INTRODUCTION

Nakasongola District is located in Uganda's cattle corridor in central Uganda. Geographically, Nakasongola borders the districts of Apac to the North, Masindi to the West, Luwero to the South and Kayunga to the East. While the cattle corridor is not currently classified as semi-arid, it has many semi-arid characteristics. These include:

i) high rainfall variability; ii) periodic droughts or late onset of rains; and

iii) historical reliance on mobile pastoralism as an important strategy to cope with resource variability. The cattle corridor is vulnerable to climate change, and this affects national and local food security.

While pastoralism and crop production are the major socio-economic activities in the district, there have been changes in land use and land cover in Nakasongola District over the last 29 years (1986 to date). The area under grassland, bushland and forest decreased by 96.1, 25.6 and 17.2%, respectively; while open water, wetland, and small scale farming increased by 5.3, 2.7 and 26.8%, respectively. Of serious concern is the increase in bare ground by 211% over this period[1]. The local communities, including individual farmers and groups, have had to adopt coping mechanisms that include the use of local knowledge and innovations.to increase resilience.

One of the innovations documented through the CLIC-SR Project is an innovation aimed at minimising the amount of water needed for watering tree seedlings in a nursery. The experimentation made use of Pawpaw (papaya) trees as they are fast growing.

Following the baseline and field studies conducted under the CLIC-SR project, farmers who were identified. One of the innovators identified was Fredrick Kavuma, who is 48 years of age. Mr Kavuma's innovation was included in the environmental protection category with his peers Ms Najja Robinah, Ms Sebyala Beatrice, Mr Sebyala Mosses and Ms Kabugo Betty who are working closely with him. This group of innovators was supported through a process of participatory Innovation Development (PID).

The origins of the innovation process

Fredrick Kavuma wanted to produce his own tree seedlings, especially fruit trees, but was faced with the challenge of water being scarce in Nakasongola. The alternative sources of tree seedlings are private tree nursery operators in Luweero District, and Nakasongola District Local Government who occasionally supply seedlings to farmers. He went on to investigate

1 http://www.unpei.org/sites/default/files/e_library_documents/uganda-NakasongolaDEP25may08.pdf

water-efficient ways of producing tree seedlings.

The innovation was identified by Kulika Uganda, an NGO that has been working with farmers in Nakasongola District since 2005. Fredrick is one of the farmers with whom Kulika Uganda has been working. Kulika Uganda is also an implementing partner of the CLIC–SR Project, under the Prolinnova Uganda Network.

Reasons for selecting this case for documentation

The various innovation cases identified were presented to the core team of Prolinnova Uganda, Fredrick Kavuma's innovation was selected because Nakasongola District is a dry area characterised by prolonged droughts, reduced tree population, environmental degradation, poor soils and low food and income security. The core team evaluated the case and found it to conform to the criteria that had been set for choosing innovations that are of good value. The innovation was perceived to contribute to environmental conservation, economic emancipation directly or indirectly, be socially acceptable and technologically simple to carry out and scale out. To summarise, the innovation requires relatively low financial input, but has a good economic value, and it is not associated with any cultural barriers.

Funding support for joint experimentation

The process of joint experimentation was supported through the provision of funds that were to be used in development of the farmers' innovations. The funds were disbursed to Kulika Uganda by Environmental Alert, the host organisation for Prolinnova Uganda. Kulika received a total of USH 4,000,000 (approximately USD 1,080) and disbursed the allocation to the different groups according to the budgets and plans that they submitted. The funds made available to farmer innovators through this mechanism were given out as a grant and not a loan.

In the case of this joint experimentation process, the request for funding submitted to Kulika also showed the groups' own contribution. The secretary and treasurer of the farmer group were responsible for keeping records and disbursing funds to the rest of members in the group, while the chairperson had the task of overseeing implementation. The other group members were to follow up and ensure accountability during the experimentation process.

THE PROCESS OF JOINT EXPERIMENTATION

Joint experimentation started in 2014 and continued into 2015. Before starting, Prolinnova–Uganda carried out two PID trainings with lead farmer representatives, staff

and stakeholders that were to be involved in the joint experimentation at national level. Later on, community trainings in PID were carried out by the earlier trained staff and a local consultant. Funds were provided by Prolinnova–Uganda to support farmers in their innovation development.

The farmer innovators in the different agricultural and socio-economic thematic groups, which included the environmental conservation group, formed research and fund management committees (one per group) comprising of a chairperson, secretary and treasurer, while the farmers whose innovations had not been selected for PID remained as active members throughout the process.

The PID process involved key stakeholders, which included the lead innovator, his family members (wife and children), farmer group, NGOs, researchers, extension workers and local political leaders. Each stakeholder had a differentiated but equally important role in the joint experimentation process. Before the joint experimentation started, the stakeholders agreed on its overall purpose and the roles and responsibilities of each stakeholder.

Planning and running the experiment

The experiment was planned by Frederick Kavuma as the lead innovator and four other members of his group (the environmental conservation group). The experiment was carried out by the group with Fredrick being in charge of the day to day care and management of the nursery. The group came together twice a month to carry out joint physical observations of growth and counts of the seedlings, in order to monitor the experiment and to keep records. Technical backstopping was provided to the innovator and the group. This was achieved through discussion and visualisation of what was on ground and what else needed to be done. It included an assessment of the treatments and their performance. This process was led by the farmers, since they live within the community - on or near the farms and experimental sites.

Documentation of the experiment

The more regular documentation of the experimental process was done by the group with the innovator and his family members taking the lead. Ms Harriet Ndagire from Kulika–Uganda led the process documentation working with the farmers and stakeholders from NARO-MUZARDI (Mukono Zonal Agricultural Research and Development Institute) and technical staff from Nakasongola Local Government. In both cases, the process of documentation involved visual observation, note taking, photographic evidence and field visits. Reports were compiled that documented progress with the innovation process. Planning and review meetings were also held with respect to the funds provided for supporting farmer innovation.

Participatory monitoring of the innovation process made use of focus group discussions (FGDs) that included the different stakeholders mentioned above. Techniques such as interviews and question-and-answer sessions were particularly important for probing for any changes in the innovation.

The treatments tested through joint experimentation

Table 1 presents a summary of the treatments applied during the experiment to test different methods of raising tree seedlings. These treatments were chosen by the farmers with guidance from NARO-MUZARDI and Kulika Uganda staff.

Table 1: Treatments applied during experimentation with raising tree seedlings

Treatment	Pictorial Illustration of the treatments
Treatment 1 - Raising seedlings in bottles in a raised (ridged) nursery bed with no manure.	
Treatment 2 - Raising seedlings in a raised nursery bed in plastic bottles in soil with manure.	
Treatment 3 - Raising seedlings in a sunken nursery bed with soil in plastic bottles – but soil not mixed with composted manure. The area was lined with polythene sheeting to prevent water loss through infiltration.	

Treatment 4 - Seedlings raised in a mixture of soil and composted manure directly in the soil (no bottles) with polythene sheeting to prevent water loss through infiltration.

Photos by Harriet Ndagire Sempebwa of KULIKA-Uganda, 2015

A summary of the key aspects of the different treatments is provided in Table 2.

Table 2: Summary of information pertaining to the different methods that were compared

Treatment	Polyethylene lining	Sunken / raised	In plastic bottles	Composted manure
1	No	Raised	Yes	No
2	Yes	Raised	Yes	Yes
3	Yes	Sunken	Yes	No
4	Yes	Raised	No	Yes

FINDINGS OF THE JOINT EXPERIMENTATION

The findings associated with the different treatments tested by the farmers are summarised below and include germination performance, seedling vigour, survival with reduced watering (resilience to water stress), water requirements, seedling growth rate, seedling survival and ease of transplanting. These are all aspects that were of importance and interest to the farmers.

Germination performance

For each treatment, 60 seeds were planted to test germination performance. All seedlings in all treatments germinated on the same day, but the overall germination rate varied across the treatments as shown in Table 3.

Table 3: Germination rates of the four treatments

Treatment	Germination rate	Discussion of the results
1	40/60 (66.7%)	The soil nutrients and water levels were lowest, thus much lower germination than in treatment 2 and 4
2	55/60 (91.7%)	The soil nutrients and water levels were good thus best germination performance
3	45/60 (75%)	The soil nutrients were low thus only fair germination performance compared to those in treatments 2 and 4
4	55/60 (91.7%)	The soil nutrients and water levels were sufficient for germination thus best germination performance

As shown in Table 3, Treatments 2 and 4 - which both had composted manure, gave the highest germination rates.

Seedling vigour

In terms of ranking the vigour of the seedlings from best to worst, the following results were obtained from the experiment:

Table 4: Comparison of seedling vigour across treatments

Treatment	Seedling vigour
4	Best
2	Second-best
3	Second-worst
1	Worst

Again, the treatments with manure outperformed those where the seedlings were grown only in soil.

Survival with reduced watering

The rate of survival of seedlings when water was withheld for a period of two

weeks was assessed for the four treatments.

Table 5: Survival of seedlings under the 4 treatments after a 2 week period of reduced watering

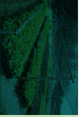
Treatment	Survival rate
1	50% (20/40 seedlings died)
2	100% (All seedlings that germinated survived)
3	56% (20/45 seedlings died)
4	100% (All seedlings that germinated survived)

Treatments 2 and 4 prevented water loss and thus allowed the seedlings to survive the two week period. More detail of the findings from the research is provided in Tables 6 and 7, which consider water requirements and seedling growth rates, seedling survival to transplanting and ease of transplanting.

Table 6: Results of the experimentation regarding water requirements and seedling growth rate

Treatment	Water consumption	Discussion of the results	Seedling growth	Discussion of the results
Treatment 1 - Raising seedlings in bottles in a raised (ridged) nursery bed with no manure	The tree seedlings required watering daily, both in the morning and the evening. The seed bed required 5 litres of water per day.	The soil did not have manure in it and thus had very little capacity to retain water.	The seedlings in treatment 1 showed the slowest growth.	The soil did not have manure in it and thus it had low levels of nutrients and it had little capacity to retain water thus the low growth rate of seedlings under this treatment.
Treatment 2 - Raising seedlings in a raised nursery bed in plastic bottles in soil with manure	This ranked second in economising water usage. Seedlings required watering twice a week for the first month and thereafter required watering once (2 Litres) per week.	The composted manure in the soil could have increased the water retaining capacity of the soil but probably the size of the water bottles could have been limiting the amount that was available to the individual seedlings	The seedlings grew faster than those in treatment 1 but slower than those in treatments 3 and 4.	The soil had manure in it to support fast growth but the walls of the bottles could have limited the access to the nutrients by the roots of the seedlings and this could be the reason for the slightly lower growth rate than in treatment 4.

Treatment 3 - Raising seedlings in a sunken nursery bed with soil in plastic bottles – but soil not mixed with composted manure. The area was lined with polythene sheeting to prevent water loss through leaching.	The tree seedlings required watering every day (once in the evening).	The soil did not have manure in it but the walls of the plastic bottles could have helped to keep the soil moist longer than in treatment 1.	The seedlings grew faster than those in treatments 1 and 2 but slower than those in treatments 4.	The soil did not have manure in it and it also had less capacity to retain water thus it had low levels of nutrients and slower growth than in treatment 4 and 3 but the walls of the plastic bottles could have helped in keeping water around the roots longer than in treatment number 1.
Treatment 4 - Seedlings raised in a mixture of soil and composted manure, with plastic lining but not in plastic bottles.	Water usage was most economical. The seedlings required watering twice a week but were consuming little water (about two litres per watering).	The composted manure in the soil could have helped in increasing the water retaining capacity of the soil.	The seedlings showed the fastest growth.	The soil had manure in it and most likely enough nutrients to support fast growth



SUMMARY OF THE FINDINGS	From best to worst performance in terms of economising water use: Treatment 4 (Best) Treatment 2 Treatment 3 Treatment 1 (worst)	From best to worst performance: Treatment 4 (fastest) Treatment 3 Treatment 2 Treatment 1 (slowest)

Table 7: Seedling survival up to transplanting and ease of transplanting in the four treatments

Treatment	Survival up to transplanting	Discussion of the results	Ease of transplanting	Discussion of results
Treatment 1 - Raising seedlings in bottles in a raised (ridged) nursery bed with no manure	10/60 (16.7%) seedlings survived upto transplanting stage	Most of these seedlings succumbed to death during the 2 weeks period of no watering due to water stress. Others died later due to poor soil and further water stress.	Seedlings were the hardest to transplant	The soil was hard and compacted because of there being no manure.
Treatment 2 - Raising seedlings in a raised nursery bed in plastic bottles in soil with manure	50/60 (83.3%) seedlings survived upto transplanting	The composted manure in the soil had nutrients in it and could have helped to increase the water retaining capacity of the soil thus ensuring better survival of the seedlings than in treatment 3 and 1 during the 2 weeks when there was no irrigation. The rest of the seedlings could have died due to attack by root collar disease.	Seedlings were fairly easy to transplant	The bottles allowed the lump of soil around the seedling to be pushed out from below. Also, the soil had manure in it and was not compacted so it easy to push out.

Treatment 3 - Raising seedlings in a sunken nursery bed with soil in plastic bottles – but soil not mixed with composted manure. The area was lined with polythene sheeting to prevent water loss through leaching.	20/60 (33.3%) seedlings survived upto transplanting	The soil had no manure but walls of bottles helped to retain some moisture more than in treatment 1. The seedlings died due to water stress.	Seedlings were difficult to transplant	The soil was compacted because of there being no manure, but the walls of bottles helped to retain more moisture than in treatment 1. The bottles also allowed the lump of soil around the seedling to be pushed out from below.
Treatment 4 - Seedlings raised in a mixture of soil and composted manure, with plastic lining but not in plastic bottles.	50/60 (83.3%) seedlings survived upto transplanting	The compost manure in the soil had nutrients in it and could have helped to increase the water retaining capacity of the soil thus better survival of the seedlings during the 2 weeks when there was no irrigation than in treatment 3 and 1. The rest of the seedling mortalities could have been due to an attack of root collar disease.	Seedlings were the easiest to transplant	The soil had manure in it and was not compacted but loosely bound the roots of the seedlings. The bottles also allowed the soil around the seedling to be pushed out from below.

SUMMARY OF THE FINDINGS	From best to worst: Treatments 2 & 4 (Best) Treatment 3 Treatment 1 (worst)	From best to worst: Treatment 4 Treatment 2 Treatment 3 Treatment 1

SUMMARY OF THE FINDINGS

Treatment 1 performed the worst in seedling survival to transplanting. This is attributed to the lack of organic matter that reduced water holding capacity resulting in poor survival. Treatment 1 also performed worst in terms of and also in terms of ease of transplanting, which is also attributed to the lack of manure resulting in compacted soil in the bottles. Treatment 1 also performed worst in efficient water use and seedling growth performance. This is attributed to lack of manure, resulting in low fertility and water holding capacity.

Treatment 2 performed well in terms of seedling survival to transplanting, attributed to the manure increasing water holding capacity. Treatment 2 was second best in terms of ease of transplanting, attributed to manure reducing compaction in the bottles. Treatment 2 performed second best in efficient water use and seedling growth performance. This is attributed to the manure, which improved soil fertility and water holding capacity.

Treatment 3 performed second worst in terms of seedling survival. Although there was no manure, being sunken and surrounded by a plastic sheet did reduce water loss to some extent. It also performed second worst in terms of ease of transplanting, due to lack of organic matter resulting in soil compaction, but not as compacted as in Treatment 1, because there was some residual soil moisture. Treatment 3 performed second worst in terms of water-use efficiency, but second best in terms of seedling growth. While there was lower soil fertility and water-holding capacity because of the lack of manure, being in a sunken bed reduced water loss, which allowed better growth of the seedlings.

Treatment 4 performed equally well as Treatment 2 in terms of seedling survival to transplanting, attributable to the manure. Similarly, it performed best in terms of ease of transplanting, because to manure reduced soil compaction in the bottles. It also performed best in terms of water-use and efficiency seedling growth, on account of the manure, which improved soil fertility and water-holding capacity.

CONCLUSION

The inclusion of manure is important for increasing germination and survival of the seedlings to transplanting. It is also important for increasing plant performance in terms of growth and water-use efficiency. This is due to the better fertility and water-holding capacity of soils with manure. Inclusion of manure also improves soil structure, making soil less prone to compaction, so the seedlings are easier to transplant. In addition, sunken beds also seem to conserve water. It is therefore recommended that for, best water-use efficiency, the tree seedlings are grown in a mixture of soil with manure and placed in plastic-lined sunken beds.

GENDER ASPECTS OF THE INNOVATION

The seedling raising innovation is technically simple and the activities were carried out by men, women and the youth. The innovation is relevant for both men and women. It can be carried out on a small piece of land, making it well suited for adoption by women and youth, who usually have less access to large pieces of land. Even youths, who are sometimes landless, can borrow or hire land - even along the roadsides - and can earn income from the sale of seedlings. They can later invest this money in land acquisition. They would however need to have access to a source of manure and would need to be able to purchase the plastic lining and/or collect plastic bottles.

SPREAD OF THE INNOVATION

The farmers in this group and those beyond the group in Nakitoma and Nabiswera Sub-county have learnt that lining a nursery bed with polythene sheeting before putting in the soil mixture is beneficial because it economises the amount of water required. They have also seen that the addition of manure improves the vigour of the seedlings as it provides an effective growing medium. Two farmers have already adopted the technique. One is Ms Kabugo Betty, who is from the group, while Mr Lwanga Kajura, from another group has also adopted this practice. Two other farmers from Mr Lwanga's crop production group have expressed interest in adopting the practice and have requested support with purchasing the high gauge plastic sheeting and the plastic drums needed for the innovation.

HOW DOES THE INNOVATION IMPROVE RESILIENCE OF COMMUNITIES?

Tree growing, if practised on a wide scale, can lead to lowering of ambient temperatures and creation of a cooling effect in the drylands of Nakasongola District. Roots of trees grown on farms can bind soil particles together and reduce soil erosion. Fallen leaves help to cover/ mulch the soil and thereby further protect it from heat and erosion. Moreover, when dead leaves decompose, organic matter and fertility are added to the soil and better yields of crops and pastures can be expected. When fruit trees are grown, food in the form of fruit will be more abundant which will, in turn, allow for better human nutrition. Trees can also improve income security and thus contribute to improved livelihoods. In the long run, if this innovation is scaled up, it is likely to contribute to strengthening resilience, leading to a reduction in the negative impacts of climate change on the livelihoods of the farming communities, especially in the cattle corridor in Uganda and possibly drylands elsewhere in Africa.

LESSONS LEARNT

Some of the lessons learnt through this process of joint experimentation are:

Through joint innovation processes, the confidence of the farmer innovator or innovators to take charge of their own situation increases.

When other people (extension workers, scientists, civil society organisations (CSOs) and other farmers) allow the farmer innovators to be centre stage, they gain recognition and this serves as motivation and helps to boost their enthusiasm to continue innovating and engaging in PID.

Farmer-led joint experimentation strengthens team work, sharing of knowledge, and wider learning. However, for groups to work together effectively, the members need to be cooperative, good 'hearted' and transparent, and willing to share and to take on roles identified according to each ones capacity/ ability.

Funding for PID plays an important role in helping farmers to acquire materials and/or equipment to use to bring out the results of the experiment or innovation.

To go through the joint-experimentation process and obtain results requires persistence and consistence.

For wider dissemination of beneficial results from farmer-led joint experiments, local governments, media, CSOs and extension workers have to participate and support the process.

Joint experimentation needs continuity - from obtaining of results to applying those results to solve a problem, meet need(s) or bridge gaps in livelihoods or development.

There is a need to strengthen the resilience of communities through technical support and encouragement to pursue and enhance their own initiatives. Local innovations geared towards farm-based water conservation will improve the production of crops, trees, plantations and livestock products such as eggs, beef, honey, milk, fruit, etc.

In terms of the tree raising innovation, a number of lessons also emerged:

This innovation has reduced the challenge of water shortages and allows farmers to raise tree seedlings on their own in order to plant new trees or replace trees that have been cut down.

For the innovation to have a longer-term impact on livelihoods, more knowledge in tree growing and other technical aspects of tree nursery management and tree growing would need to be given to the farmers in Nakasongola District.

NEXT STEPS/ WAY FORWARD

Encouragement has been given to the all interested farmers to use the

innovation so as to be able to raise their own seedlings. Once more technical and financial support is provided to current and emerging farmer groups, this innovation has great potential and it is expected that fruit tree seedlings as well as other types of tree seedlings will be propagated using the innovation.

FINAL MESSAGE

Raising seedlings in a sunken nursery bed that has soil mixed with decomposed manure and is lined with polythene sheeting to reduce water loss is an effective way to raise tree seedlings. The practice needs to be promoted as a best practice and currently there is an opportunity of mainstreaming climate change impact mitigation and resilience building among communities. This practice can be popularised and included in implementation programmes of government departments and NGOs.

ACKNOWLEDGEMENTS

I wish to acknowledge the efforts the different people and organisations including Management teams in Kulika Uganda and Environmental Alert led by Christina Sempebwa; Dr. Charles Walaga and Dr. Joshua Zake respectively, the farmer innovator Mr. Kavuma Fredrick, the peer group members in the environmental conservation group, including: Ms Najja Robinah, Ms Sebyala Beatrice, Mr Sebyala Mosses and Ms Kabugo Betty, Mr. Richard Lumu and Ms Winniefred Nakyagaba from NARO-MUZARDI; stakeholders from Nakasongola Local Government including the District Entomology Officer, Ms Nansubuga Sarah, and the District NAADS Coordinator, Sebwato Joshua, as well as other leaders of the technical staff team including Fred Kitaka, Director of Production; Ms Nakamya Sarah, District Agricultural Officer; Fred Nsambansole, District Fisheries Officer; Chief Administrative Officers Kasozi and Byekwaso; as well as all the other stakeholders in the village; the Prolinnova International Support Team including Ms Chesha Wettasinha, Laurens van Veldhuizen, Ms Ann Waters-Bayer and Ms Brigid Letty, and all others who provided technical backstopping during the CLIC–SR project.

The Rockefeller Foundation is appreciated for the financial support through the CLIC–SR project, which provided the framework through which innovation for building resilience to change was promoted.

Box 1. About Prolinnova Uganda

PROLINNOVA Uganda is an NGO-led multistakeholder initiative to build a national learning network on promoting local innovation in ecologically oriented agriculture and natural resource management (NRM). PROLINNOVA–Uganda envisions, 'a world in which women and men farmers play decisive roles in agriculture and NRM innovation processes for sustainable livelihoods.'

The mission is to, 'stimulate a culture of mutual learning and synergy among diverse stakeholder groups to actively support and promote local innovation processes in agriculture and NRM.'

The goal of Prolinnova Uganda is to, 'contribute to equitable and inclusive development of resilient and sustainable farming communities.'

Prolinnova Uganda is governed by the following Institutional structures

Prolinnova International Support Team (IST)
Supports PROLINNOVA activities at national and regional level through overall coordination, fundraising, capacity strengthening, coaching, web-based knowledge management, policy dialogue, networking, publishing and other activities to raise the profile of PROLINNOVA and inform the world about approaches and outcomes in supporting farmer innovation and PID.

The International Secretariat
This is now hosted by KIT (Netherlands), and is responsible for overall administrative and financial management of projects that are funded through the international PROLINNOVA network.

PROLINNOVA Uganda National Steering Committee.
This comprises of 10 members including: Ministry of Agriculture, Animal Industries and Fisheries; National Agricultural Research Organization; National Agricultural Advisory Services; Development Network of Indigenous Voluntary Associations; International Centre for Tropical Agriculture; Uganda National Farmers Federation; Uganda National Council for Science and Technology; Faculty of Forestry and Nature Conservation-- Makerere University; Africa 2000 Network; and Environmental Alert, the Prolinnova Uganda Secretariat. It provides overall oversight and strategic guidance in implementation of the country program.

Core Team
This comprises of PELUM-Uganda; KULIKA Uganda; Kikandwa Environment Association; Mukono Agricultural Research and Development Institute; and Environmental Alert, the Prolinnova Uganda Secretariat. They provide technical backstopping to the Secretariat and members in respect to advancing participatory innovation development.

The Secretariat for Prolinnova Uganda
This coordinates Prolinnova members and partners in the implementation of Prolinnova Uganda Country Program. Environmental Alert hosts the secretarit for Prolinnova Uganda.

Members of Prolinnova Uganda
These participate in networking, information exnchage and implementation of PROLINNOVA Uganda program activities.

Partners of Prolinnova Uganda
These share similar goals and aspirations as PROLINNOVA Uganda and hence, collaborate in the implementation of PROLINNOVA Netwwork strategic plan and related country programs.

For more information contact:

Dr. Joshua Zake (PhD), Executive Director Environmental Alert.
P.O. Box 11259, Kampala, Uganda
Telephone: 0414510215

Email: ed@envalert.org or joszake@gmail.com

Environmental Alert website: http://www.envalert.org
C/o PROLINNOVA-Uganda Country Platform Secretariat

Prolinnova-Uganda country platform
website: http://www.prolinnova.net/uganda

ECONOMIC UTILISATION OF WATER IN A TREE NURSERY BED: THE CASE OF A FARMER INNOVATOR IN NAKASONGOLA DISTRICT IN UGANDA.

By Harriet Ndagire Sempebwa (Kulika Uganda)
and
Joshua Zake (Environmental Alert)

KULIKA UGANDA
Transforming Livelihoods
SINCE 1981

ENVIRONMENTAL ALERT

PROLINNOVA
Uganda
PROmoting Local INNOVAtion
in ecologically-oriented agriculture and natural resource management