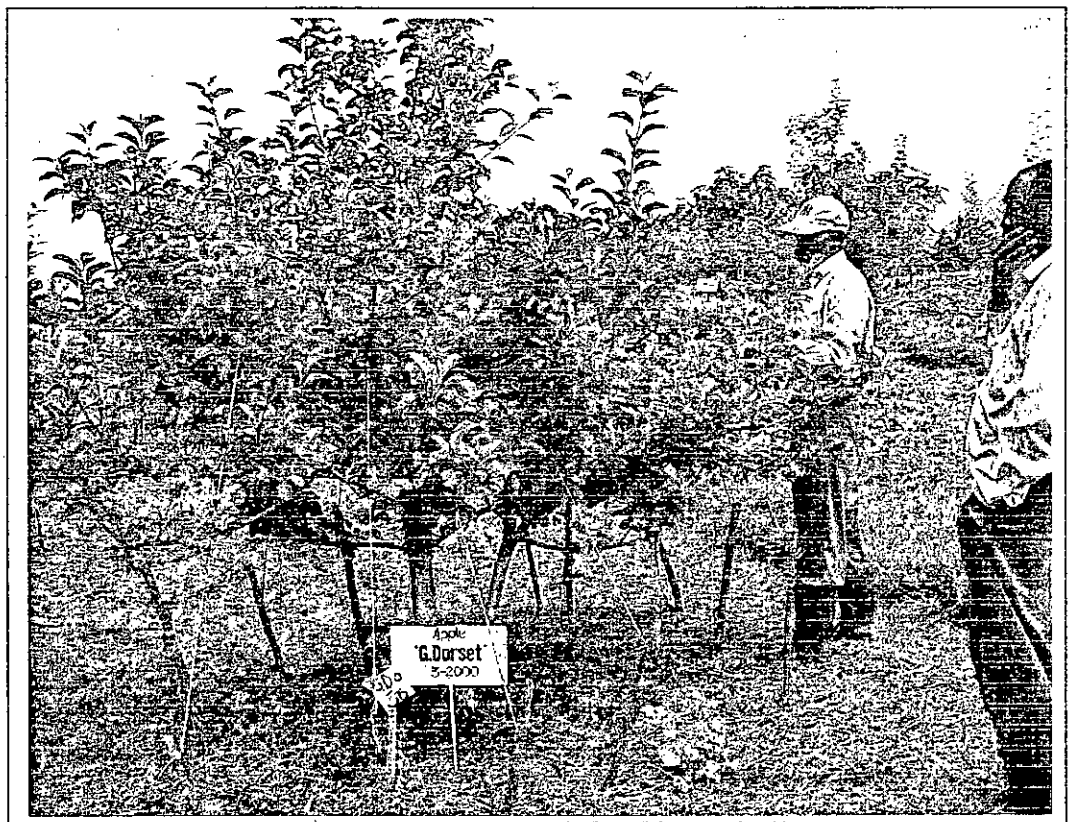
World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

FORRI

# Agroforestry Research and Development to conserve and enhance biodiversity in the Kigezi Highlands and Mabira forest buffer zone of Uganda

## Progress report for the quarter January to April 2004




*Visiting scientist overwhelmed by apples!!*

*The Agroforestry Programme is jointly implemented by FORRI and ICRAF*

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*ICRAF-FORRI Agroforestry Programme*

**Kabale and Kampala, Uganda**

*Supported by:*



The International Centre for Research in Agroforestry (ICRAF) and USAID signed an agreement in August 1999 to implement a project entitled "Agroforestry Research and Development to conserve and enhance Biodiversity in Kigezi Highlands and Mabira Forest Buffer Zone of Uganda" (Award No. 617-A-00-99-0001200).

The project was granted an extension from November 2003 to February 2004 to complete some activities and consolidate achievements made and have strengthened outputs. This report gives an overview of activities implemented during part of the extension phase with more time granted up to April 2004.

## Result 1: Profitability, feasibility and acceptability of a range of agroforestry innovations determined

### Intermediate Result IR 1.1: Options for wood production enhanced

**Activity 1.1.1** *Farmers' exploration of wood production systems on degraded upper parts of bench terraces*

Improved fallows and rotational woodlots are among the agroforestry practices being disseminated in SW Uganda, which are intended to increase soil nutrient status and crop yield while providing additional wood supplies for farmers. Under these systems, farmers are exploring planting *Sesbania sesban*, *Calliandra calothyrsus* and *Alnus acuminata* tree species for two years on the upper degraded part of terraces benches. Besides increased crop yields and enhanced wood production, these systems are hypothesized to enhance carbon sequestration in agricultural system and therefore have potential for carbon credits. Given a major widespread concern about increased carbon emissions and the resultant global warming, small-scale farmers can benefit from global carbon trade if proper institutional arrangements are established. A study was therefore conducted with the overall objective of comparing carbon storage in soil and above ground in these improved agroforestry fallow systems compared with the continuous cropping system. The specific objectives were (1) Estimating above ground and soil organic carbon accumulation and variations in mineral nitrogen under the different tree systems compared to a continuous cropping system, (2) Assessing crop performance after the fallows from the farmers' perspective, (3) Estimating potential carbon accumulation through restoration of degraded bench terraces using improved fallows, (4) assess the economic potential of improved fallow systems.

#### *Carbon sequestration potential*

Above ground carbon was determined from above ground tree biomass estimated based on a random selection of 4-6 trees within each row in a sub-plot. Crop yield data was collected for two growing seasons from individual farmers during the survey. Baseline data on soil conditions before improved fallow establishment was obtained from the project reports. Soil samples were collected and analyzed for soil organic carbon (SOC) and mineralizable nitrogen. Increase in SOC due to improved fallows was calculated as the difference between the continuous cropping system (baseline) before adoption of improved fallows and the estimated current carbon accumulated in soil under the different improved fallow systems. The carbon content of dry wood was obtained by multiplying the woody biomass by 0.42, which is an estimate of carbon content of woody biomass. To estimate the potential future carbon accumulation due to increased adoption of improved fallow agroforestry systems, we considered the total area of degraded cropland (40,000 ha) in Kabale District, assumed a 25% technology adoption and species adoption rates of 50, 32 and 18% for *Sesbania*, *Calliandra* and *Alnus*

respectively. The total carbon accumulation potential was then computed as a product of current carbon accumulation in soil and above ground biomass and the area covered by each species.

The results indicated that annual accumulation of carbon in woody biomass was equivalent to 5.6, 5.4 and 5.1 t C $ha^{-1}$ for the *Sesbania sesban*, *Calliandra calothyrsus* and *Alnus acuminata* systems respectively. Considering soil carbon, and comparing the results to the baseline, there were significant increases in soil carbon due to improved fallows of *Sesbania*, *Calliandra* and *Alnus* equivalent to 67, 78 and 82% respectively. However, there were no significant variations in soil carbon accumulated in the different improved fallow systems.

Annual increases in soil carbon due to improved fallows of *Sesbania*, *Calliandra* and *Alnus* were 2.69, 3.17 and 3.3 t C $ha^{-1}$ respectively. There were significant variations in mineral nitrogen levels with *Sesbania* having the highest and *Calliandra* having the least anaerobic mineral nitrogen level. There was also a strong (r = 0.66) correlation between mineral nitrogen and soil carbon. In addition, farmers reported higher yields from areas with improved fallows than from the continuously cropped areas. They reported sorghum yield increases of 35, 25 and 9% for *Sesbania*, *Calliandra* and *Alnus* systems respectively. Increase in maize yields was equivalent to 102, 92 and 25% for the *Sesbania*, *Calliandra* and *Alnus* systems respectively. If 25% (10,000 ha) of the degraded land is restored, this can accumulate an average additional amount of soil and woody biomass carbon equivalent to 29,600 and 27,384 t C $yr^{-1}$ respectively

The results indicate that restoring degraded bench terraces through adoption of improved fallow agroforestry systems has a substantial potential for increasing woody biomass and soil organic carbon in addition to improved soil quality. However, the carbon accumulated in woody biomass will be released back to the atmosphere if all the above ground biomass is used as fuel wood. The effect of this on the accumulation of $CO_2$ in the atmosphere as compared to fossil fuels will be provision of a renewable energy resource, which has a short term but continuous impact of reducing the amount of $CO_2$. Improvement in soil quality on fields planted to improved agroforestry fallows of *Sesbania*, *Calliandra* and Alnus species compared to the continuous cropping baseline, as indicated by the reported increase in crop yields, was a directly observable benefit to farmers. Improved fallow agroforestry systems offer opportunities for mitigating climate change; since they are capable of addressing both problems of declining soil productivity and increasing atmosphere $CO_2$ concentrations.

***Economic potential of improved fallows on farmer's fields***

Another objective was to assess the comparative economic advantage of the different improved tree fallows/rotational woodlots against the traditional continuous cropping system without and with a carbon market and identifying factors influencing their adoption. The tree fallow systems compared were *Sesbania sesban Calliandra calothyrsus*, and *Alnus acuminata*. We also estimated the potential future economic contribution of carbon fixation in the different improved fallow agroforestry systems.

The results from the cost benefit analysis indicated that without and with a carbon market, improved fallow agroforestry systems are more profitable than the continuous cropping. Improved fallows provide a source of farm income from both fuel wood sales and from increased land productivity. Without a carbon market, the mean annual net benefit of the improved fallow systems were estimated to be US$ 116 per hectare compared to the negative returns from continuous cropping (-US$72 per hectare). The benefit-cost ratio for the improved agroforestry-based farming systems was found to be greater than 1 whereas that for continuous cropping it was less than 1, (0.52) an indication of the greater cost incurred when farmers continue cropping the upper degraded part of the terrace benches. On comparison, it is more profitable for farmers to invest in a *Sesbania* improved fallow system than in *Calliandra* and *Alnus*.

Assuming the presence of a carbon market, the profitability of the different improved fallow agroforestry systems was dependent on the carbon pool eligible for credit. The soil carbon value was greater than that of the woody biomass carbon for all improved agroforestry fallow systems. Comparing the separate carbon pools, *Sesbania* had the highest woody biomass carbon net present value (NPV) followed by *Calliandra* and *Alnus*.

Crediting woody biomass carbon would increase farmers' annual returns by about 8, 13 and 26% for the *Sesbania, Calliandra* and *Alnus* systems respectively.

Considering soil carbon, *Alnus* had the highest NPV followed by *Calliandra* and *Sesbania*. Crediting farmers for soil carbon would increase their annual returns by about 9, 18 and 40% per hectare for the *Sesbania, Calliandra* and *Alnus* systems respectively. Results indicate that improved agroforestry fallow systems have substantial potential for increasing farmers' income without and with a carbon market, while mitigating climate effects due to increased carbon sequestration. From the farmer's point of view and given the uncertainties in the functioning of an anticipated future carbon market, the *Sesbania* improved fallow system may be more profitable and sustainable. However, for international investors with an overall aim of increasing carbon stocks, the *Alnus* system may be more attractive. As a policy measure and for purposes of sustainable development, *Sesbania* improved fallows may be more appropriate for meeting the requirements of both the local people and the society at large.

Considering factors curtailing adoption of improved fallows, most of the suggested explanatory variables did not have a significant influence. Sex of the farmer (more males than females), membership to a farmers' group or association, contact with extension agents, and perception of problems of fuel wood scarcity and extent of land degradation significantly affected adoption of improved fallow agroforestry systems. Most likely, it is the cognitive level of the farmers rather than the household assets that prompt farmers to adopt improved fallows. Active farmers involved in farmers' groups and with knowledge of both the problem and available solutions were found to be among those who have so far adopted the technology. In addition, the results provide an insight into some of the necessary conditions for enhancing adoption of improved fallow agroforestry systems. The implication of these findings is that when considering the degraded areas as potential niches for improved fallows in the study area, farmer perceptions of the problems are very important. Thus there is need to further encourage formation of farmer groups and to provide information/create awareness among farmers by providing better extension services. The future contribution of carbon returns will, in addition to the eligible carbon pool, be influenced by the payment system. If farmers are paid on a per hectare basis, soil carbon returns would be equivalent to USD 87, 83 and 71 for the *Alnus, Calliandra* and *Sesbania* systems respectively. Returns from woody biomass carbon could follow a reverse trend contributing about USD 74, 71 and 67 per ha for the *Sesbania, Calliandra* and *Alnus* systems respectively. If aggregate payments are made, soil carbon would still have a higher value than biomass carbon. Thus promotion of improved fallows should put more emphasis on increasing soil carbon storage since currently there is no carbon market and this results in both agronomic and environmental benefits which are of immediate value to the farmers.

**Activity 1.1.2** *Economic and biophysical assessment of rotational woodlot and crop production systems on degraded parts of terraces (Buhara S/C)*

This experiment has been finalised and closed. A final report will be produced when the concerned scientist returns from study leave.

**Activity 1.1.3** *Reducing competition between trees on upper terrace and crops through tree mixtures and tree management (Kigezi High School)*

*Collection of soil samples for bulk density measurement calibration:* More than 300 samples were collected from the upper parts of terrace at the different depths where soil moisture access tubes had been installed. Using coring blocks, fresh weights of soil samples were taken and dried in the oven for 2 days. Dry weights measurements were recorded and amount of soil water calculated. These values shall be used in the calculation of bulk density at corresponding neutron probe readings and therefore determine amount of water retention in different agroforestry systems.

*Collection of soil moisture data:* Nine (9) sets of data have so far been collected on soil moisture, using the neutron probe equipment, and the activity is on-going.

*Downloading and shifting of sap flow equipment:* Downloading and shifting of sap flow equipment is an on-going activity. Data collection is restricted to treatments that have both access tubes and runoff equipment. The equipment had some problems, and this interfered with data collection for some time. However these problems were rectified and data collection is going on.

*Collection of Radiometer data:* Equipment to measure solar radiation was installed, and so far Nine (9) sets of data were collected

*Downloading of metrological data:* Metrological data collected includes, (rainfall, temperature, relative humidity, direction and speed of wind). So far, four (4) data sets have been collected. This is an on-going activity.

**Activity 1.1.4** *Participatory evaluation of woodlots on abandoned fields*

A participatory evaluation workshop involving 28 farmers hosting the trial evaluated the performance of the trees on their farms using a questionnaire. The farmers evaluated *Eucalyptus, Alnus, Grevillea, Cordia Africana,* and *Podocarpus milinjianus.* The farmers used an indigenous Mbao game to rank the species. The most preferred tree species for woodlots on abandoned terraces were *Eucalyptus, Alnus acuminata* and *Grevillea robusta. Eucalyptus* is less preferred in annual cropping systems but is highly rated for woodlots because of its ability to coppice, necessitating no replanting costs. Farmers prefer to use *Grevillea* and *Alnus* for boundary and scattered planting on farm. *Grevillea* and *Alnus* are preferred for hilltops compared to *Eucalyptus.* Despite being indigenous, *Podocarpus* and *Cordia* were the least preferred tree specie because of their poor growth performance.

***Intermediate Result R 1.2 Improved soil management practices strengthened***

**Activity 1.2.1** *Identification of tree species for improved fallows in the Kigezi Highlands (Bubara S/C)*

A crop of maize was harvested and the preliminary results are shown in Table 1. These results show that *Sesbania Sesban* had the largest residual effect on crop yield while there appears to be no significant difference on other treatments. The effect of *Sesbania* almost doubles the effect of continuous cropping.

Table 1. Performance of post-fallow maize crop.

| Data | *Alnus* | *Calliandra* | Continuous cultivation | Natural fallow | *Sesbania* |
|---|---|---|---|---|---|
| Average Wt of fresh cobs (g) | 800 | 800 | 800 | 700 | 1300 |
| Average fresh wt of grains (g) | 392.1 | 445.0 | 463.2 | 374.4 | 679.4 |
| Average Dry Wt of grains (g) | 333.5 | 329.5 | 353.7 | 325.6 | 573.8 |

A final last crop of wheat has been planted in each treatment. It will be managed until harvest is done later this year (July).

**Activity 1.2.3** *Assessing the aggregate impact of agroforestry on landscape by monitoring the hydrological response of watersheds.*

Land use practices have important impacts on availability and quality of water resources in rural watersheds. The farming system in SW Uganda is characterised by continuous arable farming without proper land management practices. This has resulted in loss of vegetative cover, accelerating runoff and soil erosion, flooding and sedimentation problems in the valley bottoms. The overall effect is increased land degradation, destruction of crops and livestock, as well as infrastructure. These problems affect thousands of smallholder farmers as evidenced by the consequences of the flooding and landslide disasters of 1998 in Kabale District.
There is therefore need for conservation efforts to improve agricultural practices and reduce negative alterations to the hydrological regime of rural watersheds.

Agroforestry practices were introduced in the Katagata watershed in Bubare sub-county, Kabale District in 1999 following a major flood and landslide disaster. Through a collective community action, farmers have been practising agroforestry namely: contour hedgerows, upper storey trees on cropland, improved fallows and woodlots on abandoned terraces with the overall objective of reducing runoff, conserving soils, producing wood and increasing overall productivity. In this report we present preliminary results of changes in stream flow resulting from adoption of agroforestry land use practices.

Monitoring of stream flow commenced in 2002 with the installation of flumes mounted with automatic water level data loggers. This allowed monitoring of volume and flow rate of stream water over every hour for two years, 2002 and 2003. Data was downloaded on a laptop computer every 6 months using infrared communication. Results show that peak stream flow volumes take place in

September and October during the second rainfall season (Figure 1). This is despite the lower total rainfall values compared to the first rainy season. It was observed that rainfall intensity in the second season is much higher than the first season.

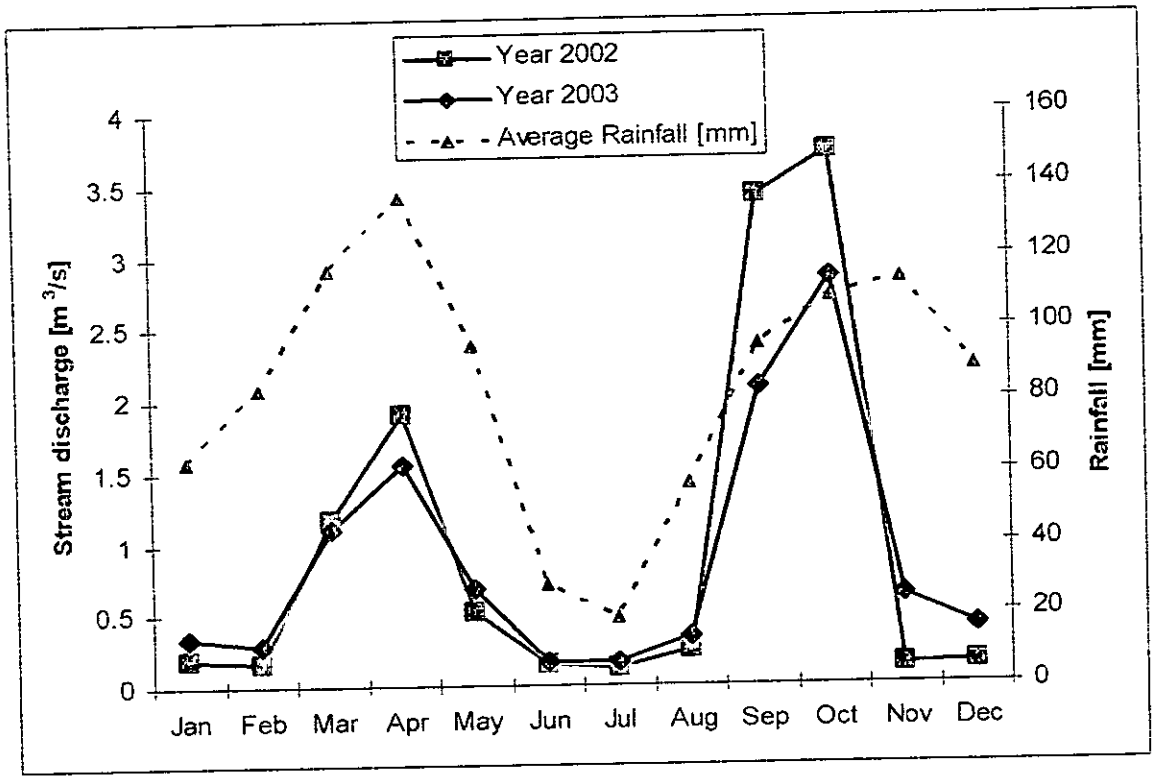



Figure 1. Trends in stream flow in 2002 and 2003.

Changes in stream flow with time were noticed particularly in the second rainy season. In the first season, stream flow in the drier months of February and March increased from year 2002 to 2003 by about 5% while in wetter month of April it decreased by about 10%.

Although these changes may be perceived as small, they are quite significant given the fact that changes in hydrological regimes take some time. The trends in the second rains were similar to the first rains except for the increased magnitude of change in stream flow between 2002 and 2003. At peak rainfall periods (September and October), stream flow was reduced by about 20% while at low rainfall periods (November and December), stream flow was increased by about 15%.

The results show that there is generally a better availability of water in the stream with time. In the wetter periods, there is less water lost as stream flow while in the drier periods, there is water available for domestic and livestock consumption. This could be related to the proper establishment of agroforestry land use systems (e.g. maturing of contour hedgerows) and increased protection of fields with new planting of trees. Reduction of peak flow volumes implies that more rainfall on the hillsides is infiltrating the soil rather than overland flow. The increased sub-surface flow encourages slow release of water and therefore explains the increased water volume of the stream during the drier spells. Runoff monitored from agroforestry land use systems are less than 5% of rainfall while infiltration is more than doubled compared to plots without conservation measures. As the agroforestry trees mature and the systems get well established, it is envisaged that the changes in stream flow will become even more pronounced. This however takes time.

**Activity 1.2.4** *Monitoring hydrological impact of AF on a watershed*

Collection of data on the amount of rainfall, total ran-off after each rainfall event and amount of sediment in the trapped run-offs continued at the Kyantobi trial. The table below shows rainfall averages, runoff and sediment collected for 15 rain days in the January-March period.

| Data | A | B | C | D | E | F | G | H | W | Y |
|---|---|---|---|---|---|---|---|---|---|---|
| Aver run off (ml) | 64.7 | 181.6 | 18.6 | 66.5 | 1175.2 | 124.5 | 58.0 | 94.5 | 339.0 | 1387.3 |
| Aver fresh wt (g) | 17.7 | 22.4 | 5.9 | 20.5 | 22.0 | 29.3 | 27.0 | 24.3 | 30.1 | 35.0 |
| Aver dry wt (g) | 0.2 | 0.7 | 0.1 | 0.1 | 0.3 | 0.2 | 0.2 | 0.3 | 0.2 | 2.1 |
| Aver rainfall (mm) | 178.9 | 165.5 | - | - | - | 205.5 | 179.0 | - | 183.0 | - |

Definitions for the land use systems considered in this experiment.

| | Number of plots |
|---|---|
| A= cultivated with hedgerows | 4 |
| B= cultivated no trees | 4 |
| C= uncultivated lines of *Alnus* & *Calliandra* | 1 |
| D= woodlot *Alnus* trees | 1 |
| E= woodlot *Eucalyptus* trees | 2 |
| F= uncultivated with shrubs | 2 |
| G= uncultivated no trees | 1 |
| H= woodlot (*Alnus* and *Grevillea)* | 1 |
| W= grazing land | 2 |
| Y= foot path | 2 |

**Result IR 1.3: Options for the integration of trees with high-value-products into community systems screened**

**Activity 1.3.1** *Testing cultivars of avocado and other tropical fruits in Kigezi*

An on-farm field assessment to assess the current status of the different Avocado cultivars introduced on-farm in the year 2000 and also find out yield performance and management problems was completed. The trial involved 50 farmers supported by Africare. Each farmer was given one tree of each of the seven varieties namely; Hass, Fuerte, Semil, Drsosm I, Drsom II, Avilla, and land race from Kabale for comparison. Detailed data are being entered in the computer. In this assessment, 43 farmers were covered in the sub-counties of Muko, Kaharo, Bubare, Rwamucucu as shown in Table 2.

Table 2. Number of farmers whose avocado cultivars were assessed during the quarter.

| # | Subcounty | Number of parishes | Males | Females | Total |
|---|---|---|---|---|---|
| 1 | Rubaya | 3 | 4 | 2 | 6 |
| 2 | Kaharo | 1 | 2 | 8 | 10 |
| 3 | Rwamucucu | 3 | 3 | 4 | 7 |
| 4 | Bubare | 1 | 1 | 5 | 6 |
| 5 | Kamuganguzi | 2 | 3 | 2 | 5 |
| 6 | Muko | 3 | 6 | 3 | 9 |
| | **Totals** | **13** | **19** | **24** | **43** |

In all the farms visited, Semil, Hass, Fuerte, Drosom 1 and Drosom 2 were found still existing. Avilla had disappeared from most farms. According to individual farmers interviewed, cultivars Hass, Fuerte and Semil are performing best. All farmers had harvested at least two times from Avocado Hass and Fuerte. One farmer in Butanda reported a harvest of over 100 fruits from a Hass tree, which he considered too small to carry that amount. Farmers complain of the following:

- Fruit and flower abortion mainly on Hass and Fuerte
- Die bark which is common on Cultivars Drosom 1 and 2
- Theft of fruits and too much scions harvest
- Destruction of trees by domestic animals
- Hairy brown leaf-spot diseases (Algae outgrowth) on older leaves

Currently most farmers manage their trees by mulching, spot weeding, integration of cropping, application of ash around the trees during flowering

*Participatory workshop to evaluate new Avocado cultivars introduced in Kigezi*

A one day workshop for farmers to share experiences on their avocado cultivars was organized. At this workshop, farmers tasted five new cultivars for palatability and marketability qualities. Also farmers provided feedback on the preference and performance of those cultivars that are on-farm. The five new cultivars that were tasted at this workshop were: Esther, Wilson Pepnol, Semil, Zutano, Tova. Farmers made a checklist of seven seven elements to use to compare the varieties namely; skin appearance, ease of skin removal, ration of fruit pulp and seed, pulp compactness, wateriness, fruit size and fibre content. Based on this checklist, the cultivars were ranked.

Wilson Pepnol was ranked 1st, as it met most qualities farmers want.
Esther was ranked 2nd because of its good taste. The rough skin made it unattractive to local farmers.
Semil was ranked 3rd mainly because of its size and therefore attractiveness to buyers.
Tova was ranked 4th, due to its fibrous nature.
Zutano was ranked 5th, due to its wateriness and difficulty to peel off the skin

However, farmers felt that fruits were not at the same ripeness and thus could have contributed to the variation in taste. This means that palatability tests will continue until a clear consistence if made.

Regarding the cultivars introduced on farm in 2000 (Avilla, Fuerte, Hass, Semil, Drosom I and Drososm II), farmers scored and ranked them as follows:
Semil was ranked number one because of its larger size, fast growth, large pulp and its taste. Hass was ranked second because it tastes best despite its small size. Farmers feel that its small size will not attract customers unless it is labeled and is known to the buyer. Fuerte is generally moderate in size and taste and so it was ranked third. Drosom I & II were growing well but farmers had not tasted their fruits. The trees have taken long to produce fruit and have resulted into very large tree compared to other cultivars. Avilla was ranked last because it performed poorly and had died in most farms.

Again at this workshop the participants mentioned the major challenges of avocadoes as:
- High flower abortion rate
- Damage by sucking insects which damage the fruits
- Drying of the fruit trees from the terminal tips.
- Long gestation period (unclear as to when the fruits have matured).
- Theft of immature fruit.
- Lack of immediate market for these fruits.
- Damage of trees by scion collectors who even don't pay for them.
- Lack of clear names of the different cultivars
- Very small number of plants (only one plant per cultivar) given for comparison

**Activity 1.3.2** *Testing of temperate fruit tree species and cultivars in Kigezi highlands*

During this quarter, activities that were planned were:
- Central nursery expansion and seedling production
- On-station orchard expansion, management and monitoring
- Documentation of amount of scion collection from on-station orchards
- On-station and on-farm surveillance of pests and diseases
- Test marketability (taste, size, colour) of Kigezi apples
- Investigate germination potential of apples at the nursery conditions
- Inventory of existing commercial nursery operators and service providers in agriculture and forestry related activities in SW Uganda
- Develop criteria to identify nursery operators, farmers to host scion centers and rootstock seed orchards, service providers and mobile grafters (community specialists in grafting) for future training and support

- Assess performance of on-farm trees/orchards
- Equip research staff with extra skills and knowledge on cultivation of deciduous and tropical fruit trees through study tours

The following sections present some of the achievements against each planned activity.

*Central nursery expansion:* Following the acquisition of one-hectare of land from the Forest department at Bugongi Eucalyptus plantation to expand nursery operations and having completed the tree felling in the last quarter, extraction of stumps was started on and is now complete. A perimeter fence comprised of barbed wire and chain links was erected all round the orchard and nursery. Initial land preparation to expand both nursery and orchard at Bugongi was done. Powdery mildew was the main disease experienced at the nursery. It was controlled by destruction of affected seedlings and by use of chemicals namely: Bayleton and Cobox.

*Management and monitoring of on-station orchards:* The four on-station orchards, namely; Buhara, Bugongi, Kachwekano and Kalengyere, managed for research purposes, production of scions, assessment of fruit production, monitoring disease and pests and other environmental issues and also for training farmers in fruit production were maintained through monthly weeding and slashing of the orchards, establishment of Calliandra hedgerows to control soil erosion and mulching. *Calliandra* hedgerows and fencing to control entry to the orchards was done at Buhara and Kachwekano. The access road at Kachwekano was opened. Pruning was done in all orchards but defoliation to break bud dormancy was only done at Kalengyere. All orchards were monitored for diseases and pest outbreak. Because of the warm conditions in the January –March period, aphids attacked all orchards. Dimethoate and Sicorin insecticides were used to control them. Leaf spot (fungal infection) and scab related diseases at Kalengyere and Bugongi Orchards were controlled using Cobox, Mancozeb and Antracol chemicals. Having started observing outbreak of diseases and pests, the project intends to establish experiments to establish effective and suitable control measures.

Other problems experienced at the on-station orchards were:

a) Destruction of fruit trees by ground rats (moles); this is common at Kalengyere, Kachwekano and Buhara. To deal with this problem, specialized hunters were engaged. At Kalengyere, 17 moles, Kachwekano, 30 moles and Buhara 29 moles were trapped and destroyed.
b) Theft of immature fruit; this affected Kachwekano and Buhara. To control theft, day and night watchmen were re-employed and also a barbed wire fence erected on some sections of the orchards.
c) Birds; birds are becoming serious pests on apples and peaches. No control measures have been devised yet.

*Tree training and management:* All the orchards trees were pruned to reduce on the number of wrong branches (branches affecting tree growth and development) and to encourage more branching where the branches have been in dormancy. Defoliation was done only at Kalengyere orchards where trees are generally larger than in other orchards. Defoliation in other orchards was done to enable the trees continue growing rather than going into productive phase associated with leaf fall. However, it has been observed that trees continued to flower and fruit with or without defoliation. This has raised a lot of questions relating to inducing and breaking bud dormancy. How to synchronize flowering and fruiting so that it happens once a year per tree is major challenge to address in the nearest future. Most probably, some flower buds stay much longer unopened than others and thus re-open when they are mature even in unsuited seasons. Thus a thorough investigations on breaking of dormancy (synchronization and timing), timing right pruning and fruit thinning for quality fruit production are major issues that need urgent attention. Protocols for investigating these issues will be developed in the next quarter and assessments subsequently start.

*Orchard expansion and replacement of dead plants:* At Buhara 12 more plants of Golden delicious (making a total of 42 plants at this site) and 10 Dulmener and 10 Granny Smith were planted. At Kachwekano, 10 ungrafted macadamia plants while 20 apple dead trees were replaced with rootstock for future grafting. At Kalengyere, 15 Granny Smith, 5 Dulmener, 6 James Grieve and 8 Rome beauty plants were introduced as new cultivars at the on-station site. At Bugongi orchards, expansions on the extended area were on plums and peaches as indicated in Table 3.

Table 3. Expansions of peaches and plums in orchards

| | Peach | | Plum | |
|---|---|---|---|---|
| | Cultivar | seedlings | Cultivar | Seedlings |
| 1 | Peach peach | 4 | Myrobolana | 12 |
| 2 | Florida Gold | 3 | Santarose | 12 |
| 3 | Barbara | 21 | Eldorado | 12 |
| 4 | Nectarine | 14 | Harry pickstone | 12 |
| 5 | Ex-Manolo | 3 | Ogden | 12 |
| 6 | Almond | 7 | | |
| 7 | Kachwekano peach | 25 | | |
| | **Total** | 77 | | 60 |

*Assessment of diseases and pests:* Following the emergence of diseases and pests on on-station orchards, a Pathologist and laboratory technician from Kawanda Agricultural Research Institute (KARI) made an assessment of diseases and pests occurring in both on-station and on-farm orchards. The aim was to help the ICRAF-NARO staff be able to identify and manage the diseases.

Table 4 below shows the preliminary of main diseases and pests present on apples, pears, plums and peaches by end of January 2004.

Table 4. Different pests and diseases of temperate fruits in on-station orchads.

| Crop | Disease | Symptoms |
|---|---|---|
| Apples | Powdery mildew | White fungal growth on both sides of leaves with stunted growth |
| | Leaf spots/scab | Spots on leaves and rough skin plus cracking of fruits |
| Pears | - | - |
| Plums, Peaches & nectarines | Bacterial spot | Shot-holes on leaves, stunted buds, splitting of fruits forming exudates |
| | Cercospora leaf spot | Leat spots and shot-hole |
| | Cherry leaf spot | Fungal masses on the under side surface of the leaves |
| | Prunus necrotic ring spot virus/X-disease | Leaf spots and shot-hole |
| | Rust | Yellowish fungal outgrowth on leaf surface |
| **Crop** | **Pest** | **Damage** |
| Apples | Aphids | Sap sucking on young leaves |
| | Caterpillars | Chewing leaves |
| | Moles | Eating rots |
| | Thieves/children | Fruits and scions |
| Pear | Caterpillars | Chewing leaves |
| Plums, peaches & nectarines | Caterpillars | Chewing leaves |

The main diseases found were: Scab mainly at Kalengyere, Powdery mildew mainly at on-station nursery, leaf spot diseases mainly at Bugongi and Kachwekano, Blights, bacterial cankers mainly on plums and peaches. Pests observed were aphids, and unidentified caterpillars. A detailed report is being compiled.

The study has concluded that a regular surveillance and monitoring mechanism be instituted and management plans for controlling diseases developed. As such the monitoring program will in future involve undertaking research studies to identify and control diseases and pest outbreaks. Some of researchable areas are disease severity and occurrence, times of outbreak, cultivar tolerance and vulnerability, cultural and chemical control effectiveness and later on effect of rootstock on disease management.

**On-station nursery activities:**

***Seedling production and release from the nursery***

Seedling of the other trees other than grafted seedlings that were produced and released from the nursery are shown in Table 5.

Table 5. Stock of tree seedlings at the central nursery.

| Species | No. of seedlings Produced | No. of seedlings released | No. of destroyed seedlings | No. of seedlings at the end |
|---|---|---|---|---|
| Apple rootstocks | 15054 | 3120 | 5984 | 6328 |
| Pear rootstock | 80 | 5 | - | 75 |
| Plum rootstock | 2740 | 1 | 153 | 1353 |
| Peach Rootstock | 500 | - | - | 500 |
| Avocado rootstock | 9577 | - | 2262 | 7315 |
| Other fruits | 5229 | 946 | 997 | 3286 |
| Indigenous trees | 14225 | 4884 | 3552 | 5289 |
| Exotic trees | 24741 | 12673 | 3006 | 9068 |

The loss of seedlings through destruction was high due to the powdery mildew that had affected most of the seedlings. All efforts are being put in place to check on the losses including proper recording of seedling releases.

*Grafting:*
Not much grafting took place during this period. Most grafting is usually done during the dormant periods of June to August. However, raising of rootstock seedlings onto which grafting will be done started. 1 kg of apple rootstock seed pre-germinated under refrigeration resulted into 9000 seedlings germinated and potted. Out of these, close to 5500 seedlings have successfully become viable seedlings for grafting on June-July this year. To ensure that there are adequate planting materials by the end of the year, 2 kg each of apple and peach rootstock seed were put under refrigeration for scarification. Table 6 shows stock of grafted materials by the end of April 2004.

Table 6. Grafted materials at the nursery by end of April

| Species | No. of seedlings produced | No. of seedlings released | No. of destroyed seedlings | No. of seedlings at the end |
|---|---|---|---|---|
| Apple | 1262 | 851 | 24 | 387 |
| Pear | 1736 | 1267 | 3 | 463 |
| Plum | 539 | 96 | 117 | 326 |
| Peach | 459 | 158 | 195 | 106 |
| Avocadoes | 1533 | 132 | 796 | 605 |

*Experiment on clonal rootstock propagation:*

A detailed protocol to evaluate compatibility and effect of different vegetative rootstock materials on different fruit cultivars of apples and pears was developed. Consultations on the design, layout and objectives are being sought to ensure thorough implementation when enough materials become ready. Materials under multiplication are still small in numbers because prior to the study tour to South Africa, the staff had little knowledge on how to multiply them. The study tour to South Africa helped in acquiring the necessary skills. Thus, this experiment will start next year when there are enough materials and more information on managing them is acquired. Clonal (vegetative) materials under multiplication at Bugongi site include five cultivars of apples totaling 155 seedlings and one cultivar of pears (totaling 29 seedlings).

*Selection of farmers and nursery operators to host scion centers and private nursery nurseries*

As reported on in the previous quarter, some of the main activities the project will be directly involved in future will include training and supporting a few farmers hosting foundation and mother blocks for collection of clean scions and commercial nursery operators to enable them produce quality planting materials. Besides provision of technical support to these, the project intends to train a large number of advisory service providers to provide advisory services on quality fruit production. Strategies to train farmers in fruit production, nursery operations and provision of advisory services are detailed in the PRIMEWEST proposal to be implemented effective May 2004. In this reporting period, the following activities aimed at identification of potential farmers to host scion centres, trainees for service provision and nursery operators to work with were carried out:

a) Organized and conducted a workshop for Kabale district partners to define criteria to select farmers, trainees, nursery operators and service providers. Participants included representatives of NGOs, Private sector, NAADS, local government and government extension agencies. A proceedings report on the details about the workshop is available in a separate report.
b) Documented existing potential service providers in Kabale
c) Recorded key commercial nursery operators in Kabale district

The exercise of identifying the nursery operators in Kabale district started last quarter. Table 7 shows the inventory of commercial nursery operators.

Table 7. Numbers of commercial nursery operators in Kabale District

| Subcounty | NGOs | CBO | Private | TOTAL |
|---|---|---|---|---|
| Buhara | 1 | 2 | 4 | 7 |
| Maziba | 2 | 4 | 1 | 7 |
| Kamwezi | 2 | 1 | 2 | 5 |
| Bukinda | 6 | 3 | 1 | 10 |
| Kaharo | 3 | 2 | 2 | 7 |
| Ikumba | 2 | 2 | 3 | 7 |
| Municipality | 3 | 5 | 13 | 21 |
| Bubare | 3 | 3 | 9 | 15 |
| Hamurwa | 1 | 3 | 2 | 6 |
| Kamuganguzi | 1 | 1 | 3 | 5 |
| **Total** | **24** | **26** | **40** | **90** |

The sub counties where information on the commercial nursery operators was not collected are Bufundi, Muko, Rubaya, Rwamucucu, Kashambya, Kyanamira, and Butanda.

*Results of On-farm survey on farmer management practices*

Part of the initial objectives of the fruit tree trial was to involve farmers in the monitoring and assessment of general tree and fruit production performance. Between October 2000 and October 2001, over 100 farmers were given at least two seedlings each of apple Anna and Golden Dorset, and two pears for on-farm trials. During this reporting period, data and partial analysis about fruit production and management of orchards was completed. A total of 55 (25 female and 30 males) farmers in four sub-counties, namely Kyanamira, Bubare, Rubaya and Hamurwa were visited for assessment. Information was collected on:

a) Flowering and fruiting observed by farmers
b) Fruit tree and orchard management practices

Results of assessment:

a) Orchard management practices:

Table 8 shows some of the management practices combination that farmers were doing

Table 8. Management practices carried out by farmers on fruit trees.

| Management practice | Number of farmers | Percentage% |
|---|---|---|
| Staking, defoliation, pruning, manure application | 21 | 38.2 |
| Defoliate, stake, manure application. | 6 | 10.9 |
| Prune, defoliate, stake | 6 | 10.9 |
| Defoliate, stake | 3 | 5.5 |
| Prune, stake, manure app | 3 | 5.5 |
| No management | 3 | 5.5 |

Over 30% of the assessed farmers were doing all the recommended practices except application of cover crop while 14.5 % of the farmers had not done weeding and application of cover crop. It was found out that 65% of farmers had not done proper weeding while 95% of farmers had not applied any cover crop/mulch around their trees. Farmers that were improperly managing their trees had not seen any fruit.

These finding shows that farmers need to be continuously advised on the need to do proper orchard management. Most farmers still regard fruit trees as any other tree planting/growing practices where trees are left to grow produce without much assistance. These attitudes need to change through constant practical training and follow-ups. Over 90% of the farmers had not applied fertilizers. Reasons given for not applying fertilizers were:

1. The high cost of artificial fertilizers
2. Fertilizers were difficult to get (They are not widespread as their use is not a common practice)
3. Lack of knowledge on the types, quantities and the time to apply fertilizers

Other challenges observed include damage by domestic animals. In over 82% of the farms visited, the fruit trees had been by goats and sheep. Farmers who were providing protection for the fruit trees said that they saw the high value of the fruit trees, and would not risk them to be stolen.
Protection is not only needed against domestic animals but also from thieves who are becoming a big problem especially harvesting immature fruits.

Other problems farmers were experiencing were: flower abortion (82%), Bird damage (flowers and fruits)- 34%, and delay in fruiting (17%). There is need to understand why trees lose their flowers and also find ways to protect the fruiting trees from bird damage.
According to farmers, flowers are mainly lost during drier periods. However flower abortion also occurs during any season and at times could be a result of bird damage.

*Enhance skills of researchers in managing temperate and tropical fruit trees*

An eleven-day study tour involving six persons namely; Levand Turyomurugyendo (ICRAF), Jean Marc Boffa (ICRAF), Hakiza J.J (NARO), Jennifer Tumushabe (NARO), Hillary Agaba (NARO) and Paul Balitta (NARO) to South Africa was effected in February. The team visited Cape Province where the deciduous fruit trees and grapes are grown and also Mumpalanga province (Nelspruit) where experiences to establish and manage orchards of sub-tropical and tropical fruit tree orchards (Mangoes, Guava, Granadilla, Litches, Macadamia and Avocadoes) were shared with experts. A detailed study tour report has been produced. The tour had the following objectives:

1. Orient the team on better practices of orchard establishment, management, marketing and packaging of fruit tree crops
2. Explore opportunities to acquire elite germplasm and literature from South Africa
3. Identify experts/professionals to backstop technology development/transfer to Uganda backstopping
4. Discuss with experts on the suited strategies for Uganda fruit program

From this study tour, the following outputs were realized:

- The team was exposed to modern practices of nursery and orchard establishment and management and fruit packaging. Institutions involved in some of these practices were visited (ARC-INFRUTEC (Stellenboch), ARC-ISTC (Nelspruit) and discussions held to from partnerships.
- Network of key resource persons for backstopping were identified
- Modes of collaboration and backstopping from experts and institutions were identified
- Pathways for procuring germplasm, literature, and expertise established
- Recommendations to improve Uganda's fruit tree industry were made

Following the study tour, key experts to support fruit tree development in Uganda were invited to Uganda to learn our experience and advise accordingly.

Pictures below shows some of the promising deciduous fruiting species and cultivars introduced in Uganda between 1999 and 2000

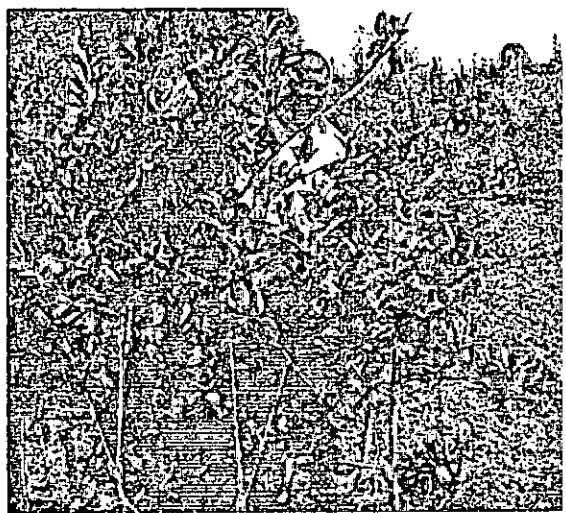


Plate 1. Apple "Anna" at Buhara site



Plate 2Apple "Golden dorset at Kalengyere site



Plate 3. G. dorset and anna Kachwekano orchard in Dec 03

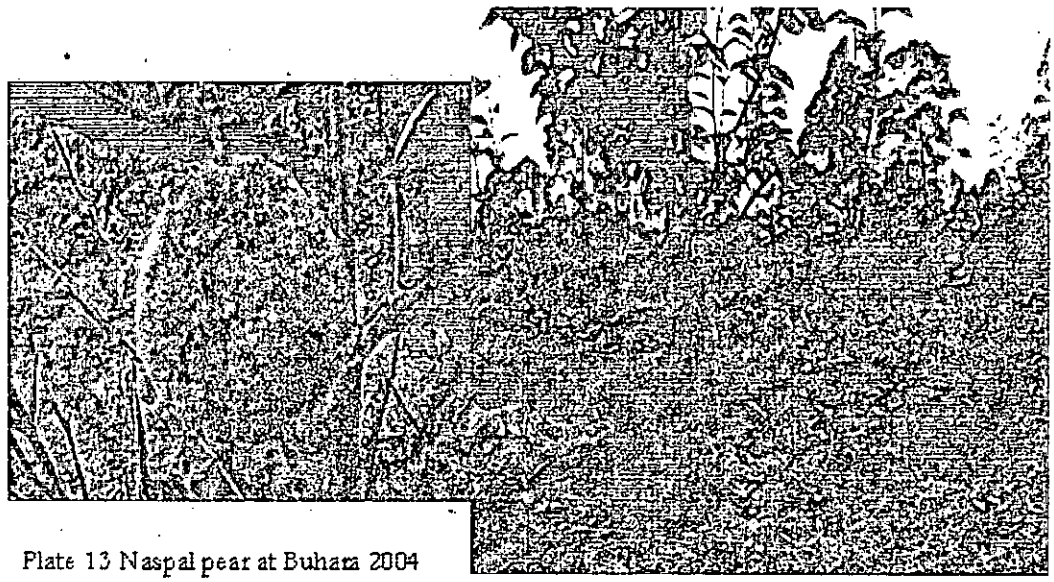


Plate 13 Naspal pear at Buhara 2004

Plate 14. Taiwan Hybrid pear at Bugongi

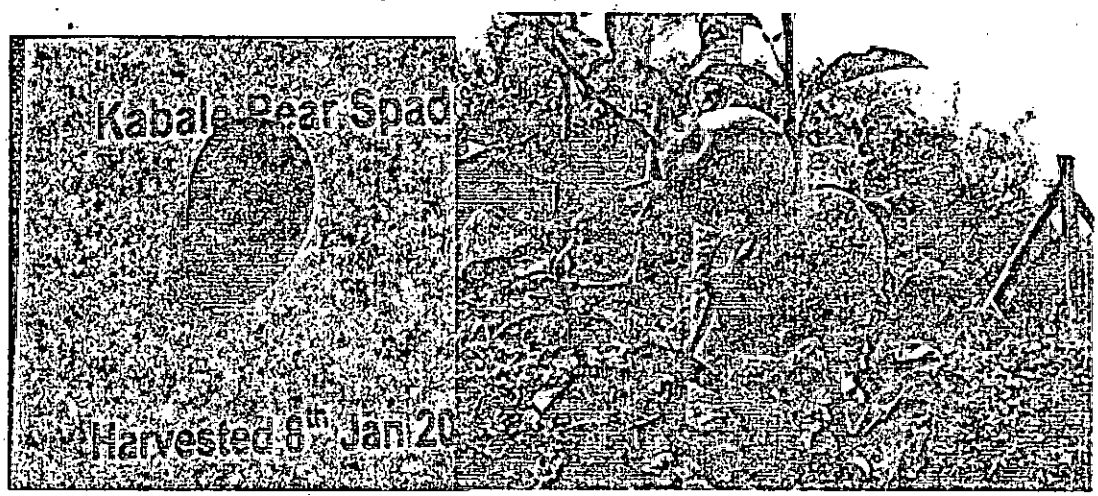


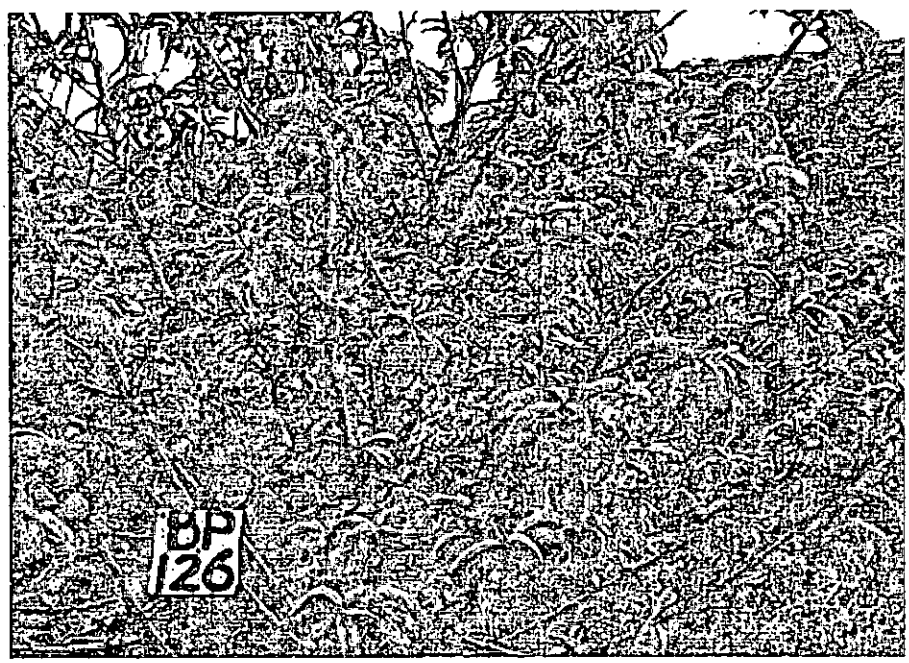

Plate 15. Spadona pear at Bugongi

Plate 16. Japanese Yellow pear at Kachwekano

Plates 13-16 shows fruiting pear fruit cultivars in Kabale district



Plate 11. Nectarine at Kalengyere




Peach Barbara at Buhara

Plates 11&12 shows fruiting Peaches and nectarines at Kalengyere in Kabale-Uganda

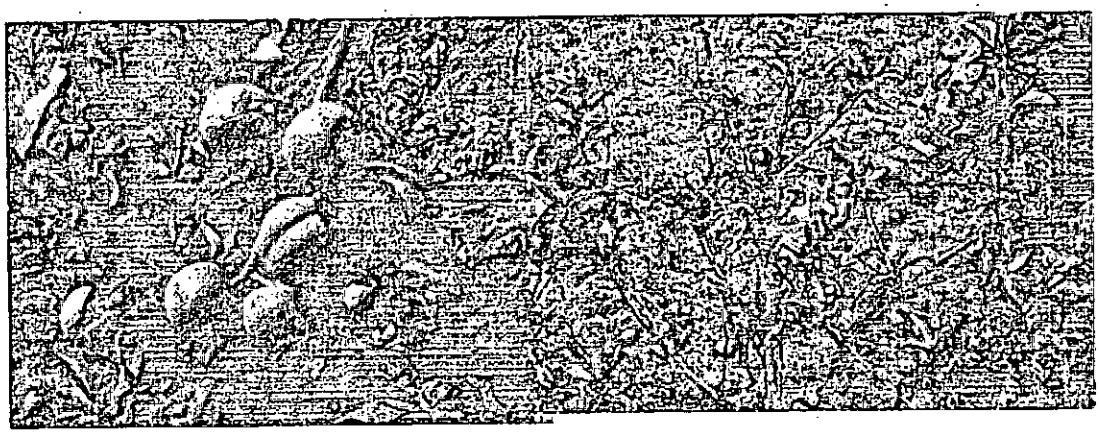


Plate 1. Plum Eldorado at Kalengyere-Uganda

Plate 8. Plum Ogden at Kalengyere-Uganda

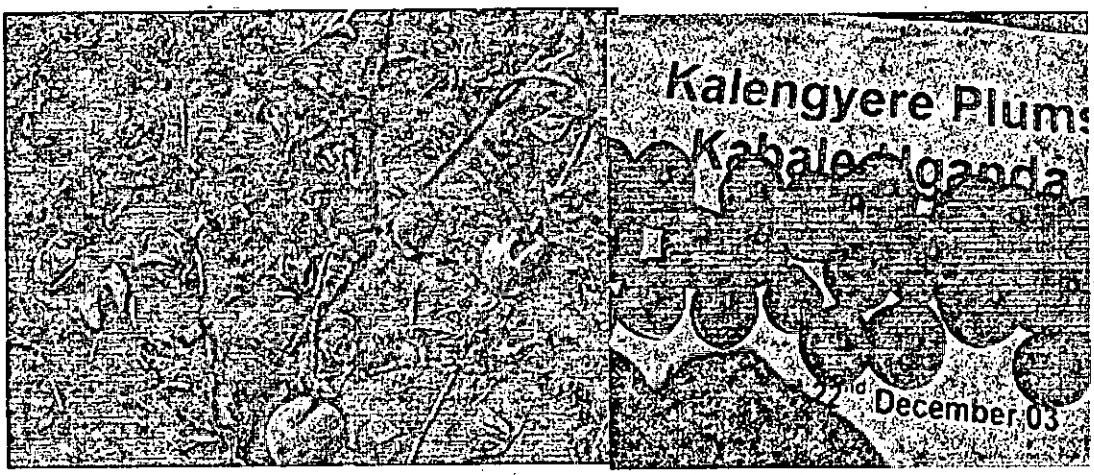



Plate 9 Plum Harry Pickstone at Kalengyere-Uganda, Dec 03

Plate 10. Plum Myrobonana harvest

Plates 7-10 shows some of the fruiting Plum cultivars in Kabale Uganda, Jan 04

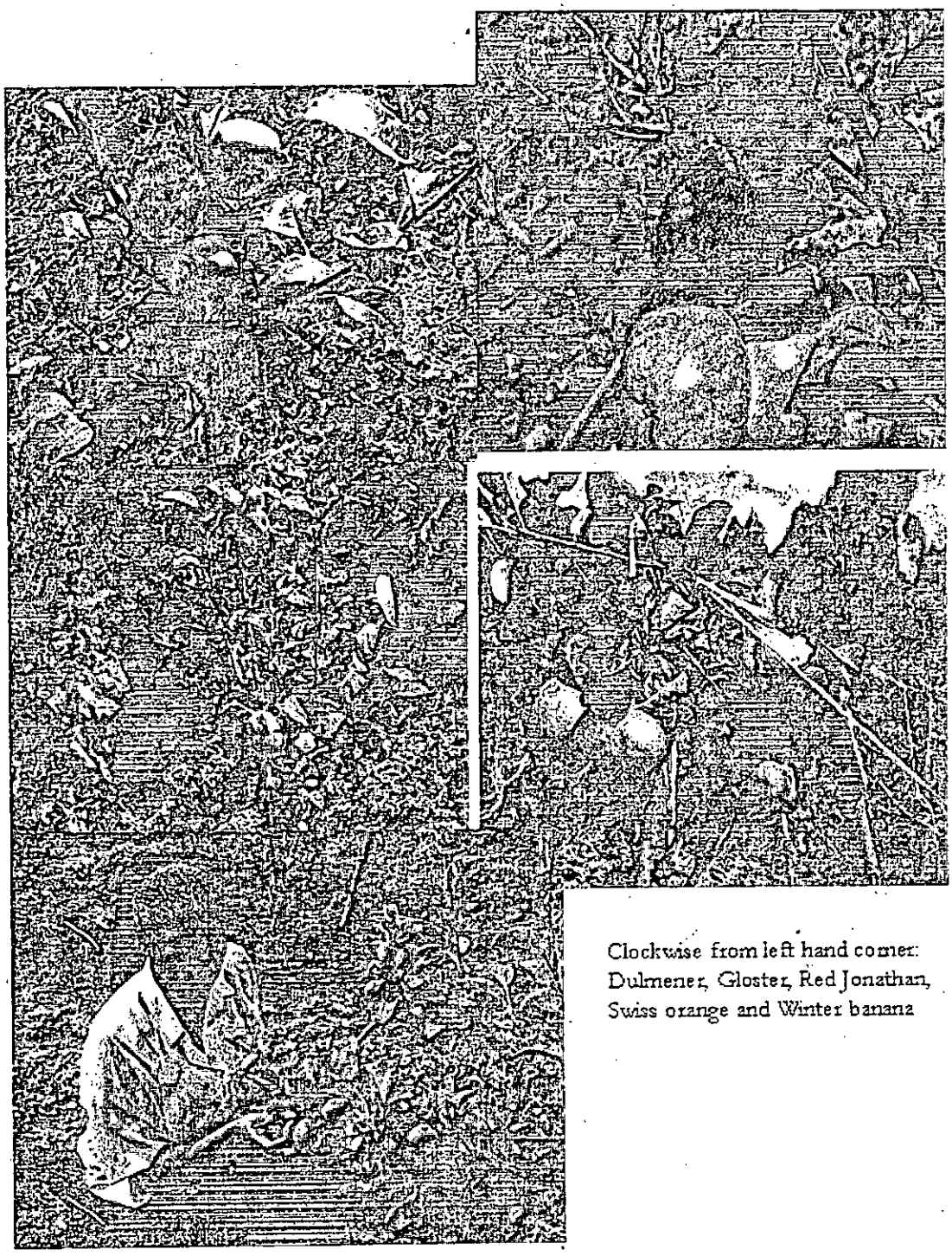


Plate 5. On-farm (Kagarama) Golden dorset tree Jan 2003



Plate 6. Harvest from two on-farm trees at Kagarama village, Jan 2004

Plats 5&6. Shows on-farm apple trees and harvest



Clockwise from left hand corner:
Dulmener, Gloster, Red Jonathan,
Swiss orange and Winter banana

Plate 4. Other apple cultivars in fruit in Kabale district in Dec 2003

Activity 1.3.4 Evaluation of indigenous high-value timber and medicinal tree species

At Kachwekano, a trial consisting of 16 high value timber and medicinal indigenous trees planted in October 2003, replacement of the dead plants was done as shown in Table 9. The trial is now five months old and after the six month, data will be collected on the agronomic performance (Height, Root collar Diameter and Health condition.

Table 9. Indigenous tree species planted at Kachwekano.

| Species | Seedlings planted | Dead seedlings | Replaced |
|---|---|---|---|
| *Entandrophragma excelsum* | 25 | 2 | 2 |
| *Khaya anthotheca* | 25 | 3 | 3 |
| *Fagaropsis* | 25 | 2 | 2 |
| *Maesopsis eminii* | 25 | 3 | 3 |
| *Powlonia fortunei* | 25 | 2 | 2 |
| *Olea welwitschii* | 25 | - | - |
| *Prunus Africana* | 25 | - | - |
| *Chincona officinalis* | 25 | 3 | 3 |
| *Alnus accuminata* | 25 | 2 | 2 |
| *Ocotea usambarensis* | 25 | | |
| *Lowoa snymertonii* | 25 | 6 | 6 |
| *Warburgia ugandensis* | 20 | 5 | 5 |
| *Vitex keniensis* | 22 | 3 | 0 |
| *Fagara microphyla* | 25 | 2 | 2 |
| *Newtonia buchananii* | 25 | 3 | 3 |
| Un identified *Albizia* species | 25 | | |
| Total | 392 | | |

Besides this trial, a seed stand trial for six different provenances of *Prunus africana* obtained from different forests of Uganda was established. The trial is three months old but is being monitored closely. Replacement of the dead trees was done in March 2004.

Entry of data previously collected from on-farm trails established two years ago was completed. Preliminary observations indicated that most of the species were still surviving in the open although the growth rate is much very varied. The species surviving are: *Cordia africana, Prunus africana, Entandrophragma excelsum, Podocarpus milanjianus, Ficalhoa laurifolia, Maesopsis eminii, Warburgia ugandensis, Carapa grandifolia*, and Albizzia. Field observation indicated that trees that had been intercropped were performing better than those planted as woodlots where management is usually very low.

**Result 2: Viable Agroforestry technologies, policies and institutional innovations disseminated and adopted.**

***IR 2.1 Information and skills related to Agroforestry extended to farmers and development partners***

**Activity 2.1.1** *Agroforestry training of trainers' workshops*

The agroforestry program has conducted several trainings where 224 farmers, students and extensionists from development partners have been trained in different agroforestry aspects. The table below shows the trainings carried out by the project staff between January and April 04.

Table 10. Trainings done in January-April 04 quarter

| Name/Institution | Category | Topic | Duration | Gender | |
|---|---|---|---|---|---|
| | | | | Male | Females |
| A2000 Network | Extension workers | Temperate fruit management | 2 days | 6 | 0- |
| Nyabyeya Forestry College | Students | Soil conservation<br>Tree nursery establishment<br>AF extension<br>Fruit management | 3 days | 36 | 19 |
| African International Christian Ministry | Extension Workers | General Agroforestry | 1 day | 3 | 1 |
| Muko Farmer | Individual Seed stands | Seed stands establishment and Management | 1 day | 12 | 1 |
| Nyakyishenyi Farmers | Individual Seed stands | Seed stands establishment and Management | 1 day | 12 | 0 |
| Soroti farmers C.O.U. | Farmers on study tour | General Agroforestry | 2 days | 36 | 4 |
| Mugyera C.O.U | Farmers | Agroforestry in food production | 2 | 21 | 26 |
| Rujanjara C.O.U | Farmers | Growing of fruits | 1 | 2 | 45 |
| | | | | **128** | **96** |

**Activity 2.1.6** *Facilitate coordination and Information exchange between the institutions working on Natural Resource Management in Kigezi.*

A two-day workshop on Improved Watershed Management was held for all institutions involved in the Natural Resource Management in Kabale District of Kigezi highlands. Agroforestry Programme Kabale hosted the workshop in collaboration with AFRICARE, which is mandated by UGADEN to coordinate agroforestry activities in the agro- ecological zone of the Southern Highlands, including the Districts of Kabale, Rukungiri, Kanangu and Kisoro.

The Natural Resource Management Consortium, established as a collaboration forum of development agencies in Kabale District, and under the coordination of NARO-ICRAF worked successfully during the past years implementing the following objectives:

- To co-ordinate the various agroforestry initiatives to ensure a balanced scaling up of agroforestry in Kabale District.
- To support the timely, decentralised, affordable and sustainable supply of required tree seed (germplasm)
- To support the improved flow of information on agroforestry related issues between various stakeholders.
- To build the capacity of various institutions in agroforestry.
- To have a co-ordinated production of dissemination materials
- To inform and lobby on policy issues related to agroforestry.
- To strengthen the two-way links between research and development partners to scale up agroforestry through watershed approach.

Its role of building partnerships with all institutions is now supposed to be taken over by UGADEN, the Uganda Agroforestry Development Network. Therefore, a review of past activities was found necessary to enable AFRICARE start its mandate and to further identify strategies necessary to enhance the joined monitoring and reviews. The objectives of the workshop were:

- To review the progress of conducted activities of the NRMC and introduce the strategies of UGADEN.
- To share information about applied watershed management strategies, technologies and monitoring systems of different development agencies.
- To identify their successes and constraints.
- To create strategies to improve joint watershed management.

Participants came from NARO-ICRAF, Africare, Africa 2000 Network, AHI, CARE International, Lake Bunyonyi Development Programme, KADFA , SWTWS, LC III Chairpersons from Bubare and Hamurwa sub-counties, NAADS coordinators at District and Bubare and Hamurwa sub-counties, dostrict fisheries and forestry, Two Wings Agroforestry Network, Agroforestry Group Kyantobi, Agroforestry Group Bubale, Super Nursery Distributors Kabale, and Ndorwa Agroforestry Association representatives.

Participants noted that there are still various constraints in implementing the created strategies and collaborations on agroforestry. These include:

- insufficient supply of germplasm and planting materials,
- insufficient knowledge and training of extension staff on agroforestry technologies and watershed management,
- absence of markets and market information to create benefits of promoted technologies,
- insufficient collaboration between development agencies to exchange information and compile resources (e.g.: agroforestry researchers and agroforestry dissemination organisations)
- lack of obligation of development agencies to implement the agreed collaboration and joint monitoring in Watershed Management areas.

These issues were pointed out as needing attention for proper co-ordination of agroforestry activities.

**Activity 2.1.8** *Support establishment of the farmer-to-farmer training centre (Agroforestry demonstration in Kyantobi)*

Following the training in record keeping and management skills of the executives of the Kyantobi agroforestry group, its community centre was able to bank U Shs 550,000 during this quarter. This has emanated from the training facilitation fees from the visitors that come for training at their centre. Because of the strong foundation built by the NARO –ICRAF agroforestry program, the centre has been now been linked to NARO's Kachwekano ARDC, which subsequently established new Potato varieties in the village. Also Africa 2000 Network offered to provide farmers with *Calliandra* hedgerows and heifer cows to be able to produce large quantities of milk from zero grazing activities. Thus through collaboration with other partners the village have been supported to widen the diversity of enterprises including fish farming, piggery, goat rearing and mushroom growing. Training in record keeping took place in the village where all members were trained for data collection and future updating of all research work that's taking place in their locality.

*Report on the extension services and their adoption rate in Katagata watershed*

Julia Schmirt an ICRAF staff on Germany fellowship conducted the study. She found out that in Katagata watershed, a participatory, people-oriented approach is jointly implemented by NARO-ICRAF, the local government and different development partners. The experiences gained from this approach are highly relevant for other areas and thus an elaborate assessment of the technologies developed and means applied to disseminate them is crucial.
The objective of the study was to investigate the adoption rate of soil and water conservation activities in the Katagata watershed. The following questions were addressed:

- Who are the main development agencies in the Katagata watershed; what are their respective activities; and how do they interact?
- What land use changes have been achieved through these extension activities and what role do local communities play in this?
- What is the attitude of communities towards agroforestry and watershed activities?

The tentative results of the study show that there are 7 different development organizations, three government agencies and two community based organizations working in Katagata watershed (namely: NARO-ICRAF, Africare, Africa 2000 Network, AHI, CARE International, Heifer Project of Diocese of Kigezi, Fisheries Department, KADFA, Makerere University, Sub-county Council Bubale, Sub-county Council Hamurwa, NAADS, Agroforestry Group Kyantobi and Agroforstry Group Bubale.)

The services they provide include:

- Training in AF practices, e.g. tree planting and management, nursery establishment and seed collection and exchange visit of farmers to Kenya
- Training in temperate fruit management
- Village territorial mapping
- Agricultural training (climbing beans, Irish potatoes, piggery, improved goat breeds, bee keeping)
- Construction and management of fish ponds
- Capacity building
- Gender issues
- Sanitation and Health
- Distribution of more than 45,000 seedlings

In summary, the experiences in Kyantobi-village show that a demand-driven, participatory watershed approach can be very successful. However, the low adoption rate outside Kyantobi needs to be further analyzed.

**Activity 2.2.1** *Establish tree seed orchards and fruit tree mother blocks for key species at sub-counties and other centres*

In 2000 and 2001, a number of seed stands were established at different sub-counties and churches as part of the strategy to sustain food production. It was hoped that the sub-counties and churches would maintain the seed stands for their future use and seed collection. Appendix I shows the results of a survey done to assess the current status of these seed stands. A workshop for sub-county local authorities will be conducted to discuss the best management options. The workshop will mark the end of the support to the sub-counties in managing the seed stands. The seed stands of *Calliandra calothyrsus* have started seeding at the sub-counties of Bubare, Kamuganguzi, Bukinda and Kamwezi. At Kamwezi seed stand, both *Grevillea* and *Calliandra* are seeding. In this quarter 1 kg of *Grevillea* and 2 Kgs of *Calliandra calothyrsus* were bought by the project from the sub-county of Kamwezi.

**I R 2.3 Scaling up Agroforestry technology adoption tested in pilot Areas.**

**Activity 2.3.1** *Explore local councils and groups as dissemination facilitators in the water sheds*

The local leaders of the villages in the watersheds have been having quarterly meetings to know how they can solve their problems in conservation of their soils. There are 4 villages that have established nurseries for the next season planting. Seedlings of various varieties have been established in the watershed.

**Activity 2.3.2** *Supply of Germplasm Bubare /Hamurwa and Kyanamira Sub counties:*

Seeds and seedlings were distributed to Bubare Subcounty as shown in the following tables.

**Table 11 a. Seed distribution:**

| Location | Group Nursery | Individuals Nurseries | *Calliandra calothyrsus* | *Leucaena trichandra* | *Acacia angustisma* |
|---|---|---|---|---|---|
| Katungu | 1 | 4 | 400 | 400 | 400 |
| Mwiguriro | 1 | 4 | 400 | 400 | 400 |
| Kyantobi | - | 10 | 500 | 500 | 500 |
| Murushekye | 1 | - | 100 | 100 | 100 |
| Nyaruteija | 1 | - | 100 | 100 | 100 |
| Kyitabugika | 1 | - | 100 | 100 | 100 |
| Karubanda | 1 | - | 100 | 100 | 100 |
| TOTAL | 6 | 18 | **1700** | **1700** | **1700** |

**Table 11 b. Seedling distribution through dissemination:**

| Location | Species | Number | Technology | Gender | |
|---|---|---|---|---|---|
| | | | | Males | Females |
| Kyanamira/Hamurwa | Pears | 470 | Fruit production | 4 | 2 |
| Kyanamira/Hamurwa | Apples | 405 | Fruit Production | | |
| Kyanamira/Hamurwa | Peaches | 30 | Fruit Production | | |
| Kyanamira/Hamurwa | Plums | 60 | Fruit Production | | |
| Lake Bunyonyi Devt company | *Prunus Africana* | 60 | Medicinal tree | Institution | |
| Africa 2000Network | Apples | 100 | Fruit Production | Institution | |
| Bubare Nangara | *Prunus africana* | 500 | Boundary/Medicinal | 12 | 5 |
| Bubare/Kyitabugika | *Prunus africana* | 300 | Boundary/Medicinal | 23 | 7 |
| Nyaruteija and Murushekye | *Olea* | 40 | Timber | | |
| | *Fagara* | 80 | | | |
| | *Albizzia Spp* | 30 | | | |
| | *Carapa* | 50 | | | |
| | *Ekebagia* | 30 | | | |
| | *Cordia africana* | 50 | | | |
| | **Total** | 2,205 | | | |

**Result 3: Local capacity to research, disseminate and implement agroforestry technologies strengthened**

***IR 3.1: Postgraduate qualifications in Agroforestry related sciences strengthened and students' knowledge and skills enhanced***

**Activity 3.1.1** *PhD studies supported*

- Mr. Bamwerinde submitted his thesis and resumed working as team Leader Kabale office
- Mr. David Siriri continued his PhD studies at Nottingham University. During this period he visited the experimental sites and collected data to write his thesis.
- Rhona Ayesiga settled at Makerere University to pursue her masters degree in Agriculture
- Julia Schmidt a research fellow was supported

***IR 3.2: Knowledge on Agroforestry related sciences of collaborating researchers and development partners enhanced***

**Activity 3.2.1** *Participation of project staff and Ugandan collaborators in training events*

- Mazimaho attended training on preparation and presentations of posters at Nairobi from 1st to 7th March.
- Mazimaho attended training on design of on-farm participatory research trials and surveys on 11th to 19th March at Mbale in Eastern Uganda
- Levand Turyomurugyendo attended training on design of on-farm participatory research trials from 11th to 19th March at Mbale Eastern Uganda
- Levand Turyomurugyendo was supported to visit South Africa to learn modern practices in fruit production and establish linkages with experts and institutions in fruit tree enterprises. Other persons supported on this study tour were:
    - Dr. Jean-Marc Boffa of ICRAF
    - Dr. JJ Hakiza of KARI
    - Mr. Hillary Agaba of FORRI
    - Mrs Tumushabe Jennifer of NARO-ICRAF Kabale project
    - Paul Balitta of FORRI

- The USAID-funded staff supervised ECOTRUST supported watersheds in Nyakishenyi watershed (Rukungiri) and Muko (in Kabale district). Similarly, the Ecotrust-funded staff received seed and seedlings from the Kabale on-station nursery and seed center to scale up activities in the watersheds already mentioned.

- Levand Turyomurugyendo while acting as a team leader for Kabale station supported agroforestry activities in the southern drylands funded by EU. The support involved field visits to guide on the planning and implementation of work plans. Later, levand established a grape vine trial in Isingiro constituency but its operation will be supported under EU supported activities in the area.

*IR 3.4: Students' knowledge and skills on agroforestry enhanced through project attachments*

**Activity 3.4.3** *B.Sc. student's special research projects identified and supervised*

No BSc. Student was attached in this period. Most students appear on project attachments in June July.

## 4. Administrative Arrangements

### 4.1 Project Development

This being the last extension under direct funding from USAID, the project is preparing to start a new phase with PRIMEWEST project. As such, in this period, a number of activities included planning and reviewing progress of the work accomplished. Three planning meetings were held including an inaugural meeting with PRIMEWEST team in April. All staff will be laid off in May and re-recruited in June 2004 and shall be given new assignments.

### 4.2 Staff movements

Mr. Wilson Bamwerinde completed his study leave and effective March started his job of team leadership for Kabale station.
Mr. Alex Ariho, a key dissemination officer resigned. He was replaced by a new staff by the names of Denis Ashaba.

### 4.3 Participation in workshops, conferences, and training events

These have been alluded to in previous sections

### 4.4 Visitors

| DATE | NAME | ADDRESS |
|---|---|---|
| 6/01/2004 | Walter Van Opzeeland | ICRAF NAIROBI |
| | Chiara Poggi | |
| | Alex Katabazi | |
| 7/1/2004 | Denis Tuwesigye | 44, Kingsley Road, Middlestex TW3 INS United Kingdom |
| | Moses Mwesigwa | A2N Uganda |
| | Leo schieformulla | A2N Uganda |
| 8/1/2004 | Mwine Catherine | Uganda Christian University Mukono, box 4, Mukono |
| 8/1/2004 | Dr. A. Tukahirwa | MBIFCT, Box 1064, Kabale |
| 8/1/2004 | Mugabi Pius Katuramu | District water Officer, Kabarole |
| 8/1/2004 | Baguma Joseph | Kabalore |
| 8/1/2004 | Katongole Steven Dick | District councilor - Kabarole |
| 8/1/2004 | Karuhath Ruhume Francis | |
| 8/1/2004 | Manyindo E. | Box 38, Fort portal |
| | Enid Kuler | |

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|---|---|---|
| 9/1/2004 | Leo schiefermulla | A2N Uganda |
| 12/1/2004 | James Tumwine | Kawanda Agri. Research Ins. |
| | Mayanja Kasirye | KARI Box 7065 Kampala |
| | Kabami B. Vincent | O.C. Ndorwa Prisons Kabale |
| 22/1/2004 | Deo N. Byarugaba | Good and Impressive work |
| 23/1/2004 | Chelimo Nk. | LC V chairman Kapachorwa |
| 23/1/2004 | Mangusho Lawrence | Sec. Finance LC V Kapchorwa |
| 23/1/2004 | Okur Ekorti | Kapchorwa |
| 23/1/2004 | Chemongeb Abas | Member DFF- Kapchorwa |
| 23/1/2004 | Bariteka Vincent | LC V sec. Kapchorwa |
| 23/1/2004 | Kintujo Frankline | Member DFF |
| 23/1/2004 | Andrew Yesho | Member DFF |
| 23/1/2004 | Wilson Chemusto | Member DFF- Kapchorwa |
| 23/1/2004 | Musubu Stephen | Member DFF |
| 23/1/2004 | Foweth Muhamed | Member DFF |
| 23/1/2004 | Yesto Fred | Member DFF |
| 23/1/2004 | Makweila Isaac | Member DFF |
| 23/1/2004 | Jopehine Sokimo | Member DFF |
| 23/1/2004 | Florence Sokuton | Member DFF |
| 23/1/2004 | Mushamlich Moses | Member DFF |
| 23/1/2004 | Mutabazi Denis | District NAADS coordinator Kabale. |
| 23/1/2004 | P.K Sabiiti | District Environment Officer, Kabale. |
| 10/2/2004 | Geoffrey Kasozi | ECOTRUST |
| 10/2/2004 | Nankya Rose | ECOTRUST |
| 10/2/2004 | Sam Korutaro | ECOTRUST |
| 10/2/2004 | Martin Asiimwe | ECOTRUST |
| 5/3/2004 | Godfrey Nabona | Nyabweya Forestry College |
| 5/3/2004 | Isingoma B.B. K.Amooti | A good place kept in the same order for a long time. |
| 17/3/2004 | Fiona Mutekanga | Kyambogo Univ. Box 1 Kyambogo |
| 18/3/2004 | Mugisha M. Charles | Nyabweya Forestry College |
| 18/3/2004 | Esalu Moses Shehmond | Nyabweya Forestry College |
| 18/3/2004 | Robert Otuko | Nyabweya Forestry College |
| 18/3/2004 | Karenget Job | Nyabweya Forestry College |
| 18/3/2004 | Khamiati Kusiima | Nyabweya Forestry College |
| 18/3/2004 | Mugume William | Nyabweya Forestry College |
| 24/3/2004 | Okiror John Robert | Soroti COU |
| 24/3/2004 | Ben Omoping | Farmer COU Teddo Box 107, Soroti |
| 24/3/2004 | Aleke Iriot | Farmer COU Teddo Box 107 |
| 24/3/2004 | Rev. C. Apan | Farmer COU Teddo Box 107 |
| 24/3/2004 | Engoru George William | Farmer COU Teddo Box 107 |

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|---|---|---|
| 24/3/2004 | Akol George William | Farmer COU Teddo Box 107 |
| 24/3/2004 | Okiror Robert | Farmer COU Teddo Box 107 |
| 24/3/2004 | Odeng Pampas | Farmer COU Teddo Box 107 |
| 24/3/2004 | Odong Patrick | Farmer COU Teddo Box 107 |
| 24/3/2004 | Okiror Felix | Farmer COU Teddo Box 107 |
| 24/3/2004 | Akul Magu | Farmer COU Teddo Box 107 |
| 24/3/2004 | Ocela Stephen | Farmer COU Teddo Box 107 |
| 24/3/2004 | Ekarethkokas | Farmer COU Teddo Box 107 |
| 24/3/2004 | Eseru Samuel | Farmer COU Teddo Box 107 |
| 24/3/2004 | Amongin Agnes | Farmer COU Teddo Box 107 |
| 24/3/2004 | Eroju Moses | Farmer COU Teddo Box 107 |
| 24/3/2004 | Okurut Simon | Farmer COU Teddo Box 107 |
| 24/3/2004 | Inau Lucy | Farmer COU Teddo Box 107 |
| 24/3/2004 | Olupot Cochas | Farmer COU Teddo Box 107 |
| 24/3/2004 | Asilong Joyce | Field coordinator |
| 24/3/2004 | Engwedu Raymond | Farmer COU Teddo Box 107 |
| 24/3/2004 | Dr. Paul Ojuman | Farmer COU Teddo Box 107 |
| 24/3/2004 | Mr. Akellem Richard | Farmer COU Teddo Box 107 |
| 24/3/2004 | Ongoleo James | Farmer COU Teddo Box 107 |
| 24/3/2004 | Aguti Elizabeth | Farmer COU Teddo Box 107 |
| 24/3/2004 | Enonung William | Farmer COU Teddo Box 107 |
| 24/3/2004 | Eryelu Richard | Farmer COU Teddo Box 107 |
| 24/3/2004 | Enyior Austine | Farmer COU Teddo Box 107 |
| 24/3/2004 | Engulu Juven | Farmer COU Teddo Box 107 |
| 24/3/2004 | Oisu David | Farmer COU Teddo Box 107 |
| 24/3/2004 | Oriro Richard | Farmer COU Teddo Box 107 |
| 24/3/2004 | Enimo Radus | Farmer COU Teddo Box 107 |
| 24/3/2004 | Epitu Michael | Farmer COU Teddo Box 107 |
| 24/3/2004 | Elwongu Daniel | Farmer COU Teddo Box 107 |
| 25/3/2004 | Zaina Muwongye | ARDC Kabale |
| 26/3/2004 | Dr. Anguy Geofrey | KIHEFO |
| 30/3/2004 | Dr. Tukahirwa Abel | |
| 3/4/2004 | Ahmed Kasule | |
| 5/4/2004 | Rev. Canon. E. Kayeeye | AICM - Kabale. |
| 5/4/2004 | Jasper Kyomukama Kazebisha | 077-429526 |
| 7/4/2004 | James Dunn | |
| | Nightngale Nantamu | USAID – 031-387387 |
| 8/4/2004 | Joy Tukahirwa M.B. | ECOTRUST |
| 8/4/2004 | Lazarus Owakubariho | |
| 8/4/2004 | Heinz Loos | |
| 8/4/2004 | Fina Opio | |
| 9/4/2004 | Alinemary Kemerwa | RDC Rakai District |
| 15/4/2004 | Jimmy Twinomugisha | |
| 15/4/2004 | Byamugisha Livingstone | |
| 19/4/2004 | Miika Makela | ICRAF-NAIROBI |

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|---|---|---|
| 20/4/2004 | Anand Dilhai | |
| 20/4/2004 | Re'my NOE | EU delegation – Kampala |
| 20/4/2004 | John J. Oloya | World Bank, Kampala |
| 20/4/2004 | John f. Olweny | Royal Danish Embassy, Kampala |
| 20/4/2004 | Jacob Kampen W.B. Gursnllal | |
| 20/4/2004 | Dr. John J.W. Aluma | |
| 20/4/2004 | Japheth M. Magyembe | |
| 20/4/2004 | Dr. Jean-Marc Boffa | |
| 20/4/2004 | Sophy Musaana | |
| 20/4/2004 | Roger kakuhenzire | ARDC Kachwekano - Kalengyere |
| 20/4/2004 | Dr. J.J. Hakiza | |
| 20/4/2004 | Dr. W.W. Wagoire | |
| 27/4/2004 | Ferdi Vau Lyc, | SAPO |
| 27/4/2004 | Hugh Cumpbell | DFDT South Africa |
| 29/4/2004 | Atwine Moses Kanuriira | C/O PRIME-West Tel. 077-472788 |

Appendix 1. Status Report for the Centralized Seed Stands in Kabale District:

| | # Initial planting | | | Present # of trees | | | |
|---|---|---|---|---|---|---|---|
| Subcounty | Calliandra | Grevillea | Alnus | Calliandra | Grevillea | Alnu | Comments |
| Kitumba | 100 | 100 | 100 | 7 | 20 | 55 | • Well managed but needs spot weeding<br>• Most *Calliandra* had a been lost<br>• Space is the problem to the Sub county |
| Kamuganguzi | 100 | 100 | 100 | 49 | 57 | 88 | • *Alnus* is over-grown needs thinning and pruning<br>• The weeds have over-grown<br>• Some trees were cut down for stakes production<br>• *Calliandra* trees damaged by domestic animals |
| Kyanamira | 100 | 100 | 180 | 55 | 56 | 93 | • Undergrowth is thick and overcrowding trees.<br>• The location of the stand needs to be revised with the Sub-county administration |
| Kaharo | 100 | 180 | 180 | 4 | 23 | 133 | • The *Calliandra* trees no longer exist, they were grazed<br>• Some trees were cut, *Alnus* is the one surviving in the stand. |
| Rwamucucu | 100 | 50 | 50 | 74 | - | - | • *Calliandra* is seeding, the rest of the species didn't survive<br>• Others were grazed |
| Kashyambya | - | - | - | - | - | - | • The whole tree stand was destroyed |
| Kamwezi | 150<br><br>150 | 150<br><br>150 | 150<br><br>150 | 129<br><br>120 | 125<br><br>56 | 110<br><br>97 | • Two stands exist in the area<br>• Communal seed stand -well managed, needs replacement<br>- *Calliandra* survival was very low<br>- *Grevillea* trees are very healthy and vigorous<br>• Church seed stand - *Calliandra* is seeding<br>- *Calliandra* seeds have germinated below the trees<br>- *Grevillea* and *Alnus* are performing well |
| Bubare | 150 | 150 | 150 | 99 | 76 | 75 | • Well managed<br>• Needs beating up of *Calliandra* and *Leucaena*<br>• *Calliandra* already seeding. |

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|---|---|---|---|---|---|---|---|
| Bufundi | 100 | 100 | 150 | - | 67 | 90 | The *Grevillea* and *Alnus* seed stands are doing well but need slashing and spot weeding<br>*Calliandra* was suppressed by weeds and therefore needs beating up. |
| Muko | 150 | 150 | 150 | 5 | 96 | 110 | • The *Grevillea* and Alnus seed stands are doing well but need slashing and spot weeding<br>*Calliandra* was suppressed by weeds; need for beating up. |
| Bukinda | 100 | 100 | 100 | 15 | 45 | 50 | • Needs spot weeding , slashing and replacements<br>• *Calliandra* already in Seeding already |
| Maziba | 150 | 150 | 150 | 16 | 120 | 120 | • Survival for *Calliandra* was less<br>• Needs slashing, spot weeding and replacement of few *Alnus* and *Grevillea*<br>• Not yet seeding. |
| Kanaba (Kisoro District) | 125 | 125 | 125 | 12 | 98 | 66 | • Survival percentage for *Calliandra* is low due to lack of appropriate management<br>• Needs slashing, spot weeding and beating up. |
| Hamurwa | 100 | 100 | 100 | 10 | 76 | 54 | • Bush had engulfed the seed stand<br>• *Calliandra* survival % is very low<br>Spot weeding and slashing is needed for *Grevillea* and *Alnus* |
| Rubava | 50 | 50 | 50 | - | - | - | The seed stand was uprooted |