dimensions	Height (Inside)
RB 480	1020	335	335	40 x 40	100
RB 250	710	280	260	40 x 40	100

Notes: All dimensions are in centimeters.

Status

Of the 26 barns constructed, none was fully completed and only 4 combustion chambers were constructed due to changes in design and problems with the timely supply of specialized Dedza bricks for the furnace. Currently most barns are intact except 3 that collapsed from heavy rains. The farmers whose barns collapsed agreed to reconstruct the barns.

Households

A total of 26 households were involved in the new barn technology trial. Farmers appreciated the technology, but complained that they were unable to see the results due to failures to complete construction.

Recommendations and Plans for 2007/08

- Barn modifications by Probec need to be finalized quickly.
- Builders need to undergo training on the modifications.
- Barns from last season need to be completed in time for the coming season.
- Farmers need training on how to build and use rocket barns.
- 30 more barns are targeted by LLTC in 2007 / 08 season.

Conclusions

The technology is welcomed by smallholder farmers as it will save on fuel and transport costs, while reducing demands on forest resources although it has not demonstrated assurance for quality tobacco. The modifications and supply of materials should be provided in a timely manner to demonstrate the potential of this barn with farmers. This will facilitate scaling up in the future.

Rocket Barn Plans for 2007/08

1. Modifications

Results above revealed the need for further design modifications. To test these modifications before the next tobacco season, it was proposed to grow 2-4 ha of tobacco under irrigation to assess the efficiency and quality of the cure. In addition, it was proposed to develop a software program to analyze all the data being collected. PMI has approved funds for the following costs in conducting these trials:

- Software program to analyze data from trials: \$ 4000
- Modifications of barns at Nature's Gifts for curing tests

2. Transferring Funds between Tanzania and Malawi

Costs for barns constructed in Tanzania were estimated by ATTT in April to total about \$25,000. Final costs with receipts were submitted by ATTT end of May. There was a substantial savings from

the original \$71,000 budget in Tanzania. There was also a savings on the Malawi budget for Draft Oxen as no program was implemented this year by Universal. Since PMI is very interested in supporting this program, transferring funds saved from this program to another activity is not possible. Based on the difference in the rocket barns programs between Malawi and Tanzania, PMI has approved the transfer of some funds from Tanzania to meet the costs in Malawi this season and next season.

3. Allowable Costs for use of PMI Funds

There appears to be confusion over who is responsible for what costs between PMI, the Tobacco Suppliers (Universal and AOI) and the farmers. Correspondence between TLC, Universal and AOI in Malawi and Tanzania since March 2007 indicates that expectations were not made clear and no written agreement exists. To clarify everything for next season, TLC recommends a written memorandum of agreement to avoid misunderstandings. **Table 8A** below suggests a breakdown of costs and expected partner contributions from PMI's perspective (see details in **Table 8B**).

Table 8A: Summary of Contributions by Each Partner for 2007/08
(100 x 250 Stick Barns in Malawi & 70 x 480 Stick Barns In Tanzania)

Partner	Nature of Contribution	Contribution Per Barn (USD)	Contribution in Malawi (USD)		Contribution in Tanzania (USD)		Totals for Barns in Mw & Tz (USD)
			Total \$	%	Total \$	%	
PMI *	Specialized materials and construction	\$ 392	\$ 35,238	22%	\$ 19,577	24%	\$ 54,815
JTI *	Specialized materials and construction	\$ 392	\$ 3,915	2%	\$ 7,831	10%	\$ 11,746
Farmers	Labor, bricks, other materials as per normal barn	\$ 272 Mw / \$ 121 Tz	\$ 27,164	17%	\$ 8,440	10%	\$ 35,604
ProBec	Research / Mgt Staff and related support	\$ 439	\$ 62,300	38%	\$ 12,400	15%	\$ 74,700
ULT/AOI Mw	Barns mods/Scott accomm/transport/training	\$ 166	\$ 28,200	17%	\$ -	0%	\$ 28,200
ATTT	Transport, training, staff allowances	\$ 386	\$ -	0%	\$ 27,025	33%	\$ 27,025
TLC	Administration / Finance / Comms / Reports	\$ 74	\$ 7,000	4%	\$ 5,500	7%	\$ 12,500
TOTAL			\$ 163,818	100%	\$ 80,773	100%	\$ 205,065

* Proposed to cover 50-60% of the farmer costs for tiers and bamboo in Malawi (\$60-75/barn) only for 2007/08 because of testing nature of program & related risks (needs approval from PMI/JTI)

4. Scale-up Plan

Research will continue at Nature's Gift to assess cost, quality and energy use in relation to a) design modifications, b) barn size, and c) type of wood using different tree species (Pine, Eucalyptus, Senna, Miombo, Acacia).

It is proposed to continue selected research trials of the rocket barns while simultaneously undertaking field tests of the latest modifications with selected farmers in Malawi and Tanzania. This will be implemented under a coordinated plan of construction and supervision that involves ProBec and TLC in both Malawi and Tanzania with support from the Tobacco Suppliers. PMI has also stipulated that the cost to produce the required "off-season" tobacco should be borne by the Tobacco Suppliers (2-4 ha at an estimated \$5000).

The target number of farmer barns is 100 in Malawi and 70 in Tanzania (see **Table 8A&B**).

5. Conclusions

Feedback is needed from PMI on the proposals above, in particular to clarify who funds what, and to assign clear responsibilities for the tasks needed. This requires a clear response from PMI on what exactly PMI is willing to fund.

Table 8B: Breakdown of Costs and Partner Contributions to Rocket Barn Program in 2007/08
100 x 250 Stick Barns in Malawi (90 PMI and 10 JTI) & 70 480 Stick Barns In Tanzania (50 PMI and 20 JTI)

Improved Wood Use Efficiency:

Rocket barns use an average of 4 kg vs. 15-20 kg of wood for traditional barns per kg cured tobacco.

In terms of wood and associated transport costs in Malawi @ USD18 per ton, savings equate to USD 200-300 per ton of tobacco

Current Costs of Rocket Barns: These are very high at present because of the R&D pilot nature of the program. Costs will drop dramatically once farmers and local builders are trained to build their own barns using local materials and with little or no support from the outside.

Item	Quantity /Barn	Cost/Unit	Cost/Barn	Cost/90 Barns	Cost/50 Barns	Cost/140 Barns
				(Total Cost for Malawi)	(Total Cost for Tanzania)	(Total Cost for Mw & Tz)
Custom Springer Bricks	200	10	2,000	180,000	100,000	280,000
Custom Wedge Bricks	40	10	400	36,000	20,000	56,000
Portland Cement (Bags)	4	1,600	6,400	576,000	320,000	896,000
7' Corrugated Roofing	4	945	3,308	297,675	165,375	463,050
28 Gauge Flat Sheet 76x180cm	7	840	5,880	529,200	294,000	823,200
28 Gauge Flat Sheet 240x90cm	2	2,500	5,000	450,000	250,000	700,000
Round Bar 6mmx6m	1	960	960	86,400	48,000	134,400
Plastic Sheet (Roll)	1	3,100	3,100	279,000	155,000	434,000
Soft Wire (Kg)	1	360	180	16,200	9,000	25,200
4" Hinges	2	135	270	24,300	13,500	37,800
2" Hinges	4	60	240	21,600	12,000	33,600
Roofing Nails (Kg)	1	210	210	18,900	10,500	29,400
6" Nails (Kg)	1	190	143	12,825	7,125	19,950
5" Nails (Kg)	1	190	95	8,550	4,750	13,300
3" Nails (Kg)	2	190	428	38,475	21,375	59,850
2" Nails (Kg)	2	190	428	38,475	21,375	59,850
1"x8" Timbers	2	1,550	2,325	209,250	116,250	325,500
2"x4" Timbers	1	1,800	900	81,000	45,000	126,000
Quarry Stone for Lintle	0.2	1,000	200	18,000	10,000	28,000
Secure Material Storage (On Site)	1	750	750	67,500	37,500	105,000
Specialized Building Team	1	20,000	20,000	1,800,000	1,000,000	2,800,000
Metal & Woodworking Team	1	1,600	1,600	144,000	80,000	224,000
TOTAL COST (MWK)			54,815	4,933,350	2,740,750	7,674,100
TOTAL COST (USD)			392	35,238	19,577	54,815

Item	Quantity /Barn	Cost/Unit	Cost/Barn	Cost/10 Barns	Cost/20 Barns	Cost/30 Barns
				(Total Cost for Malawi)	(Total Cost for Tanzania)	(Total Cost for Mw & Tz)
Custom Springer Bricks	200	10	2,000	20,000	40,000	60,000
Custom Wedge Bricks	40	10	400	4,000	8,000	12,000
Portland Cement (Bags)	4	1,600	6,400	64,000	128,000	192,000
7' Corrugated Roofing	4	945	3,308	33,075	66,150	99,225
28 Gauge Flat Sheet 76x180cm	7	840	5,880	58,800	117,600	176,400
28 Gauge Flat Sheet 240x90cm	2	2,500	5,000	50,000	100,000	150,000
Round Bar 6mmx6m	1	960	960	9,600	19,200	28,800
Plastic Sheet (Roll)	1	3,100	3,100	31,000	62,000	93,000
Soft Wire (Kg)	1	360	180	1,800	3,600	5,400
4" Hinges	2	135	270	2,700	5,400	8,100
2" Hinges	4	60	240	2,400	4,800	7,200
Roofing Nails (Kg)	1	210	210	2,100	4,200	6,300
6" Nails (Kg)	1	190	143	1,425	2,850	4,275
5" Nails (Kg)	1	190	95	950	1,900	2,850
3" Nails (Kg)	2	190	428	4,275	8,550	12,825
2" Nails (Kg)	2	190	428	4,275	8,550	12,825
1"x8" Timbers	2	1,550	2,325	23,250	46,500	69,750
2"x4" Timbers	1	1,800	900	9,000	18,000	27,000
Quarry Stone for Lintle	0.2	1,000	200	2,000	4,000	6,000
Secure Material Storage (On Site)	1	750	750	7,500	15,000	22,500
Specialized Building Team	1	20,000	20,000	200,000	400,000	600,000
Metal & Woodworking Team	1	1,600	1,600	16,000	32,000	48,000
TOTAL COST (MWK)			54,815	548,150	1,096,300	1,644,450
TOTAL COST (USD)			392	3,915	7,831	11,746

Table 8B: Breakdown of Costs and Partner Contributions to Rocket Barn Program in 2007/08 (page 2)

Farmer's Contribution	Item	Quantity		Cost/Barn	Cost/100 Barns	Cost/70 Barns	Cost/170 Barns
		/Barn	Cost/Unit		(Total Cost for Malawi)	(Total Cost for Tanzania)	(Total Cost for Mw & Tz)
	Burned Bricks (190x90x90mm)	9,000	0.005	45	4,500	3,150	7,650
	Mud Bricks (300x140x100mm)	1,500	0.005	8	750	525	1,275
	Thatch (Bundles)	70	0.36	25	2,500	Moved to ATTT	2,500
	Sand (Tonnes)	6	0.71	4	429	300	729
	Ox Cart to Move Sand	1	14.29	14	1,429	1,000	2,429
	Linear ties for thatch	50	0.14	7	714		714
	Bamboo	62	0.18	11	1,107	These items moved to ATTT	1,107
	Tiers (10-12cm)	16	4.29	69	6,857		6,857
	Tiers (8cm)	10	3.93	39	3,929		3,929
	Dagga Boy (Days)	21	1.07	23	2,250	1,575	3,825
	Laborer (Days)	21	1.29	27	2,700	1,890	4,590
TOTAL COST (USD)		Cost/Barn: \$272 in Mw / \$121 in Tz			27,164	8,440	35,604

* These items and their transport are expensive for the farmer, especially when he/she already has a functioning barn. Until the farmer is convinced of the efficiency and savings with the rocket barn, it will be difficult to commit extra funds for these items. The purpose of this season is to demonstrate the benefits to farmers under typical farm conditions to facilitate scaling up in 2008/09 with stronger support and interest from farmers. Given this situation, perhaps PMI would be willing to meet 50% or more of the cost for these items, recognizing the risk of setting a precedent that would raise expectations for this to continue.

ProBEC Contribution	Item	Cost/Barn	Cost/100 Barns	Cost/70 Barns	Cost/170 Barns
			(Total Cost for Malawi)	(Total Cost for Tanzania)	(Total Cost for Mw & Tz)
	Peter Scott Salary	235	40,000		40,000
	Peter Scott Summer Replacement	38	6,400		6,400
	Full Time Malawian Supervisor	9	1,600		1,600
	Support Staff Travel Costs	35	6,000		6,000
	Accommodation (Field Visits)	18	3,000		3,000
	Travel for Project Manager	18	3,000		3,000
	Transportation & Fuel	12	2,000		2,000
	Phone Credit for Staff	2	300		300
	Tanzanian Project Manager	38		6,400	6,400
	PManager Accommodation & Food & Phone/Email	7		1,200	1,200
	Full Time Tanzanian Supervisors (3)	28		4,800	4,800
TOTAL COST (USD)		439	62,300	12,400	74,700

Limbe Leaf / A1 Malawi Contribution	Item	Cost/Barn	Cost/100 Barns	Cost/70 Barns	Cost/170 Barns
			(Total Cost for Malawi)	(Total Cost for Tanzania)	(Total Cost for Mw & Tz)
	R&D at Nature's Gift (modifications May-June)	31	5,200	-	5,200
	Peter Scott Accommodations	24	4,000	-	4,000
	Off Season Crop (Aug-Dec 2007)	24	4,000	-	4,000
	Transport / Training	88	15,000	-	15,000
TOTAL COST (USD)		166	28,200	-	28,200

ATTT Tanzania Contribution	Item *	Quantity/Barn	Cost/Unit \$	Cost/Barn \$	Cost \$ /70
					Barns (Total Cost for)
	Night Allowances for ATTT staff			30	2,100
	Linear ties for thatch	50	0.14	7	500
	Bamboo	62	0.18	11	775
	Tiers (10-12cm)	16	4.29	69	4,800
	Tiers (8cm)	10	3.93	39	2,750
	Material transport			80	5,600
	Transport (David Ross)			150	10,500
TOTAL COST (USD)				386	27,025

* Excludes costs of overseeing the project, purchasing, accounting, reporting results etc.

TLC Contribution	Administering Project & Accounts	Cost per Barn	Cost per day	Days/Annum- Malawi	Days/Annum - Tanzania	Total	Total Cost for
						Days/Annum (Mw + Tz)	Malawi & Tanzania
	Meetings with Partners		250	6	4	10	2,500
	Field Checks on work progress		250	6	4	10	2,500
	Checking accounts / receipts		250	5	4	9	2,250
	Summarizing meetings/reports		250	5	4	9	2,250
	Correspondence/emails/phone calls		250	4	4	8	2,000
	Transport for field visits		250	2	2	4	1,000
	Volunteer from Engineers without Borders at no cost to TLC						
TOTAL COST (USD)		74		28	22	50	12,500

Note: The above breakdown of costs and contributions, once discussed and agreed, should be included in a management agreement signed by each partner clarifying specific responsibilities and commitments in terms of technical support, financial and in-kind contributions, implementation, and reporting.

LIME PROGRAM – IMPLEMENTED BY AOI MALAWI

This program is in its second year and has proved very popular with farmers. Non contracted farmers are buying lime on their own having been convinced from the observed benefits. Details below were based on information supplied by Ron Ngwira.

Purchase and Deliveries

1000 metric tons (Mt) of lime were purchased and delivered with 67 Mt remaining in stock which was earmarked for the burley program that never got applied. The remaining 933 Mt was divided and applied for 496 households.

Training and Application

The farmers were trained in the application and benefits of lime through field days and demonstration plots. The application was done through incorporation at the time of ploughing, and in some cases when building the ridges prior to the onset of the rains. The rate remained the same as the last year at an equivalent of 2 MT per ha of which half was applied to the maize and half on the tobacco.

Cost and Results

The lime landed on average at around U.S \$ 80 /Mt in the villages with roughly half the cost lime and similar amount transport. This being the second year some exciting observations and result are showing, although the imperial data is not complete the overall program results are very encouraging in yield and quality for tobacco

Year	2004	2005	2006	2007
Yield Kg/Ha	650	850	1056	1380
Avg Price U.S \$	1.21	1.31	1.34	1.85

Although this season had a lot of rain and overall yields are down the smallholder FCV program registered an average increase in yield of 300 + Kg and an improved quality of 60 cents +. The maize response, although not quantified, can be seen by the huge response through the increased interest and demand for this product. Average reported yields of maize for contracted farmers were 2.8Mt /ha.

2007-2008 Plans

Lime: 1000 Mt for Small-scale Flue Cured Tobacco
267 Mt for Small-scale Burley Tobacco

Conclusion

With the overall improvement of farmer results and increases in yield, quality and repayment from farmers, the AOI small-scale FC tobacco farmers are improving their livelihoods and understanding the overall importance and timing of agronomic practices. This has led to farmer complying to deadlines much earlier and without the need to force them to do it. The farmers are actually a few steps ahead of the program due to the fact that they have seen and reaped the benefit from the maize and tobacco.

DRAFT OXEN PROGRAM IN MALAWI AND TANZANIA

Introduction

Alliance One has programs on draft oxen in both Malawi and Tanzania, while Universal Leaf operates only in Tanzania. The AO program in Malawi is new, while its operation in Tanzania has been running for over 2 years with 100 Primary Societies in the 4 regions of Tabora, Urambo, Kahama and Mpanda. Universal operates a smaller program with 15 Primary Societies in Tabora and Urambo.

The report below was compiled from information supplied by James Munthali of AO Malawi, by Claudio Fischer and Jeff Kockott from AOTT, and by Emmanuel Soko and Colin Blair from TLTC. Their contributions in helping to produce this report are gratefully appreciated.

Purpose and Goal

Over 95% of tobacco growers in both countries still depend on hand hoe cultivation while less than 5% use oxen and tractors. Among other factors, continued use of hand hoe cultivation in farming will limit the growth of the agricultural sector due to the demand and scarcity of labor. Given this situation, it is difficult to reach the national targets for tobacco in terms of quantity and quality by the year 2010 while addressing needs for other crops. In many tobacco growing areas, most farmers do not have the culture of keeping cattle and using them in farming.

The goal of introducing draft oxen is to raise the production of quality tobacco, to reduce human labor (especially child labor), and to provide opportunities to increase household income. By providing the opportunity to use draft oxen, the production capacity and efficiency of tobacco farmers will be increased, as well as their income. As such, both tobacco companies have initiated programs to train oxen and to educate farmers on the use of oxen in farming. The focus is to target farmers who already have livestock and who understand the importance of proper animal care. Trained oxen are then returned to farmers who have been sensitized and are motivated to use and care for the animals properly.

Objectives

- To raise production of tobacco in order to reach the National targets
- To reduce manual human labor, with a focus on children
- To improve efficiency on transporting fuel wood and tobacco (i.e. the latter includes green leaf from the field to the barn and tobacco bales to the market)
- To improve tobacco quality by minimizing leaf loss and breakages during transportation.
- To reduce women workload of fetching water and firewood for domestic use
- To increase the opportunity for children to go to school (through reduction in child labor and women workload and increasing incomes)
- To generate other income e.g., by hiring out oxen for farming and carrying goods.
- To increase use of animal manure for soil fertility.

Results

PMI is providing financial resources to support the draft oxen programs of both companies with the aim of reducing the cost to the farmer for draft equipment – namely ox-carts, ploughs, ridgers and related accessories. Funds supplied for this purpose total USD 10,000 to AO Malawi, USD 20,000 to AO Tanzania, and USD 10,000 to TLTC.

Total expenditures by AOI Malawi are shown in **Table 9** for 10 pairs of oxen and related equipment, including costs of feed and animal care. The costs of ox-carts, ridgers and ploughs are very expensive in Malawi relative to Tanzania, perhaps because there is little competition with production based in the capital of Lilongwe. With sales to farmers at 75% of the total cost of the oxen and equipment, it will be possible to purchase more oxen and equipment. Oxen and equipment have yet to be distributed and sold to interested farmers due to training needs.

Table 9: AOI Mw Costs for 10 Pairs of Oxen and Equipment Including Stalls, Feed and Vet Care

Item	No. of Units	Unit Cost			Total Cost		Total Contribution	
		MK	+17.5% Tax	USD	MK	USD	AOI & Farmers	PMI
Oxen and Related Care *								
Oxen	20	22,500	0	\$ 160.71	450,000	\$ 3,214	\$ 3,214	
Training	20	8,400	0	\$ 60.00	168,000	\$ 1,200	\$ 1,200	
Vet expenses /medicines	20	4,000	4,700	\$ 33.57	94,000	\$ 671	\$ 671	
Feeds	20	5,000	5,875	\$ 41.96	117,500	\$ 839	\$ 839	
Transport animals	4	60,000	70,500	\$ 503.57	282,000	\$ 2,014	\$ 2,014	
SubTotal					1,111,500	\$ 7,939	\$ 7,939	\$ -
Ox Equipment								
Plough	8	34,750	40,834	\$ 291.67	326,670	\$ 2,333		\$ 2,333
Plough (Kalaria)	2	31,000	36,425	\$ 260.18	72,850	\$ 520		\$ 520
Ridger	10	31,500	37,013	\$ 264.38	370,125	\$ 2,644		\$ 2,644
Chains	10	1,915	2,250	\$ 16.07	22,501	\$ 161		\$ 161
Ox-cart (Ngolo Services)	4	65,000	76,375	\$ 545.54	305,500	\$ 2,182		\$ 2,182
Ox-cart (Kalaria)	6	104,000	122,200	\$ 872.86	733,200	\$ 5,237		\$ 5,237
Cattle herders	3	42,500	0	\$ 303.57	127,500	\$ 911	\$ 911	
Trainers	5	90,000	0	\$ 642.86	450,000	\$ 3,214	\$ 3,214	
Watchmen	2	60,000	0	\$ 428.57	120,000	\$ 857	\$ 857	
SubTotal					2,528,347	\$ 18,060	\$ 4,982	\$ 13,077
Ox Stalls								
Poles	90	350	411	\$ 2.94	37,013	\$ 264	\$ 264	
Cement	20	1,550	1,821	\$ 13.01	36,425	\$ 260	\$ 260	
Sand (tons)	10	1,200	1,410	\$ 10.07	14,100	\$ 101	\$ 101	
Quarry stones (tons)	5	4,000	4,700	\$ 33.57	23,500	\$ 168	\$ 168	
6" inch nails	20	250	294	\$ 2.10	5,875	\$ 42	\$ 42	
5" nails, and	10	250	294	\$ 2.10	2,938	\$ 21	\$ 21	
barbed wire	5	12,000	14,100	\$ 100.71	70,500	\$ 504	\$ 504	
1" U nails	15	300	353	\$ 2.52	5,288	\$ 38	\$ 38	
SubTotal					195,638	\$ 1,397	\$ 1,397	\$ -
TOTALS					\$ 14,319	\$ 13,077		

* Farmers are expected to provide or pay for their own oxen, and to contribute to the cost of training and care

Results on the cost and distribution of oxen and equipment in Tanzania for both Alliance One and Universal Leaf are shown in **Table 10**. Costs are clearly much lower than in Malawi.

With an estimated value of USD 440 for a full set of equipment comprising an ox-cart, plough, ridger, yoke assembly and related accessories, PMI effectively supported the purchase of 68 sets of equipment. However, if farmers are given a 25% subsidy on the cost of this equipment, the number of farmers that can be reached is 272.

Targets for 2007/08

AOI's target in Malawi for 2007/08 is to secure, train and distribute 20 pairs of oxen to tobacco farmers with full sets of equipment. AOTT and TLTC targets for 2007/08 are to train and distribute 300 and 90 pairs of oxen respectively fully equipped with ox-carts, ploughs, ridgers and related accessories.

Conclusions

This program is making a significant difference in the lives of tobacco farmers. It definitely requires continued support from PMI, perhaps at an increased scale. It is important to agree on a consistent approach with each company for the nature and level of this support – i.e., not giving equipment as a free hand out, but as a way to reduce the overall costs to farmers. For example, PMI agrees to purchase equipment only to be sold to farmers at an agreed subsidized cost, e.g., 25%.

Table 10: Summary of Oxen and Equipment Sold to Farmers in Tanzania in 2006/07 ¹

Item	Alliance One Tobacco Tanzania ²					Tz Leaf Tobacco Company ³		
	Unit Cost		No.	Total Cost		No.	Total Cost	
	TSH	USD		TSH	USD		TSH	USD
Oxen (pair) *	330,000	264	186	61,380,000	49,104	24	7,920,000	6,336
Training Oxen	70,000	56	186	13,020,000	10,416	24	1,680,000	1,344
Totals on Oxen				74,400,000	59,520		9,600,000	7,680
Equipment & Accessories								
Ox-Cart with tires & tubes	300,000	240	214	64,200,000	51,360	24	7,200,000	5,760
Buffalo Plough	75,000	60	222	16,650,000	13,320	24	1,800,000	1,440
Plough No. 7	95,000	76	220	20,900,000	16,720	0	0	0
Reversible Plough No. 7	150,000	120	2	300,000	240	24	3,600,000	2,880
Ridger	150,000	120	50	7,500,000	6,000	0	0	0
Yoke & Other Accessories	60,000	48	79	4,740,000	3,792	24	1,440,000	1,152
Medicines	30,000	24	186	5,580,000	4,464	24	720,000	576
Total Equipment/Accessories				119,870,000	95,896		14,760,000	11,808

* Farmers are expected to provide or pay for their own oxen, and to contribute to the cost of training

¹ Data extracted & summarized from reports by Claudio Fischer and Jeff Kockott from AOTT and by Emmanuel Soko and Colin Blair from TLTC. (Please excuse any minor errors and omissions).

² 186 Households and 38 Primary societies received oxen and equipment from AOTT in 2006/07; 79 pairs of oxen were trained by AOTT; total households to date is 578 and 100 Primary Societies

³ 24 Households from 15 Primary Societies received oxen and equipment from TLTC in 2006/07