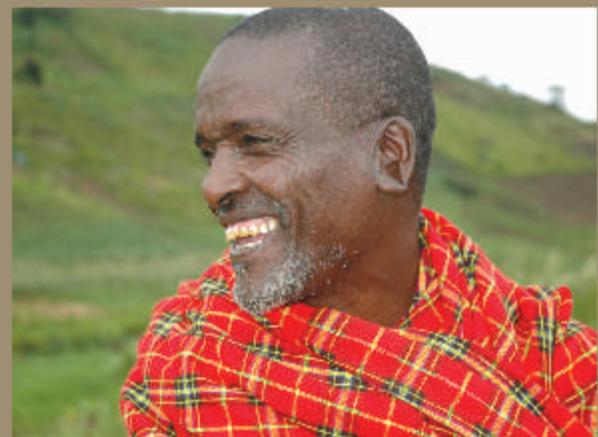


Innovations on Natural Resource Management



Case stories from farmers in Tanzania



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Marianne Buhrkal Soerensen. The front cover photos show - Left: Picking of dried fruits from the "*Casuarina Cunninghamiana*" tree. Top: Sungura Mang'aro. Middle: Grace Mkwidu. Bottom: Omari Killo.

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Introduction

One of the great challenges we face in Tanzania today is our ability to manage our natural resources - our soil, water, plants and animals. A sustainable management of natural resources is important if we want to maintain the health of our environment, conserve our land and biodiversity and continue to be a major agricultural producer. The issue concerns us all, and we owe it to both ourselves and the generations to come to take it serious. And changes are first and foremost about people taking action.

In this brochure we have documented six case stories from farmers in different regions of Tanzania, who have taken action and adopted innovations or invented new ones within natural resource management. The innovations have enhanced their agricultural production, increased their yield and secured the future of their land. Consequently the innovations have improved the livelihood of the farmers by providing more food to eat and sell, allowing children to go to school and by making it possible to build and/or improve houses, among others.

Our intention with the case stories is to document and disseminate information about new and unknown innovations, although we appreciate the fact that an innovation unknown in one part of the country can be well known in another part and vice versa. We encourage you to read about the innovations for inspiration and to grasp the ideas you can use.

We thank the farmers in the brochure for the willingness to share their knowledge and experience with other small scale farmers in order to enable them to make a difference to our environment and to improve their livelihood.

We hope you will enjoy the reading.



Jatropha Tree Prevents Soil Erosion



Sungura Mang'aro with a cutting from one of his jatropha trees.

Sungura Mang'aro has been a farmer since 1984. During the years he has been challenged by the dry land in Monduli Juu, Arusha, and the steep slopes of his fields. Cattle, goats and wild animals have added to his worries. Now the jatropha tree has made his life easier and a new village law will also help increase his yield.

A branch is cut of a jatropha tree and leaves and twigs are removed before the cutting is replanted.

Text and photos: Marianne Bubrkal Soerensen

After visiting a friend, who uses the jatropha tree for fencing, Sungura Mang'aro came up with the idea of using the tree to reduce soil erosion and to protect his ridges. A jatropha cutting was planted at the top of a field and now several trees are produced.

A tree with numerous qualities

“The tight and strong roots of the jatropha tree decrease the speed of rainwater running down the slope and hence prevent soil erosion. At the same time the plant is safe from being eaten by livestock and wild animals. The leaves, twigs and seeds are toxic to them”, says Mang'aro. He also stresses that the mole rat, who is normally very fond of roots, keeps away from the jatropha tree. Other qualities of the tree are its ability to resist drought and to grow in marginal soil. It grows equally well in areas with low and high rainfall.

Before using the jatropha tree to prevent soil erosion Mang'aro tested other types of trees but none of them fulfilled his objectives. They were either eaten by animals or killed under the rough conditions of the dry climate.

Sungura Mang'aro shows how soil erosion has destroyed maize crop on another field in his village Emairete.

Easy to reproduce

With his knife Mang'aro cuts of a branch on the bias from one of his jatropha trees. He quickly removes leaves and twigs from the lower part of the branch and digs a one foot deep hole. Kneeling down to plant the branch he explains the importance of tilting it to one side. If planted straight up in the air the rain can penetrate the plant and make it rot.

When asked why he does not plant the seeds from the trees instead, Mang'aro replies: “Because the seeds need more water and take longer time to grow.” It takes three to four years from a seed is planted till the tree is about 9 to 15 feet high. A cutting strikes roots very easily and grows to the same height in only two years.

For the time being Mang'aro only has planted jatropha trees at the top of one steep slope. His plan is to plant the tree at the top and on both sides. They will not be planted at the bottom of the slope as this will hinder the rainwater from running out of the field. Before surrounding most of the field with jatropha trees he wants to construct ridges again.



After cutting off a branch Sungura Mang'aro cleans his knife thoroughly as the jatropha tree is poisonous.





Seeds from the jatropha tree.

Seeds are put in small plastic bags in a nursery.

Village law helps protect the trees

Ridges are a common way of preventing rainwater from damaging crops. This is well known by the farmers in Emairere, the village of Mang'aro. Many of them have received training in how to construct ridges, even though not a single ridge is in sight. Instead it is easy to spot the soil erosion made by the rain on the nearby fields. The ridges had been constructed, however they are constantly destroyed by herds of animals as it is custom for Maasai to let the animals wander around freely.

But this is hopefully about to change. In August 2006 a new village law was agreed upon to protect ridges from

being destroyed, as well as trees and crops from being eaten by cattle and goats. Violation of the law will result in a penalty – a charged fine payable to the village. The responsible herdsman will be sentenced to pay for the damage in form of cattle or money. Whether the law will be upheld or not remains to be seen. At a village meeting it was also decided to construct ridges and that trees must be replanted if they are cut or burned.

A wish for the future

Mang'aro tells vividly about the different uses of the jatropha tree. Not only can the tree protect his fields from the rain and animals. Its seeds can be used to produce fuel for illumination, bio diesel, medicine, soap

and other cosmetics. Also the waste of the seeds is useful. It can be used for fuel, organic fertilizer and even food for animals. Mang'aro's wish for the future is to learn how to produce the different products from the seed. "It will increase my profit even more, if I can produce these products myself or sell the seeds to a manufacturing company for further processing", he concludes.

Seeds from the jatropha tree can be used to produce soap and kerosene for illumination, among others. These products were found in Makambako in Iringa. Here the jatropha tree is well known.



Facts about the jatropha tree

The specie planted by Sungura Mang'aro is called "*Jatropha curcas*". It is a multi-purpose tree that helps farmers fight the battle against soil erosion and protects crops against animals and the wind. Characteristics of the tree are:

- Small gestation period
- Grows easily in marginal soil
- Drought resistant
- Can be intercropped with crops such as coffee, sugar cane, fruits and vegetables
- Seeds with up to 40% oil content
- Gives on average 40 kg seeds per tree annually
- Yield seeds in the first year after plantation
- Productive in up to 50 years
- Large shrub that gets up to three to four meters high.

Sources: www.jatrophacurcas.net and www.jatrophabiodiesel.org.

Water Harvesting and Manure Raise Crop Productivity



Devis Mlonganile from Sekalenga in Njombe, Iringa, harvests rainwater and underground water to increase his crop production. Four dams of soil and a tank of stone is made at different levels of his fields to ensure accessibility to water. He also uses two kinds of organic manure to increase the yield.

*Text and photos:
Marianne Bubrkal Soerensen*

The story of the innovations of Mlonganile starts with a fish pond he made 35 years ago. After ten years he replaced the pond with a dam, because he needed to harvest water to produce food to his growing family and to generate more income. The first two dams were made in 1976 and the last three in 1997. Asked about the long time span Mlonganile laughs and says: “Innovations take time and they are developed further as you go along.”

A network of water dams

It is with great enthusiasm Mlonganile demonstrates and explains about his innovations. He has ten acres of land spread over one steep and several gentle slopes. On the top of the steep slope lies a dam named “the source”. It is big and helps provide water to the other four, smaller dams through gravity and hoses. The placing of the dams makes it possible for him to distribute water to all his fields.

Some years ago there was no underground water in the area. Therefore only rainwater could be harvested. Today Mlonganile harvests water from both

Getting water from the dams to the crops



1. A can is filled with water from the dam.



2. The hose is put on the tap of the can.



3. The pressure is created when water starts running out at the other end of the hose, and then the hose is put into the water.



4. Devis Mlonganile puts a diffuser on the hose before watering the crops or he uses a sprinkler made by hand out of a small piece of bamboo.

sources. The water in the dams can overflow, however he can direct the water as he wishes due to blockings made on strategic areas around the dams.

Tank of stone

One of the dams is cut out of huge stones – it is called “the tank”. When making the tank, Mlonganile covered and burned the stones with firewood and other materials and then poured cold water on the hot stones to make them crisp and thus easier to cut out. After cutting and removing the stones he covered the bottom with small stones and clay soil to make a solid foundation, hence avoiding leakage. “I wanted to cover the bottom with concrete as cracks arise in the clay, but I didn’t have money to make the optimal solution at the time. I have not given up on the idea, though - it is just postponed”, he says.

Right now the tank is full of branches, as it has not yet been prepared for the season. It was not used in 2006 due to the drought, but this year it will be full of water. Also the soil dams need to be cleaned for leaves and branches before the start of the season.

To get water to the fields

Mlonganile has already prepared one of the dams. Here he shows the process of getting the water from the dams to the crops. To make the water flow, he creates pressure in the hose. It is done, either by filling water in the hose with a can and waiting for water to run out at the other end, or by sucking air out of the hose with the mouth until the water starts running.

At the moment Mlonganile has placed a bamboo under one of the water dams. It works like a pipe, but a great disadvantage is the tendency of the bamboo to rot. If possible he will buy a hose for the underground water to flow.

Organic manure increase yield

“I prefer to preserve the environment by using organic manure instead of the industrial fertilizer. And then I save

money at the same time”, says Mlonganile. Five years ago he listened to a radio program telling about production of top dressing manure from fresh cow dough. He took up the idea and experimented for 1½ month before he got the recipe right.



Another way of creating pressure is by sucking the hose till the water starts flowing.

And now we come back to the old fish pond. At one point in time Mlonganile fed the fish with lots of leaves from vegetables. After that he removed the fish and the pond was left to dry out, as the family was moved to another village because of the ujamaa system. When they came back to stay at their own farm again, Mlonganile found rotten leaves lying at the bottom of the fish pond. He got the idea to use the material as manure and it turned out to be effective.

After that he changed the pond into the first water dam – and use of the green manure died with it. But now it is revived. When making the manure from fresh cow dough, he remembered the manure from the fish pond and tried to produce it using the same method as the dough. Yet again it proved to be effective. He can see how both kinds of manure make the soil more fertile.

How to apply the manure

The manure is used for all kinds of vegetables and fruits. The manure is time consuming to use for maize, though, as it has to be applied to every plant. One cup equal to ¼ liter is added to each plant. It should be applied

around the plant once a month during the season. As soon as a pot is finished, Mlonganile makes a new one.

Ideas in the pipeline

Besides the ideas of improving the foundation of the water tank and of establishing a sustainable pipe system under the floor of one of the soil dams, Mlonganile wishes to build a big storage place made of concrete to keep the two types of manure. “I know water is a friend of concrete and the sun an enemy, hence I will have to make a grass roof to give shade to the storage place”, he adds.

Sharing of knowledge and experience

Mlonganile has trained many farmers in his innovations. More than 20 farmers have adopted the idea of building water

dams. Water is a problem in the area, and he is pleased that the innovation has turned out to be a success for the other farmers as well.

In regard to production of the manure, he has trained a lot of farmers and he knows of at least 12 farmers, who have adopted the idea. He is aware that some people shake their heads because he produces organic manure instead of buying industrial fertilizer, but he also receives a lot of encouragement - and he is eager to share his innovations to help other farmers increase their crop production.



Devis Mlonganile in his tank. The branches in the tank will be burnt and removed before the season starts. A hose will be connected to a tap to lead the water to the fields. The tap is highlighted on the picture.

How to make organic manure

The pots used by Mlonganile can contain 60 liters. The recipe to make the two kinds of manure is the same. It is as follows:

1. Fill $\frac{3}{4}$ of a pot with manure – that is fresh cow dough or fresh, older leaves from all kinds of vegetables and leaves from the plant sunnhemp. The leaves from this plant are especially good for making manure.
2. In the rainy season the cow dough should be fresh to avoid e.g. mud.
3. Fill the remaining $\frac{1}{4}$ of the pot with water.
4. Add five kg ashes from the kitchen fire on the third day.
5. Put half of the manure in another pot (same size) after 15 days.
6. Refill the two pots with water. This dilution of the manure is very important to prevent it from killing young plants.
7. The manure is now smooth and liquid and ready for use.

It is likewise important to stir the manure everyday to prevent it from settling down at the bottom of the pot. Then it will be difficult to stir. However the manure can be left for a couple of days once in a while without stirring.



Stirring of the manure made of fresh cow dough. The manure is one day old.



Some of the leaves applied to make the green manure are cabbage leaves. This manure is also one day old.



The manure is applied around a plant.

*Text and photos:
Marianne Brukøl Soerensen*

Grace Mkwidu from Nyandira, Mgeta in Morogoro, encourages farmers to use natural medicine from botanicals for crop protection as well as for human and animal diseases. The medicine is effective and doesn't have a negative impact on the environment, human beings and animals as the industrial agro-chemicals do.

Grace Mkwidu cuts some branches from trees close to her home. As she sits down in her house she starts picking leaves from one of them with quick movements. The leaves are put in a mortar as she explains about the process of producing natural medicine from botanicals. They are made in both liquid and powder form.

Various uses

The branches Mkwidu cut are from the trees kibembeni and hunduhundu. They both grow near rivers and water basins, and kibembeni can also be found in gentle slope areas. Other kinds of plants she uses for natural medicine are kidugutusungu, fungamelele, mkundekunde, tumbaku, koniflei, utupa, melemele and ng'aluma. The names are local, but the scientific names are mentioned by the pictures of the plants. Most of the indigenous plants are used to protect vegetables from insects, to wash animals to avoid e.g. ticks and to treat wounds. Four of the plants are used to treat human diseases such as malaria, diarrhea, earache, hernia and ulcers.

24 hours expiry for plant medicine

Mkwidu was handed over the knowledge about using indigenous plants for medicine from other farmers in the village. Watching the other farmers she began to produce the medicine herself, but she also took it a step further and began to experiment on her own. This resulted in an important discovery about five years ago. "By letting the leaves soak in water for 36 hours instead of 24 hours I found out that the medicine gets too

Natural Medicine Protects Crops and Cures Diseases

concentrated. The plants were burned when I applied the test medicine. They looked as if I had poured hot water on them”, Mkwidu explains. She tested all the plants separately and the expiry time is valid for them all. The leaves are only to soak for 24 hours. As for applying the medicine it should be done the day after it has been produced.

How to apply the medicine

Until four years ago Mkwidu only applied the medicine using a small branch and a bucket. Today she also uses a knapsack, which is carried on the back. “There is no significant difference in the two methods, but when I use a branch I can carry my child on the back while I apply the medicine. This is not possible with the knapsack”, says Mkwidu. On the other hand the machine is quicker and more medicine goes to waste using the branch.

Up against beliefs

In 1996 Mkwidu was one of the initiators of forming a farmers group called Mavumbura in Nyandira. Today she is the leader of the group and an active promoter. Together with the other members she disseminates information, gives advice, distributes free samples and shares her technical knowledge about natural medicine to other farmers in the community. This is mostly done through training sessions and home visits.

To change the minds of farmers to believe in natural medicine instead of in industrial agro-chemicals is a challenge. Many farmers adopt the innovation but especially old and well-off farmers believe that natural medicine is only used by poor people. Luckily most young people are willing to adopt it.

“It might be that industrial agro-chemicals require less time for preparation. I only wish farmers would understand that the natural medicine is better for human beings, animals and the environment, because it has no side effects“, Mkwidu comments. As for herself she has saved money using the natural medicine.

How to prepare and use natural medicine

The liquid medicine for crops and animals is applied every two to three weeks and is prepared as follows for all kinds of plants:

1. Four kilos of leaves are pounded in a mortar. Four kilos are equal to 20 liters of compact leaves.
2. The pounded leaves are put in a bucket with 20 liters of water.
3. The leaves soak in the water for 24 hours.
4. The mixture is filtered with a clean cloth.
5. The medicine is ready for use.

The powder to treat wounds is also prepared from leaves. They are pounded, dried, repounded and filtered. The same method goes for powder to preserve cereal such as maize. When 150 kg of cereal is mixed with one kilo of powder it is protected from being eaten by insects for six to eight months.

The medicine for treating human beings is prepared by pounding leaves or by boiling leaves or roots from the plants. To treat diarrhea, earache, malaria and delay of child birth the medicine is prepared by boiling ½ kg of leaves or roots in two liters of water. Diseases are cured by drinking ¼ liter of medicine three times a day for five days. For treatment of hernia roots from ng'aluma are boiled and the disease is cured by drinking ½ a cup a day. To treat ulcers leaves from koniflei are cooked and eaten like a side dish vegetable two to three times a day. Liquid medicine from boiling the koniflei root can be used for teeth problems. It is gurgled and spit out again.

Use of the plants

1. Protect vegetables from insects (liquid)
2. Preserve cereal (powder)
3. Wash animals to avoid e.g. ticks (liquid)
4. Treat wounds on animals (powder)
5. Treat wounds on human beings (powder)
6. Treat diarrhea and earache (liquid)
7. Treat malaria (liquid)
8. Treat hernia and delay of child birth (liquid)
9. Treat ulcers and teeth problems (liquid)



Kibembeni
"Adenoplia uluguruensis
Loganiaceae"

Use: 1, 2, 3 and 4



Hunduhundu
"Cissus oliveri
Vitaceae"

Use: 1, 2, 3, 4 and 6



Kidugutusungu
"Vernonia lasiopos
Asteraceae"

Use: 1, 2, 3, 4 and 7



Fungamele
"Solanum sp.
Solanaceae"

Use: 1, 3 and 4



Mkundekunde
"Senna singuena
Fabaceae"

Use: 1



Tumbaku
"Nicotiana tabacum
Solanaceae"

Use: 1, 2 and 3



Koniflei (Local name)

Use: 9



Utupa
"Tephrosia vogelii
Fabaceae"

Use: 1, 2, 3 and 4



Melemele
"Asclepiadaceae"

Use: 1



Ng'aluma (Local name)

Use: 4, 5 and 8

Bamboo Prevents Flooding and Soil Erosion

A small forest of high bamboos covers ¼ of an acre of one of Omari Killo's fields in Tubugwe in Kongwa, Dodoma. By planting the bamboos he has prevented floods, soil erosion and hence destruction of crops. Years ago it was almost impossible to grow anything on the field. Using the bamboos he gained three acres and today he can harvest 3000 – 4000 cobs of green maize per season, among others.

*Text and photos:
Marianne Bubrkaal Soerensen*

Omari Killo came up with the idea of using bamboos to prevent floods and soil erosion visiting a friend, who uses bamboo to tap juice for a local brew. Experiments with other types of trees and stones had shown no results, but the bamboo turned out to be a great success.

From soil erosion to growing crops

Initially three bamboos were planted on the field, which had been destroyed by soil erosion and water was still flooding down the slope. "Before planting the small bamboos I planted three sisals a little further down the slope to make the soil more loam. One sisal for each bamboo. I also redirected the water away from the field with logs of trees, so that the bamboos could get strong and multiply. Soil retained around the bamboos, covering the pits and making the plants even stronger", says Killo.

After three years the bamboos had replanted themselves and they were now strong enough to let some of the water run into the field again. At this point Killo planted maize, bananas, guavas,



Omari Killo by a newly planted bamboo.



Omari Killo explains about the new project standing on the ridge of soil and pointing down at the sisal and the bamboo.

sugar canes and other types of fruits and vegetables. After another four years all the water was allowed into the field, as the bamboos were fully capable of reducing the pressure of the water.

Today part of the field is reserved for planting maize in the dry season. “I do not plant anything on this area during the rainy season, as I am afraid it will effect the good yield I get from the maize”, Killo comments. In Dodoma there is only one rain season and it runs from November to May.

Important advices

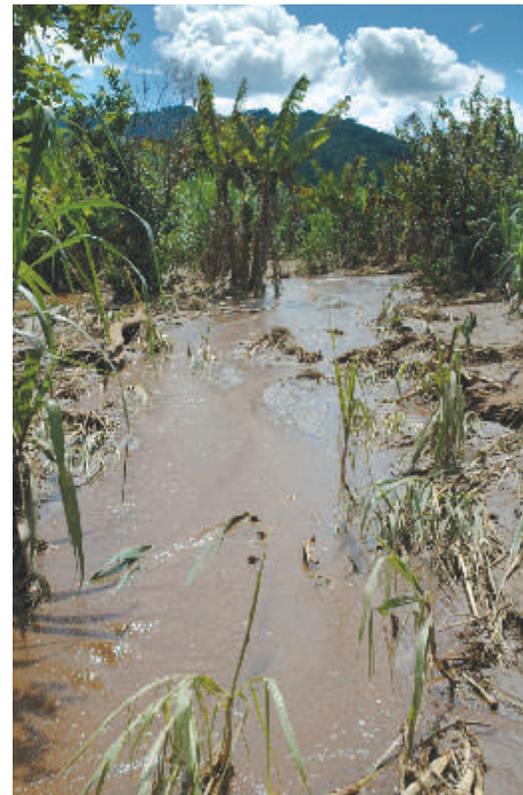
Killo explains that a bamboo should be planted in a one to two feet hole at the beginning of the rainy season, preferably in loam soil. He stresses the importance of planting the bamboo with roots to make it multiply faster. Further more he mentions the

importance of cutting down the plant in order to control it. “As it grows extremely fast, it needs to be cut down to prevent it from spreading too much and to grow too high”, he says.

Other farmers have adopted Killo’s innovation and increased their yield and the fertility of their land because of it.

New project in the pipeline

In another field Killo is working on a new project. A big sisal has once again been planted to make the soil loam, but this time the pressure of the water running down the slope has been reduced by building a ridge of soil. A bamboo has been planted and in three to four years it will have reproduced itself enough for the ridge to be removed. This time he gains one acre of fertile land for crop production. That means he gained four acres all together.



Flooding on a nearby field in Tubugwe.

Facts about bamboos

Bamboo is a very robust grass. It needs no care and spreads easily - mainly through its roots and/or rhizomes, which can spread widely underground and send off new culms to break through the surface. There are more than 1500 different types of bamboo and once planted it can be difficult to remove. When treated it forms a very hard wood which is both light and exceptionally tough. It is used for various things such as houses, bridges, fences, furniture, kitchenware, mats, juice, paper and art.

Source: Ezinearticles.com.

Small Banana Seedlings Increase Yield

Replanting small banana seedlings instead of cuttings from big banana trees gives the Mtui family in Mlimani Village in Monduli, Arusha, a better yield. Not only do the small seedlings produce bigger bananas, they also grow faster.



Aurelia Mtui digs a hole for a small banana seedling.

In 2003 the family changed the way of producing new banana plants. They got the idea from extension officers and received training from MVIWATA. Since then their children have learned about the new innovation and Elias Mtui has trained fellow villagers using his own field as a demonstration plot.

Small is better

“The advantage of the small seedling is that it has not yet matured, hence it will continue to grow. It matures early while a cutting from a big banana tree takes longer time to grow”, Elias Mtui explains. Also it takes longer time to prepare the cutting for replanting.

The small seedling is replanted when it is one to three feet high. The success rate is 100% while the cutting sometimes fails to crop. Other advantages are bigger bananas and a shorter gestation period. The seedling produces bananas after one year during drought and after only nine months if there is no shortage of water. “This method provides us with more bananas to eat and sell”, Aurelia Mtui ads.

Planting a banana seedling

Watching Elias and Aurelia Mtui and their daughter Eva replant a banana seedling is like watching a well run machine. They all know what to do and how to help each other. Elias Mtui stresses that the method can be used for all kinds of banana species. The family itself has 15 kinds in its field, among these Williams, Chinese Cavendish, Jamaica, Pazz, Ugwairuma and Kimalindi.

Steps in how to plant a banana seedling



Elias Mtui digs up the small plant with a knife.



He prunes it and cuts off the roots to avoid diseases, if any, to spread. New roots appear after one week.



Aurelia Mtui digs a two-foot deep hole, three meters in diameter. The top soil is put in a separate pile.



Five buckets of manure from cow and goat dough are poured over the top soil by Eva Mtui. The manure increases the fertility of the soil.



The manure and the top soil are mixed and put back into the hole.



The seedling is planted in the middle of the hole.



The soil around the plant is made firm in order for the seedling to remain upright.



Mulch is put around the plant as a protective cover to retain water, adjust the soil temperature and to control weeds by blocking the sunlight necessary for germination. Finally the plant is watered.

The optimal space between the seedlings is three meters between rows and one meter between plants in a row. This applies when only bananas are grown. In case of mixed crops the space between the banana trees should be five meters between rows and three meters between plants.

Harvesting rainwater

The adopted innovation has changed the life of the family, but Elias Mtui has also come up with ideas for improving the yield himself. He even received prizes for preserving the environment and harvesting rainwater from the road. By making a ridge he

redirected the water from the road into the field thus ensuring a soft and fertile soil. But the lack of water is still a challenge and it hinders the family from utilizing all its land. It is easy to see the demarcation between the fertile and the uncultivated land.

Wish for the future

Elias Mtui's wish for the future is to establish a producer market with a group of farmers. The purpose of the group would be to get a better selling price due to larger quantities and avoidance of intermediate agents, to improve storage facilities, reduce input prices, get better access to financial

credits and to receive more specialized training. "If the producer group succeeds and helps generate more income for me and my family, I plan to cultivate more of our land to get a bigger farm", he says.

In regard to replanting banana seedlings he also encourages farmers to join in groups and try out the innovation themselves. He hopes, they will gain from changing their methods – just as he and his family did.

*Text and photos by
Marianne Bubrick Soerensen*

“Casuarina” Trees Improve Soil Fertility on Coral Rag Land



Two brothers secure the future of their coral rag land by planting “*Casuarina cunninghamiana*” trees. The trees increase the fertility of the land and generate income as it can be sold for timber to produce furniture and other wooden products. Also the twigs can be sold for firewood.

*Text and photos:
Marianne Bubrick Soerensen*

Mbaraka Manzi and Azan Mmanga live in Pagali village on Zanzibar. They have 40 acres of land but only part of it is cultivated due to coral rag. The porous limestone composed of ancient coral reef material makes farming difficult, but it also has a good feature as it protects the land against soil erosion. Estimated 73% of the forests on Zanzibar are coral rag forests.

Hard work to prepare the land

It takes a lot of effort to utilize coral rag areas for farming or forestry. Some stones are easy to move, while others

go deep into the ground. No matter whether the stones are big or small, Manzi and Mmanga leave them on the field, as the “*Casuarina cunninghamiana*” tree has shallow roots that can find their way in and around the stones.

“One of the most challenging tasks is to prepare the land. Before planting the small trees we have to cut down and burn all vegetation, as well as remove all the waste. It takes time and is very hard work“, says Mmanga. He and his brother adopted the innovation of cultivating the coral rag land through training with other farmers.

They planted the first trees three years ago and now they have a forest of “*Casuarina*’s” on one of their fields.

On Zanzibar coral rag is used for building material, but it is too difficult for the two brothers to collect and transport the coral rag from their farm to the village.

To produce seedlings

Standing on a two acres, newly planted field with 2000 small trees, Mmanga explains the process of producing the seedlings. The “*Casuarina*” starts to produce fruits after three years; hence



Mbaraka Manzi and Azan Mmanga on a coral rag field.

this is the first year, seeds are extracted from the existing forest. The steps of producing the seedlings are:

1. Pick the cone like fruits from the tree.
2. Put the fruits in a plastic bag for about two weeks to release the seeds. They are extracted readily from the air-dried fruits.
3. Plant the seeds in a small bag.

After three months the seedlings are ready to be planted out. They are planted in one meter squares – that is

one meter between rows and one meter between the plants. Manzi stresses the importance of planting the tree just before the rain season; however the tree can survive under severe conditions and is resistant to drought. An important quality in the dry and hot season of the island – the tree just does not grow fast without water. A bigger threat to the survival of the tree is the gazelle, as the animal enjoys eating the young plants.

In the first season, while the trees are still small and young, crops such as

tomatoes and beans can be planted among them. In the remaining time, until the trees can be harvested, no other crops are grown. The shade from the tree and its heavy root mat makes it difficult to grow anything else.

Expectation of high earning

The tree is ready for harvest after five years, thus Manzi and Mmanga expect to increase their income from selling the first timber and firewood in two years time. Some of the money they intend to use for hiring help to

A "*Casuarina cunninghamiana*" two weeks after it was planted out and the three years old forest.

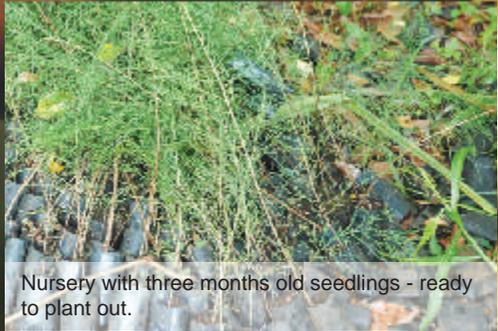




Azan Mmanga picks the cone like fruits of a “*Casuarina cunninghamiana*” tree.



Seeds from the tree. They are released from the fruit after about two weeks in a plastic bag. The seeds are also spread by the wind, but they do not germinate by themselves.



Nursery with three months old seedlings - ready to plant out.

A fruit from the tree. Mmanga shows how the seeds lie in layers in the fruit.

cultivate more of their coral rag land. Help is needed due to the time consuming process of preparing the land and because they themselves are also busy producing fruits and vegetables. On non coral rag areas

they produce grapes, oranges, bananas, eggplants, watermelons, tomatoes, coconut jams and spices, among others.

An advantage of the “*Casuarina*” is its ability to make the soil more fertile for

growing vegetables and fruits. But so far the brothers intend to keep producing trees, as they expect to get a high earning from them.

Facts about “*Casuarina cunninghamiana*”

“*Casuarina cunninghamiana*” is a long-lived, relatively fast-growing tree with average height increments of one to two meter per year. It is a medium to large tree 12-35 meter in height and it grows mainly in sand, sandy loams or gravel, including poor soils and eroded sites. Generally it is a dominant specie in riverbank vegetation. It is restricted to river- and stream banks and adjacent valley flats, and may extend for a short distance up rocky hillsides above watercourses.

When the fruits dry from December to March the seeds are released and disseminated by the wind. Propagation is usually from seed, since seed production is prolific and germination occurs easily.

Sources: www.worldagroforestrycentre.org and www.na.fs.fed.us.

Functional uses of the tree are:

1. Around the world the tree has been used for wooden products such as paneling, furniture, axe handles, parquetry flooring and barrels, as well as general utility farm timber.
2. The tree is an excellent firewood species that dries rapidly, burns well and retains ashes for a long time.
3. The green leaves are useful for drought fodder, although it is not high in nutritive value.
4. Dry leaves can be used as mulch.
5. With its network of fine subsurface roots, the tree is valued for erosion control.
6. Extensively planted for wind protection and shelterbelts.
7. Rehabilitation of severely degraded lands.



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