

Farmer Trainer Extension Approach

An assessment of its impact in
selected areas of Kenya

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GTZ + MoARD



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1.0 Introduction

ITFSP is implementing the "farmer trainer" Training Approach for tree crop technologies in five districts in Western Kenya and in collaboration with the Horticultural Crops Development Authority (HCDA) and Non-Government Organisations (NGO's) in the eastern province. The response of the Farmer Trainers and Extension Officers (DHCO) involved is very positive. However, little information is available on the interaction between the farmer trainers and the local farmers, and hence the effectiveness of this approach has not been assessed.

In order to improve design and development of this extension approach, which aims to actively involve skilled farmers in the skill development and dissemination process, more information is needed.

Therefore a field research was conducted in Western Kenya which began in March and ended in April.

The main objective of this research was to assess the effectiveness of the Farmer Trainer Extension Approach and to compare the results with other areas in Kenya.

In order to compare the results from Nyanza a study was conducted in Iria Murai, Embu District in collaboration with the Kamurugu Project.

The field research in Western Kenya was arranged in two weeks workshop and two weeks field survey where some Farmer Trainers, who participated in the workshop in Homa Bay or Migori, were visited. The field survey in Embu took two weeks.

In contrast to the ITFSP approach in the Nyanza Province the Kamurugu Project in the Eastern Province started training farmers on fruit-tree propagation and nursery management in 1995. In this case the expectation on the level of spreading the extension approach was higher. The number of mature trees and the marketing awareness are higher, too.

In the first section of this report the aims of the project will be shortly demonstrated.

In the second section it will be explained why an investigation was necessary, how it is structured and which observations were made.

In the third section the results of the research will be presented. It will be given attention to the investigated region, the different ethnic groups, the workshop and the evaluation of the questionnaires which were filled in during the field study. After that an economic assessment of the concept will be presented.

1.1 ITFSP Objectives, Project Strategies and Levels of Objectives

ITFSP stands for "Integration of Tree Crops into Farming Systems". Consolidated by the "Bundesministerium für wirtschaftliche Zusammenarbeit" (BMZ) / "Federal Ministry of Economic Cooperation" and carried out by the "Gesellschaft für Technische Zusammenarbeit" (GTZ) / "Technical Cooperation" together with research and development workers of the Ministry of Agriculture and several "Non Government Organisations" (NGO's). ITFSP projects are not only conducted in Kenya, but also in Tanzania, Malawi, Zimbabwe and Uganda.

ITFSP develops concepts in order to integrate tree crops into small farming schemes. The main problem concerns the fact that at the moment trees as a resource are insufficiently used in farming systems. The main aim of ITFSP is to increase the value of these tree crops in farming systems and thus to optimize the protection of resources. In brief, the following question has to be asked:

"Where is the biggest lack concerning fruit-trees?" (VAN ECKERT 1998)

Underlying frameworks and important assumptions:

1. Lasting political and economic stability in the region is given.
2. Underlying conditions concerning the right of ownership and regulations support the private economic interests of the users of the land.
3. Agricultural systems recognize the effect of saving resources and the economic use of tree crops.
4. Decision-makers estimate correctly the necessity and the potential of integrating tree crops into development programmes.

An intensive exchange of experiences takes place between different projects of the GTZ, DANIDA, ICRAF, KARI and other NGO's in order to evaluate the experiences and activities concerning the integration of tree crops into farming systems in Kenya. The result is that up to now the main focus of the increase of seedlings in tree nurseries is on the production of agroforest and forest tree species whose seeds can be taken from seed banks. In contrast to that the enormous demand of the farmers for fruit-tree seedlings of high quality cannot be covered.

The reason for that is on the one hand that most development programmes support tree nurseries for reforestation, agroforestry and for soil and water protection, and often they hardly paid any attention to fruit-trees. On the other hand fruit growing is supported by a state advice centre. So the genetic resources of the different fruit species and varieties which are existing in the country, e.g. on prison farms and big farms, are not consistently used for dissemination strategies.

That is why a research programme, supervised by Holger Marbach, was set up in 1995 for analysing the role of tree crops in various farming systems in Kenya.

An investigation on the influence of socio-cultural factors on the spreading of tree crops, which turned out to be another hindering factor, was undertaken as well in order to investigate rights of disposal as well as plantation methods and practical habits of farmer families.

ITFSP supports the realization of tree crops by means of specific farmer trainings and "extension workers" of the government.

1.2 ITFSP Levels of Objectives

In the following the course of the training periods up to the handing over of the project to the government will be demonstrated.

Table 1: ITFSP Levels of Objectives

| |
|--|
| Level I Orchard establishment and management Pruning Grafting, budding and top working Plantnutrient Pest and disease |
| Level II Selection of really interested farmers More emphasis on grafting, budding and top working Tree management Pest and disease control |
| Level III Pest and disease control Harvesting ? Farmer should have adopted the trained skills and should be able to teach other farmers |
| Level IV Handing over the project to the government |

At the first level the idea of the concept developed by ITFSP is passed on to the farmers. Therefore the first trainings are more intensive and longer than the trainings which follow at the next level. At this point it is important to mention that there is not necessarily only one single training at one level, but it is possible to have several trainings at one level. However, at the latest at the second or third level there should be established a sort of network between farmer and trainer (ITFSP and government). This means that a certain mutual trustfulness has developed between trainer and farmer. Until then the farmer should on the one hand identify with the concept and on the other hand the trainer should be able to recognize which farmers are interested and do not mind to put in an initiative of their own in order to select them for further trainings. Between the trainings follow-ups are required for finding out which farmers are interested, which progress has been made and where the causes for misunderstandings are. These follow-ups are either carried out by ITFSP staff or by the responsible "extension officer".

Since December 1995 the newspaper "Miti Ni Maendeleo" ("trees help the development") has been published in co-operation with the International Centre for Research in Agroforestry (ICRAF). It appears every three months and is also sent to the farmer trainers. In this newspaper agroforest economic reports, reports on rather unknown plants, useful information on pest management and livestock farming are published. Another main emphasis has to be put on the publication of letters of the readers in which farmers describe their problems and introduce new innovations. On the one hand this should serve as advice and on the other hand farmers should be motivated to try out new ideas. During the trainings at level II and III, which are also shorter, more importance is attached to the deepening of the so far learned skills. But also new topics that come into existence during the development of fruit-trees are added, e.g. the harvesting and storage of fruits.

At the fourth level the project will be handed over to the government, either to the Agriculture Minister or the responsible District Agriculture Officer. Up to this time the farmer trainers should be able to perform the learned skills on their own and to pass them on to others. Besides, the farmer trainer should already have his own "Mutterbestände" from which he can also receive his scions.

A time span of four years, from the first to the fourth level and thus the handing over to the government, should not be exceeded.

2.0 Problem Statement, Research Questions and Methodology (Field Research in Nyanza and Embu)

2.1 Research Questions and Methodology

As the efficiency of the ITFSP concept to introduce tree crops into small farming systems has not yet been recorded, there was an investigation in February and March 1998, in co-operation with the "Fachhochschule Wiesbaden" / "Technical College Wiesbaden" ("Außenstelle Geisenheim" / "branch Geisenheim") and ITFSP (Kenya). The results of this investigation will be presented in this paper.

The investigation was divided into several parts. At first it was looked at the available literature concerning already existing investigations and evaluations on the project.

Secondly, preparations were made for the forthcoming field study. Among other things the questionnaires, which are listed at the end of this paper, were elaborated. The following field survey consisted of two parts: On the one hand the prepared workshops were held in Nyanza and on the other hand selected farms were examined.

At the end the data was analysed and evaluated.

The main objective of this investigation was to recognize existing problems, success and faults of the concept. Moreover the ideas of the farmers should be identified and checked concerning their suitability. During a second field survey in the Eastern Province, where a similar concept was already started in 1995, another field observation including several farm visits took place, also within the framework of this investigation. In this investigation the two different regions with their different ethnic tribes, the Luos and the Embus, will be compared. A comparison between the two slightly different concepts will be discussed. Another important aspect of the investigation is to be the observation on the level of acceptance and necessity for the project on the part of the farmers and what a continuation of the project should look like.

On the grounds of these questions, as described before, a questionnaire was worked out and distributed to the farmers. The efficiency of this questionnaire will be discussed later on. The results of this investigation are based on the observations made during the workshops and the field study and the evaluation of the questionnaires.

2.2 Workshops

The workshops were carried out in Homa Bay, Migori, Kisumu and Siaya district. At the Homa Bay workshop participants from Suba were present. In Homa Bay, Kisumu and Siaya the workshops took place at the Farmer Training Centre (FTC). In Migori the workshop was held in Girango Lodge.

The workshops were a follow-up of previous trainings in April 1997.

In most cases the District Horticulture Crop Officer (DHCO) or the District Horticulture Officer (DCO) prepared the workshops after a feedback from ITFSP and also performed most of the activities in the workshop.

The followup workshop took place to ensure that the participants were trained farmers and to assess the spreading of the knowledge on fruittree production. Some agriculture extension staff also participated in the workshop in order to advise the farmers later in the field.

The workshops were arranged in a theoretical and a practical part. With a special emphasis on the practical part.

The workshop took place for at least three days in each district. The participants were trained on nursery management, orchard establishment, pest and disease control, pruning, propagation theory and in practical trainings.

After the workshop the farmer trainers were encouraged to adopt special technical skills and to disseminate these skills to the potential users and other farmers in the rural areas.

2.3 Observations

2.3.1 Nyanza

During the theory lessons of the workshop it was observed that most of the farmers are interested in fruit tree propagation techniques. They showed interest by trying to acquire the information and knowledge on fruit tree propagation. This was observed during the lessons by means of the feedback questions from the farmers during the theoretical and practical lessons. The lesson often developed into discussions which showed the high interest on the part of the farmers. If a farmer had a particular question or had observed an unknown disease on the trees, participants discussed the problem and came up with a solution.

The second part of the workshop was practical work. The practical lessons were arranged in two parts. During the first part, participants gained practical experience in grafting. During the other part the participants visited a farm with an already established orchard or a tree nursery to see the results, and how work could be done.

In the first part of the practical training farmers got mango seedlings and pre-selected scions. Most of the scions were varieties like Van Dyke, Haden, Apple, Ngowe and Sabine. After this each farmer could start to graft his own mangoes.

This was a follow-up training and the participants already had some skills in grafting and bud grafting. However, it was observed that the dissemination of the technique took place slowly. Many farmers still lacked the knowledge and skills on grafting and bud grafting techniques.

In this case during the workshop in Migori, participants got a kind of „drought training“. It is very important that the grafting cut is smooth and that there is no twist. To do it perfectly needs a lot of practice. Before the farmers tried to graft the offered seedlings with the selected scions they took branches from shrubs and practiced top wedge, whip and tongue grafting, and also bud grafting on these branches to ensure that the cut is well done and thus the survival rate of the plants is higher.

In the other part of the practical training the participants visited a farm or tree nursery. In most cases the tree nursery was owned by a prison. Under the guided tour by the owner of the farm or the chief of the prison the participants saw in practice what they had learned in theoretical lessons during the workshop. Another reason for visiting the farms was to show the participants how to select planting materials or scions, how to handle a secateur, how to prune trees, how to identify the mango variety and many other practical things.

It should be noted that not all the farmers showed an interest in the activities. One of the points on the time table of the workshop was the report of the farmer trainer. From these reports from farmer trainers one could get an idea how interested each farmer trainer was and how intensive the Farmer-Trainer had his or her work done, for example one reported he had done nothing because he was too busy. Other people are not ready to spend their own money for motherblocks or scions. This was observed during some farm visits where only trees given out during the last workshop (April 1997) were present. These farmers haven't tried to establish tree nurseries or raise some seedlings for grafting.

During the last day, each of the selected farmer trainers got a secateur and a pruning saw. Grafting knives which had been promised couldn't be provided at that time because there was no supplier who

could provide the knives. In this case ITFSP had to use some available knives which were not grafting knives. The proper grafting knives were promised to be distributed when they become available. All farmers got about eight to ten mother trees in addition to the seedlings grafted by themselves. The varieties of the mangotree are Van Dyke, Haden, Ngowe, Apple, Sabine, Sensation and Kent.

The field survey took two weeks, and farmer trainers were selected in Migori, Suba and Homa Bay. A farm walk was followed by a conversation in which the advantages and disadvantages of the site were discussed. Often other farmers from the area or group members were also present. Sometimes the visited farms belonged to trained farmers.

The most common problems observed were

- ? ? nutrients deficiency,
- ? ? pest and disease,
- ? ? drought,
- ? ? trees not pruned and
- ? ? human disease,
- ? ? damage by bigger animals like goats or wild animals.

Chlorosis on many trees was recognized due to lack of nutrients, mostly iron. One of the major problems on citrus trees is the greening disease which is a virus and is spread by the psyllid (*Trioza erytreae*) and by using diseased planting material. Affected trees develop an open growth, sparse, mottled/chlorotic leaves and branches die back. Fruits are commonly of poor quality, they are dry and lopsided. Excessive and out-of-season blooming frequently occurs and may be followed by abnormal fruit-drop.

Drought is a problem which is spread over the whole area, though the lake is not far, off. Most farmers have to walk several kilometres to get water because the lake or river is often a few kilometres away from the farm. In most cases the water is fetched by using human labour or with the help of donkeys. The priority is for drinking and domestic use. The nursery or the seedlings are watered after that.

During the visits it was striking that just a few farmers had used their new tools which were supplied at the workshop. Though the farmers now had a secateur and a pruning saw most of the farms had unpruned trees. Often the branches were so dense that they rubbed against each other when blown by the wind. The trees got wounds which are entry points for viruses, fungi and diseases.

Some farmers had already planted the supplied seedlings and mother trees. Other farmers were waiting for the next rain season because of a shortage of water at the moment. The trees which had not yet been planted were stored in cool and shady place, and according to the advice of the DHCO watered two times a day.

Most of the new grafted seedlings were shooting. However, this could also result from the vigour of the scion and the survival rate should be checked in a follow-up after a few weeks.

There was evidence of little use of farm inputs like fertilizers or pesticides. Most farmers are using manure. Manure is for example a mixture of cowdung and straw. Only a few farmers are using a fertilizer like NPK. Even though several farmers had a problem with the greening disease, none of the visited farmers sprayed the advised white-oil onto the flowering stage of the tree.

In Western Kenya results show that there is a high potential of fruittree production. There are already some fruittrees established in all the visited areas. Most of the trees are next to a river or a stream. In this case water which is rare is easily available. Bananas, avocados, mangoes, sugar cane, passionfruits and watermelons are also found, but most of these fruittrees are local varieties. The improved varieties are often unknown or the scions are hard to get.

In most cases there is a lack of knowledge on propagation of improved varieties. Another problem is the soil which is rocky. The top soil is shallow, less than 15 cm in depth. However, many farmers have managed to plant trees between the rocks. For example, one farmer in Homa Bay possesses seven acres of land planted with 400 citrus trees, 20 mangotrees and 20 other fruittrees. It is crucial to observe that many of the visited farmers have started to establish treenurseries. After this evaluation it must be noted that 36 of the 62 interviewed farmers already have established their own treenursery. This is more than 50% of the total number of the visited farmers.

In view of the farmers the major problems in propagation of mangotrees are

- ? ? drought,
- ? ? inadequate planting material,
- ? ? scions are unavailable,
- ? ? lack of tools for propagation,
- ? ? lack of knowledge,
- ? ? pest and diseases and
- ? ? irregular follow-up trainings by ITFSP.

2.3.2 Embu

In Embu a field survey was conducted. Farmers trained by the Kamurugu Project and farmers trained by the ITFSP training in 1995 were visited. The training was the only one which was done by ITFSP in the area. Later Kamurugu Project continued with farmer trainings.

The Kamurugu Project is an NGO which is based in Mbeere District at Iriamurai. The NGO promotes fruit trees to small scale farmers, especially mango trees. They have their own tree nursery where the management of seedlings has risen up to about 26,000 each season. These seedlings are all grafted by using their own labour and sold to farmers in the whole district. Apart from mango trees they also propagate citrus trees, avocado trees, macadamia nuts and baobab trees. The nursery is situated in an area of 6000 m² and is part of a farm which belongs to the Kamurugu Project. They have six seedbeds (about 1m * 35 m) where the seeds are directly cultivated until they get transplanted into polybags. They have four permanent labourers and depending on the season up to 30 temporary workers.

The difference between the trainings by ITFSP and Kamurugu is that ITFSP trainings have a duration of three to five days while the Kamurugu trainings are only one day trainings with an emphasis on grafting.

It was observed during the field survey that farmers in Mbeere District were really interested in mango growing. All the visited farms cultivated improved mango varieties. On two farms the young mangoes were dry because of the drought but the farmers were willing to buy new ones to replace the dried ones. Most farmers had more than ten mango trees (improved varieties) in their shamba. One of them even had more than 100 improved mango trees on his field. Another farmer raised more than 100 seedlings from collected seeds to graft them later.

Almost all visited farmers prefer to buy the mango trees in the Kamurugu nursery. They even know how to graft and they do grafting or top working on a few trees, but it seems that the process of raising seedlings needs more time. Farmers who are members of a group or group nursery graft their own raised mango trees. They graft usually together when they meet once a month. Farmers only used their own knives, which means that kitchen knives work very well for grafting or top working. It was observed that only the group nursery which was visited bought their own polybags for transplanting trees from the seedbed or raise seedlings directly in the polybags. The rest of the farmers transplanted the seedlings directly into the field. Hence goats or wild animals like antelopes were one of the biggest dangers for the small seedlings and it is necessary to cover the young plants. However most farmers who participated in a training by Kamurugu do not have the knowledge of tree management or pest and disease treatment because there is no farmer who prunes trees. They also do not know how to treat other improved fruit trees like budded citrus trees. But in comparison to all farmers in Nyanza, they manage their shambas better. It was observed that the farms in Mbeere had more crops in the same space than farms in Nyanza. Farmer in Embu built terraces or used several types of small earthwork structures, such as micro catchments, contour ridges or infiltration ditches to struggle against the drought and erosion.

Similar to Nyanza the major problems in view of the farmers are

- ? ? drought,
- ? ? lack of knowledge for propagation,
- ? ? lack of tools,
- ? ? termites,
- ? ? wild animals like antelopes and
- ? ? pest and disease.

2.3.3 Description of Research Sites (Geographical Location, Climate, Soils, Rainfall, Population)

At the moment there is only data from South Nyanza available. This includes Suba, Homa Bay and Migori.

2.3.3.1 Geography

South Nyanza District is located in South-Western Kenya, along Lake Victoria, and covers an area of 7,778 sq.km (5,714 sq.km land area and 2,064 sq.km water). The district borders Kisumu and Siaya District in the North, Kisii and Narik District in the East, the Republic of Tanzania in the South and the Republic of Uganda in the West. It is one of the four districts comprising Nyanza Province and occupies 48% of the land area of the province.

The Eastern part of the district is part of an eroded plateau and it's altitudes are between 1,200 m and 1,600 m above sea level. To the West there is a famous feature of the landscape, the Lambwe Valley which is part of the Davirondo Rift Valley. In the North of the district remnants of large volcanoes rise up to over 2,000 m above the lake level. The lake shore lowlands range from 1,163 m to 1,219 m above sea level and are bound by an arc-shaped shoreline measuring approximately 260 km in length.

2.3.3.2 Ecology and Water Resources

South Nyanza District has basically an inland equatorial climate, modified by the large body of water in the form of Lake Victoria. Because of the cooling influence which the lake exerts, temperatures are a little lower than an equatorial climate. The temperatures in the lower parts of the district (1,135-1,300 m a.s.l.) range from a minimum of 17°C to a mean maximum of about 30°C. In the higher Eastern part (1,300-1,600 m a.s.l.) the mean minimum and maximum temperatures vary between 14°C and 25°C.

Rainfall in the district shows considerable variations and is in any case much lower than in a typical equatorial climate.

Rainfall occurs almost throughout the year with a maximum during April and May. In the drier Western part of the district, two dry and two relatively wet seasons can be distinguished.

| | |
|--------------------|---------------------|
| major rainy season | = March-May |
| minor rainy season | = October-November |
| dry seasons | = December-February |
| | = June-September |

Potential evaporation is 1,800 - 2,200 mm per year and in most months exceeds the monthly rainfall. The main perennial rivers are Kuja, Migori, Awach Tende, and Awach Kiboin, all of which originate in the higher rainfall region of Kisii District. Perennial and seasonal rivers and streams originating within the district form a characteristic pattern coinciding mainly with zones of higher and lower rainfall.

2.3.3.3 Soils and Land-use Patterns

The district has a variety of soils, most of which are highly localised. The lowlands striding the shores of Lake Victoria, though relatively dry, have rich alluvial soils in most parts and sandy loam soils in other areas. The medium potential zone which also comprises the plateau areas has patches of loam soils and packets of greyzems and grey soils especially on the hillslopes. The high potential zone which comprises the upper savanna belts and the inland plateau receives between 1,300-1,600 mm of rainfall annually. Loam soils and brown clay soils are dominant.

In the upper zone (high potential zone) with its well drained soils, crops such as sugar cane, tobacco and Arabica coffee are grown as cash crops; and maize, finger millet, potatoes and bananas are grown as subsistence crops. In the medium potential zone sugar cane is grown in small quantities as a cash crop and maize, sorghum, cassava and beans are grown for subsistence. In the lower zone with its moderate amount of rainfall, the only cash crop grown is cotton, maize, sorghum and groundnuts are the subsistence crops. Cattle ranching and fish farming are also very important economic activities in this area.

2.3.3.4 Population

In 1989 the district had a total of 1,226,105 people and was projected to have 1,429,929 by the year 1993. Out of this population there was a total labour force of 579,113 people in 1988, and this was projected to increase to 695,116 people in 1993.

3.0 Description of two Ethnic Tribes: Luos and Kikuyus

In the following two ethnic groups will be compared, namely the group of the Luos and the group of the Kikuyus. The Kikuyus were chosen because there was no data available for the group of Embus in whose region the second evaluation was done. According to several African friends the Embus and the Kikuyus are similar with regard to their development, their modes of behaviour, actions and habits.

The following reports on the Luos and the Kikuyus are summaries of existing specialist literature. The specialist literature consists of reports which were selected by Dr. Dorothea Hecht.

3.1 Luos

As early as before the end of the 16th century the Luos came to Kenya. Originally they were cattle breeders and nomads, but as they came to Kenya they settled down and began to farm the land. Still today the whole family of the Luos is responsible for farming. But due to the fact that they still possessed herds of cattle some areas were used as pasture-land.

By using the sea route the Luos were trading with Uganda.

Due to the insecurity caused by internal clan and ethnic wars, the Luos often lived in fixed villages. The chief demanded obedience of all his wives, unmarried children and married sons who lived on his plot of land. Consequently the chief was in control of the whole household.

There were council meetings in the villages. The chief of the village, the elders, the war leader and the peacemaker were the participants; and sometimes also the rainmaker was invited. They discussed important topics, such as war and peace, draught and hunger. However, within one region often independent council meetings took place in the different villages.

The reputation of a man rose by an increasing livestock and an increasing number of wives.

Presents to the father of the bride, in the form of cattle and sheep were obligatory when a man intended to marry a woman. With the first wife the bridegroom was still supported by his father and his uncles. But every following wife and thus every following present had to be acquired by the bridegroom himself.

In case the husband died, the widow had to live in a "forced matrimony" with the brother of the dead. The first born son of the first wife was in the leading position in the hierarchy of the children. He also became head of the family in case his father died. And as the first born son of the first wife stood above all others in the hierarchy of the children, the first wife stood above all other wives in the hierarchy of the women. Therefore her house was directly opposite the gate. She had priority concerning ritual functions. The chief of the house was buried in her camp or even in her house. During the mourning all women lived in the camp of the first wife.

During British colonial times the British suddenly charged taxes. Taxes had to be paid for houses and people, corresponding to the number of family members. Since until then there had been no money

and people were not familiar in dealing with it, since self-sufficiency or changing goods were the only things people knew, from now on the sons had to work on the farms of the wise men or they were forced to do public work, such as building roads, in order to earn money.

For the colonial officer the chief of the village was the one who had to push through the intentions of the colonial master and he was responsible for the acceptance and the following of these rules by the people. He got money for this position which allowed him to reach a higher standard of living, free school education for his children and power. Thus he could also have more women than usually and he could increase his livestock.

At this time the first Christian missionaries also entered the country. They founded schools in order to teach their children to read and write. First problems concerning cultural traditions, e.g. to marry several women (polygamy), lead native people to found their own missions.

During recent times the interest of the Luos shifted from being a herd owner to a land owner. In the past the Luos were a pastoral community and they carried on fishing, while men often drove herds of cattle over vast areas and women were in charge of the agriculture. Along with the increasing importance of agriculture, the owning of land got more and more important. Apart from inheriting a piece of land one could get the rights to the land by means of cultivating it as the first or gaining it through a fight. The whole family was responsible for cultivating the land. For grazing the herds were taken to uncultivated areas of the clan or the chief territorial. Besides it was allowed for everybody to harvest grass for thatching roofs, to cut wood for the fireplace or for building and to use other natural resources.

The Luos followed their ancestors by living according to a segmentary clan system which included all relatives of direct descent to the father including his male ancestors. Today problems between relatives of the eldest concerning the right of land ownership are solved according to nowadays laws. One could already see earlier that the eldest had much influence on the events of a clan. The Luos trust the eldest who are familiar with the local circumstances and understand the complicated factors better than outsiders.

After the death of the father the land was divided between his sons, as he had decided it beforehand. Nobody was able to revoke this decision. He usually made his aims clear before his death.

The pattern of the land distribution was the following: the first wife and her oldest son got pieces of land close to the place of the father and all other heirs followed.

Women have a strong interest in the things they receive along the wishes of their dead husband.

They are neither the owner of the plot of land, nor they inherit it. Women or widows are merely the guardians of the land which was given to them for their sons. In case the son was old enough he decided on the distribution of the land between himself and his brothers. In case there were no sons the land was given back to the male relatives.

Daughters inherited nothing from their fathers. They were expected to use the land of their husband. Usually they were allocated a piece of land by their mother-in-law.

Families who needed more land had the possibility to lease it. The rights of the tenant were limited in time. These rights could not be handed on. The tenant was expected to cultivate his land. If he did not do so he was deprived of all his rights again. Besides he was not allowed to build a hut or a solid accommodation unit on this land. In some parts of South Nyanza it was also not allowed to grow trees on these leased areas, for all trees of several years belonged to the property of the landlord, although this often happened.

Nowadays, due to shortage of space, farmers have to decrease their livestock, which also leads to a reduction of erosion. In addition the rights on the land were given to the tenants. However, the rights of women were reduced due to the registration of land as individual property. This is the case since the husband, who is the owner of the land according to the new system, can do with it what he wants, without the approval of the woman. But on the other side nowadays widows can protect their land better from the male relatives of their dead husband.

Today sons can also be registered early as heirs.

3.1.1 Agriculture

The fishing in Lake Victoria was probably an exclusively male domain, for women had to deal with the production of plants. This can still be seen today at several places, except with regard to the cultivation of cash crops.

The change from the cattle farmer to the farmer also led to a migration of men into villages and towns in order to look for work, while women remained at home, cultivated the land and tended the remaining cattle. However women were not used to tend herds of cattle, so that they had to be sold. The population growth also led to a diminution of pasture land because new arable land was needed. Only in the less inhabited regions, e.g. in Sakwa location in Bondo, there was enough room for bigger and several herds of cattle.

The Luos are producing various cultivated plants, but most of the time the quality of the cultivation is quite low. Suggested cultural methods, such as the usage of fertilizer or certified seeds were positively accepted by the farmers. The plant production is mostly used for private consumption. The produced surplus is sold on the closest market.

Below the most well-known patterns for cultivation are listed:

- The husband and owner of the land gives all the land to his wife and keeps nothing for himself (polygamous families).
- A small piece of land remains for the husband and he keeps the harvest for himself, while his wife and his children do all the work. This is often put into practice if the husband has to pay for school education and similar things.

- The husband decides everything concerning plant production, the woman employs temporary workers and supervises them. This system is found when cultivating cash crops such as sugar-cane or coffee.
- The land is cultivated by the whole family (monogamous families).

Cultivated plants are:

- cereals (sorghum, finger millet, maize, rice)
- seed legumes (beans, cowpeas, green grams)
- oil crops (ground nuts, maize, simsim, sunflowers)
- root tubers (sweet potatoes, cassava)
- vegetables (sukuma wiki, cabbage, ...)
- fibre plants (cotton, sisal)
- cash crops (sugar-cane, coffee, tobacco)

Maize is used for the production of maize flour. The main food for the "ugali", the Kenyan population, is made of maize flour. Lowland rice is grown in Kehancha Division since ca. 1930. Another possibility are watered paddy-fields as they can be found in the Central Division (South Nyanza).

Coffee is mostly cultivated in Oyugis, Central, Migori and Kehancha Division.

In mixed culture methods agroforest trees, which are then used as firewood or as building timber, are grown in between other cultures.

A big fruit production is not yet existing in Siaya or South Nyanza. One or two fruit-trees such as mangoes, oranges, lemons, limes, guavas or bananas are generally found on each plot of land. Others are pineapples or papayas. In South Nyanza it can be seen that the fruit production of oranges, mangoes or citrus fruits has increased. Although there is a big potential for pineapples, the production fails due to a lacking market in the region.

There is also a big potential for bananas as food plant and cash crop. In South Nyanza the main cultivated areas are Oyugis, Central, Kehancha, parts of Migori and Ndhiwa Division.

Generally fruit plants do not receive a lot of attention. Local sorts and varieties often grow coincidentally and usually they are quite neglected. Improved orange-trees were introduced, but only a few farmers showed an interest because the seedlings had to be bought and these trees need a certain degree of care and management in order to bring in a good return.

At the market stalls mangoes often have signs of fruit-fly attacks, while other fruits do not show such signs.

Mangoes, guavas and citrus fruits normally grow in a wild form.

Fruits are often only consumed because of the taste and not because of their nutrients.

They are consumed whenever they are found or bought.

3.1.2 Problems

Problems occurring in this region are among others irregular rainfall, different kinds of soil and connected with that different requirements for cultivation, migration of young people, insufficient marketing, bad infrastructure (roads, telephone, ...), energy problems, health problems (plants and human beings).

Suggested solutions for the problems were watering devices in regions where periods of draught occur regularly. Soil conservation with the traditional "bush and fallow" system, which is still practised today. Use of "manure", a mixture of several kinds of fertilizers, which are obtained on the farm, in order to improve the soil nutrients.

Since prices in the country are often too low, the harvest is often smuggled into neighbouring countries and sold there on local markets.

The belief in witchcraft is still widespread today. The result is that people try to avoid everything that would put them in the limelight. A good farmer better does not carry out his ideas, otherwise he would be bewitched. Other people do not dare to build nice houses. It is also considered normal that whenever an accident or a disaster happens witchcraft is involved.

3.2 Kikuyus

The Kikuyus form the biggest ethnic group in Kenya with five million inhabitants. At the moment they inhabit parts of the Central Province, Murnagá District, Nyeri and Kiambu. According to tradition they are all descended from a man named Gikuyu. He was told by the God Ngai to wander to Mount Kenya and there he found a woman with whom he founded the clan of the Kikuyus.

Archaeological it became visible that the Kikuyus immigrated from the direction of Meru which the Kikuyus today regard as their native country.

They traded early with other people or tribes and even with Arabs. They changed goods such as buffalo skins, shields, animal horns, ivory, iron, tobacco and other products resulting from farming the land or gardening.

The trading was done almost exclusively by women. They even had a special immunity while walking along the streets to Naivasha, Narok, Kajiado or Nanyuki.

Since the Kikuyus produced more than they actually required, they knew how to sell or exchange the surplus production to caravans or to foreign expeditions.

The patterns of the various groups of immigrants was extremely influenced by local occurrences.

Most of the time the regions of different groups were limited by rivers or gorges. Each group was an independent autonomous community which used the natural resources of the surroundings.

The plot of land of a Kikuyu, the shamba, was considered to be the possession of the clan whose forefathers entered the land in far-off times, broke the earth and cultivated it. The clan consists of the ancestors, the living and the unborn family members. The eldest were the guardians of the land for the following generations. Thus every single person was allowed to use the land, but only for a certain period of time.

The plot of land of a family was characterized by several houses. One for the house or farm owner and one for each wife. The house of the first wife was bigger than the ones of the other women. The fireplace was in the middle of the house and it was surrounded by "flints". The entrance was narrow and began directly beneath the roof.

Traditionally the men ploughed the land, built the houses (it was not permitted for women to do this) and tended the sheep. They did the hard manual work. Women cultivated the land and brought in the harvest, they looked after the children, collected firewood and did the cooking. Hence they did all works which were not that "physically exhausting". The children helped their mothers. However nowadays they go to school.

The men of the family were the only heirs, but in the myth of the Kikuyus it could also be observed that usually women had the say in the family.

Today there are a lot of Kikuyu single mothers.

The "white highlands", the area of the Kikuyus, was very fertile. Nevertheless this was a disadvantage during colonial times because the British occupying forces laid claim to vast areas of land. In addition to that forced labour on European farms deteriorated the relationship, but the white settlers did not or did not want to see it.

The tendency to industrialize, a sharp mind and the proximity to Nairobi made it possible for the Kikuyus to absorb Western knowledge quickly. First demands for the independence of Kenya also came from the Kikuyus.

Due to the bad behaviour of the British the Kikuyus were always hostile towards the troops of the white people. Therefore fights against the "Imperial British East African Company" took place in 1891. Animals of the Kikuyus were stolen, houses were burnt down and their shambas were destroyed. The cause for these fights was that the Kikuyus had refused to deliver cereal for the whites along the road to Uganda.

During the First and the Second World War African mercenaries were signed on by the British in order to fight on their side at the war.

Even during World War I first demands for independence came into existence due to forced labour, bad living conditions and other circumstances. The situation got worse so that after 1952 more and more Africans, especially the Kikuyus, followed the militant Mau Mau. Even though Mau Mau was taken prisoner in 1956, his resistance movement urged British government to talk with African leaders. Eventually this led to the independence of Kenya.

The settling structure nowadays looks different from the settling structure at earlier times because of the colonial influences and in connection with this the joining of clan lands. The structure of the inhabited houses has also changed due to limited access to forests. For instance, another material for thatching roofs had to be found. Corrugated iron was often used, as it is still found today. But it had to be bought and thus paid for. These materials could only be acquired thanks to neighbourly help which became more and more popular.

The life of a Kikuyu was characterized by going through many different stages in life. The system divided the society into different groups, according to the age of the people. The youngest entered the system and became full society members as soon as they reached a certain age and were able to take on more responsibility. The group of the eldest was the most highly regarded one. They carried out the council meetings and they were responsible for certain ritual and spiritual happenings. They supervised the other groups which had to keep to the rules.

Colonial times and the period of the Mau revolts extremely changed the society and the economic system of the Kikuyus. The land was systematically divided up into plots which were registered afterwards. Consequently completely new villages came into being.

Today the Kikuyus belong to the most successful employers and farmers in Kenya. Not only because they had suffered from colonial power, but also because they had learned to adapt to the situation.

Due to the close contact with the colonialists on the one side and the missionaries on the other side, they learned to walk the "way of the white man". They integrated the skills and knowledge into the old Kikuyu system. They were the first of all tribes who took advantage of the European economic methods.

Men were recruited from their farms in order to work on the farms of the settlers or as domestic servants. Often they only did this in order to be able to pay the taxes. This meant that they could not work on their own farms anymore and women and children had to do these works in addition to all other work. In about 1950 many men drew back into the forest to live as pacifists.

In 1960 more and more men were looking for work in the non-agricultural sector in the cities.

Small farmers who had no additional income changed to the production of cash crops or got a job on a plantation. This happened at the expense of the food plant production. The consequence was that many children and adults suffered from malnutrition.

3.2.1 Agriculture

In Muranga District effective measures for soil conservation are absolutely necessary for every agricultural project. The white settlers realized early that something had to be done against soil erosion.

During colonial times most farmers were not keen on using modern methods for farming their land. However, after the independence and the beginning of land consolidation the interest in new methods increased. Farmers became aware of the value of fertilizers and manure. Agriculture officers endeavoured to take measures for soil conservation, e.g. terrace cropping.

Food plants for local use are:

- maize
- beans
- potatoes
- sweet potatoes
- sugar-cane
- cassava

As with the Luos maize is very popular with the Kikuyus. It is among other things also used for the production of "ugali". As fruit plants the Kikuyus grow citrus fruits, bananas, papayas, mangoes and passion-fruits, like the Luos. Moreover there are plums, apples and peaches, but their cultivation depends on climatic conditions.

Cash crops are mostly tea and coffee.

4.0 Assessment of the Farmer Trainer Training Workshop (Nyanza)

The workshops were divided up in two parts. Each time there was a theoretical and a practical part. The workshop took at least three days in each district. The participants were trained in nursery management, pruning, propagation theory and practical work. The theoretical part was very detailed and in my opinion it was very well understandable for the farmers. Many participants asked specific questions in relation to the topic dealt with. On the one hand comprehension questions concerning the relevant topic were asked and on the other hand questions related to problems concerning planted mangoes were asked.

The classes were well structured and it was possible to see some kind of thread running through all lessons up to the end.

The practical part consisted of practising different grafting and pruning techniques on fully-grown mango-trees. It was explained how to handle tools and prison farms or other farms were visited to show an example.

It could often be observed that the farmers had difficulties with the different grafting techniques. Grafting cuts were done without care or in a wrong way. The farmers knew how to handle the grafter but often they touched the cut at the scion with their fingers. The grafters they carried with them often had a blade which was too big and thus very unwieldy. In such cases a simple kitchen knife probably would have been more helpful than the grafting knives especially produced. The observations made in Iria Murai later on clarified this even more. The farmer trainers which were trained in Iria Murai grafted their own mango-trees with their kitchen knives and the results were more successful than those of the farmer trainers in Nyanza.

During the practical training periods the participants often had to work directly with mango root-stocks and mango scions. Only in Migori the participants learned the basic grafting techniques using material which was cut off from bushes in the area.

The interest of the farmers in the conducted workshop varied a lot. Many farmers were very interested, others however were extremely uninterested and were more concerned with eating and drinking.

5.0 Results from the Field

5.1 Nyanza

From the data collected during the study in Nyanza, a graphical representation of the existing trees in the area is given.

Unfortunately there was not much data available for the evaluation of this paper since due to the cutting of subventions on the part of the government the communication between DHCO in the field and ITFSP did not work. Therefore information asked for on the results of the follow-ups was not available.

Diagram 1 indicates the fruit-trees preferred in this area. For example, it shows how many farmers grow mangoes. There is no relation between local and improved varieties in this diagram.

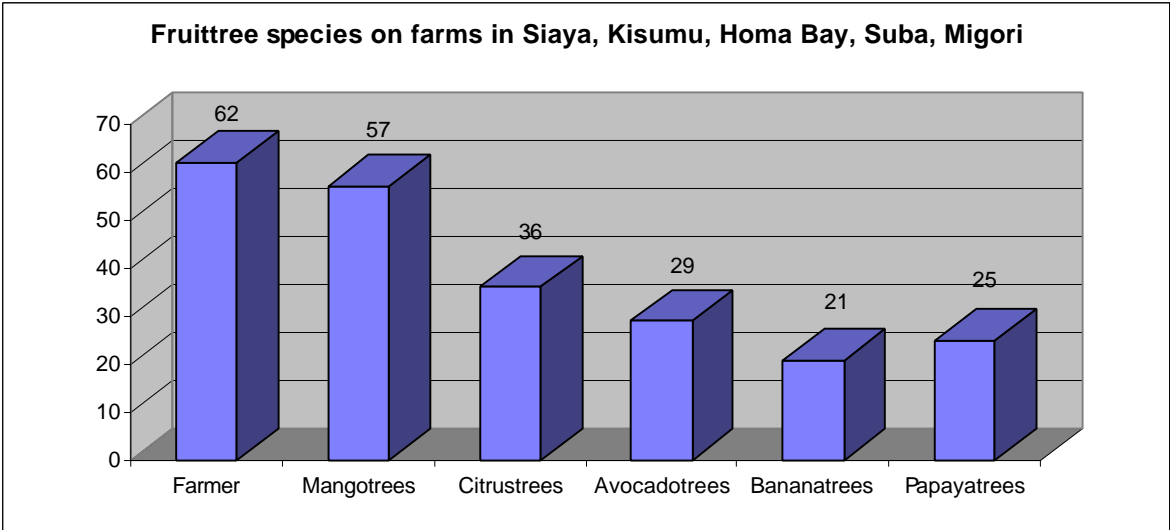


Diagram 1: Fruit-tree species on farms in Nyanza

In addition to these fruit species some farmers also grow passion-fruits, watermelons, limes, nuts, pineapples, potatoes, sorghum, cassava, napier grass, some vegetables and cash crops like maize or sugar-cane.

5.2 Iria Murai

In chapter 5.4.1, in which the results of the evaluation in Western Kenya were demonstrated, there was a diagram showing the existence of fruit-tree varieties on visited small scale farms. Although there was more data available from Embu and a more exact evaluation could be obtained, the same diagram with this data from Embu is shown below in order to draw direct comparisons.

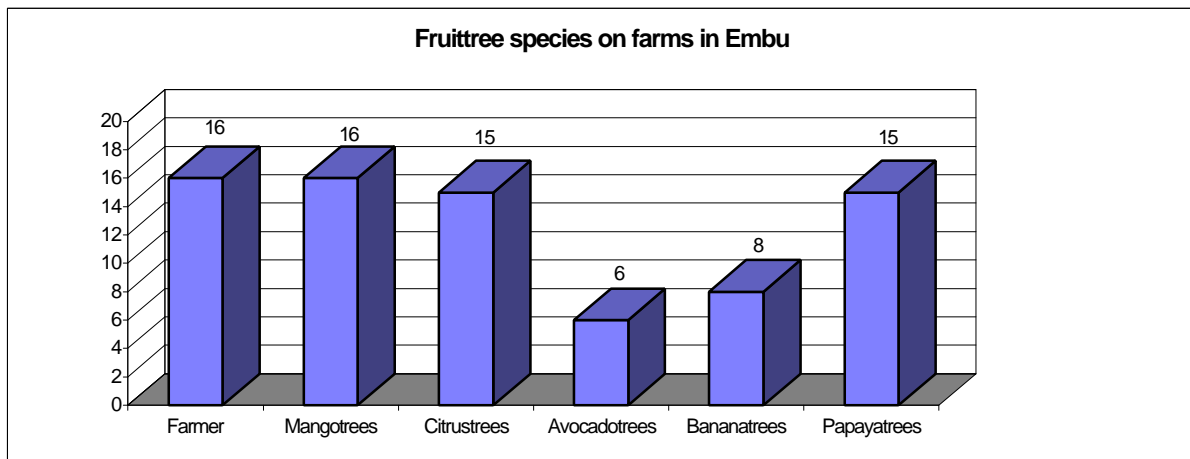


Diagram 2: Fruit-tree species on farms in Embu

Most of the farmers in Embu grow mangoes, citrus fruits and papayas. Only 50% of the farmers grow bananas and 37.5% of the farmers grow avocados.

In Nyanza most of the farmers grow mangoes because ITFSP supports all farmers with mango motherblocks and seedlings. But only 59% of the farmers grow citrus fruits, 47% grow avocados, 34% grow bananas and 40% grow papayas.

It is important to note that the amount of fruit-trees on each farm in Embus is higher than in Nyanza.

However, the presentation of the different fruit-tree species grown on the visited farms does not explain the distribution of local and improved varieties. Therefore the proportion of local and improved varieties is demonstrated in diagrams 3 and 4. As an example mango-trees and citrus-trees were chosen.

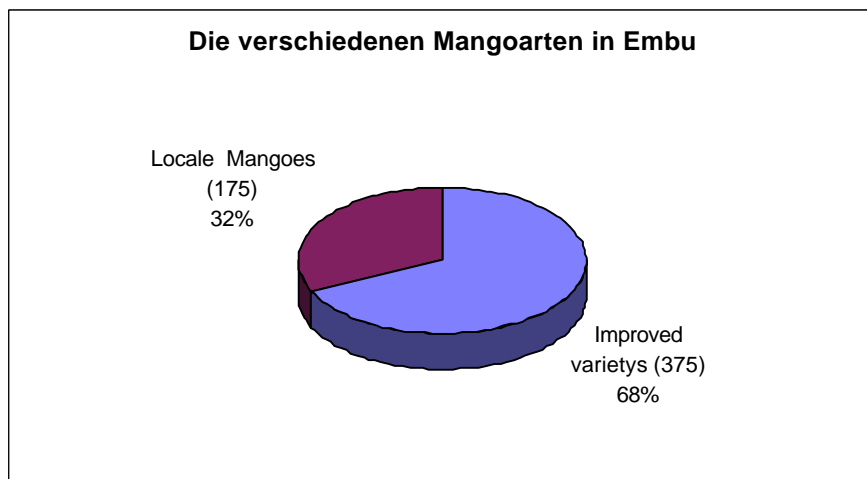


Diagram 3: Different mango varieties in Embu

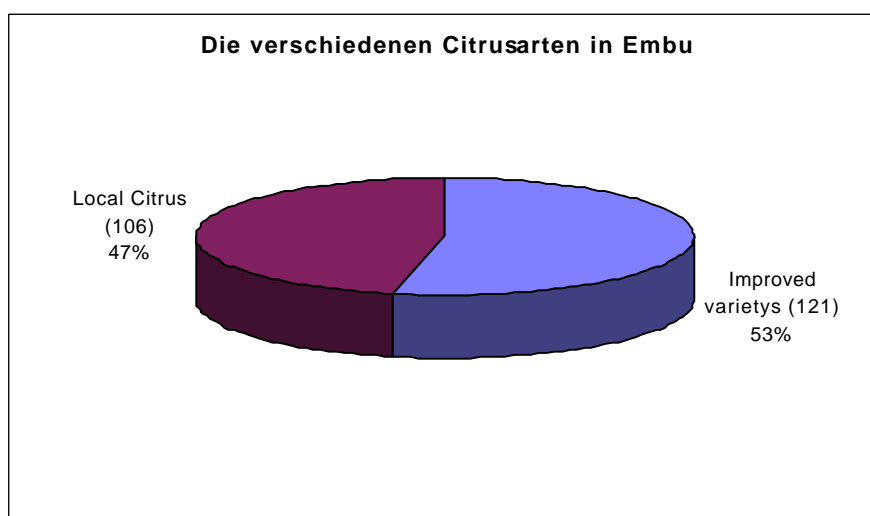


Diagram 4: Different citrus varieties in Embu

From these diagrams it is possible to see that the proportion of improved fruit varieties is predominant. It is explicable with the existence of the Kamurugu Project that the improved mango varieties amount to 68%. The main aim of the Kamurugu Project is to integrate improved mango varieties as cash crops into orchards of this region. Since people were questioned in the near surroundings of the office and in the tree nursery which belongs to the project, it is expected to find a higher amount of improved mango varieties here. The average value of improved mango varieties on one farm was 23.5 trees and of local varieties 11 trees.

It has to be added that the highest number of mango-trees that was found on one single farm was 100 trees and on two farms there were no mango-trees at all. These mentioned farms are exceptions and if they are left out of the evaluation, the result is an average value of 21.5 mango-trees per farm. The evaluation of all remaining data is presented in diagram 5.

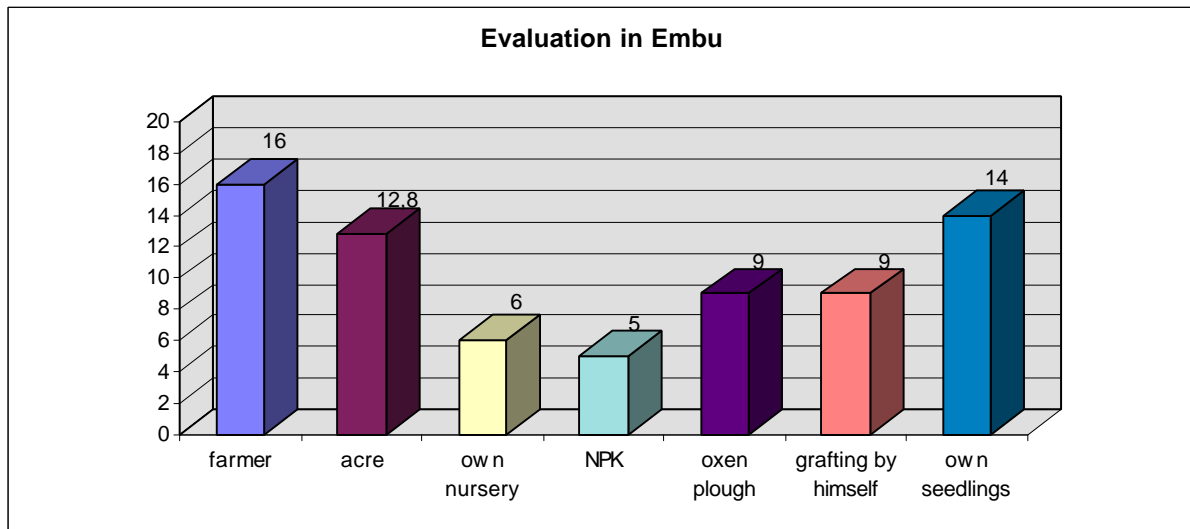


Diagram 5: Evaluation in Embu

The evaluation indicates that the growing area of a small scale farm situated in the investigated region is on average 12.8 acres. It is only 0.3 acres above the average value of cultivated areas in Nyanza. Moreover six out of sixteen farmers had their own nursery and five out of the sixteen farmers used NPK fertilizer in addition to manure, the local fertilizer made of dung. Nine of the farmers had their own oxen plough. It is not shown in the diagram that one of the farmers has his own tractor. Besides, nine of the farmers graft their mango-trees themselves, and even fourteen of the farmers grow their own seedlings. Furthermore the evaluation showed that all farmers use the produced fruits for private consumption and ten farmers sell their surplus, in case there is one, on the market. Seven farmers offered help to other farmers who were not trained, yet most of the time the help was limited to their "women groups". And only two farmers grafted trees for other farmers in exchange for money. Eight of the farmers said that they had trained other farmers or "women groups".

6.0 Economic Assessment of the Farmer Trainer Extension Approach

In the following chapter a "cost assessment" will be set out. The expenses on the part of the project will be compared to the "additional income" a farmer or farmer trainer could achieve by integrating fruit-trees into his farming system. It is important to mention that it is impossible to give an exact cost assessment due to lacking data on the part of the project management as well as on the part of the farmers. The aim is simply to present the costs of the project in contrast to the income of the farmer. For this calculation data of the province South Nyanza was used. The farmer trainers are divided up in three groups.

The division is as follows: bad, normal and good farmer trainers. The author has decided on the criteria for dividing these groups on the basis of observations made during the field survey.

6.1 Definition: „bad“ farmer trainer

Bad farmer trainers are farmers which were trained by the project, but apart from participating in the trainings they did not show any interest. Inattentiveness during lessons, lacking knowledge in practical skills that had been taught before and the poor results of trees growing out, even of grafted trees, demonstrated among other things the lack of interest. Furthermore an initiative of the farmers is lacking. They do not endeavour to build up their his own mother cultures of fruit-trees, to look after delivered young plants and they have no interest in training further farmers.

6.2 Definition: "normal farmer trainer"

Normal farmer trainers were trained by the project and show avid interest in the trainings. They are able to learn practical and theoretical skills very easily. They also express their interest when taking care of their delivered young plants and when having grafted some of their plants at home without any help. However, the willingness to invest more is quite small. For instance, no investments are made to buy more young plants. The stock of mother plants is limited to plants which were delivered by the project. Besides in this category the desirable readiness to train other farmers is not very big.

6.3 Definition: "good farmer trainer"

Good farmer trainers are farmers which were trained by the project and had genuine interest in integrating fruit-trees into their farming systems. They work independently and try to translate ideas into action. They do not shy away from investing money in new young plants and thus to build up their own stock of mother plants. In this connection there are groups of farmers or the so-called women groups. Unfortunately it often occurs in these groups that only members of the group are trained and the knowledge is not passed on outwardly.

6.4 Project expenses

As project expenses only the costs for the trainings and follow-ups are registered. The regular costs as well as the labour costs for people working at this project and other costs, e.g. for data capture and field surveys (e.g. survey of pest and disease) are excluded from this calculation.

It is planned to have different numbers of trainings at the different levels. However, it also depends on the trainer's estimation how many trainings really take place.

In the table below it is shown how many trainings and follow-ups should be carried out at each level (ideal values).

| Level | Trainings | Follow-ups |
|-------|-----------|------------|
| I | 2 - 3 | 4 - 5 |
| II | 2 | 4 - 5 |
| III | 2 | 4 - 5 |

The number of trainings should decrease from one level to the next. The duration of the trainings should also be reduced. A network should develop between the farmer trainers, so that the farmers can discuss problems and exchange ideas. The follow-ups should be conducted continually, also because they are some sort of instrument for measuring the effectiveness of the concept. In case it is recognized during the follow-ups that the imparted skills and knowledge are not at all or hardly absorbed by the farmers, it is possible to react promptly by looking for the reasons and talking to the farmers. The follow-ups should also serve to keep in contact with the farmers. The expenses for a training are listed in the following table:

Item Description

- | | |
|--|---|
| ?? Accomodation for participants | ?? Fuel for field visits |
| ?? Hire of conference hall | ?? Out of pocket allowance for participants |
| ?? Root stocks | ?? Contingency |
| ?? Mango scions | ?? Allowance for GK driver |
| ?? Transport refund for participants | ?? Facilitations allowance |
| ?? Fuel for advance workshop preparation | |

Stationary

- | | |
|-----------------|--------------------|
| ?? Ruled pads | ?? Pieces of chalk |
| ?? Pens | ?? Manila papers |
| ?? Flip charts | ?? Chalk duster |
| ?? Felt pens | ?? Coolbox |
| ?? Masking tape | ?? Polythene bags |
| ?? Box files | |

Equipment/material

- | | |
|--------------------|----------------------------------|
| ?? Grafting knives | ?? Videos |
| ?? Pruning saws | ?? Propagation manual |
| ?? Secateurs | ?? Jembe |
| ?? Grafting wax | ?? Panga |
| ?? Grafting tape | ?? Spade |
| ?? Measuring tape | ?? Current information from HCDA |
| ?? Spaying pumps | |
| ?? Slides | |

Others

- ?? Fuel for project vehicle
- ?? Allowance for project driver
- ?? ITFSP officer allowance
- ?? ITFSP PM allowance

Some things of the equipment can certainly be used several times and for things like videos, the panga or the spade there are only the cost of purchase which are later excluded from the calculation. It is planned that every farmer trainer gets a grafter, a grindstone, a secateur and a pruning saw on loan. Consequently the farmer trainer is obliged to lend the tools to the farmer who is trained by him. If a trained farmer intends to prune down his trees, he can go to his farmer trainer and borrow the pruning saw which was given out by the project management for these works. Tools should only be lent to eager and interested farmers who live in the closer surroundings. The distribution of tools to the farmer trainers is usually done by an officer who is familiar with the project. He should also be able to assess the farmer trainers and not give any tools delivered by the project to bad farmer trainers.

The costs of such a training depend on the number of participants and the length of the training. The result of inquiries was that the attendance varied between 16 and 46 participants and the trainings took three to nine days.

When the data input was done expenses of

101,390/= KSHS and 221,700/= KSHS (KSHS = Kenyan shillings)

were established for one training.

Due to incomplete data collection the cost for one "farmer day" (cost per farmer for each day of training) could not be figured out exactly. Therefore in the following calculation an average value of

161,545/= KSHS

is used.

Calculations in which the expenses for one training were divided by the number of participants and days showed nearly a similar result.

Trainings which were held by the farmer trainers and which were paid for by the project are also excluded from this calculation (see "ITFSP Allowance Guidelines"). The follow-ups were carried out by employees of the Ministry of Agriculture, people at the local place who are familiar with the project and project workers. Follow-ups are important in order to assess the effectiveness of the concept. By means of the follow-ups it is possible to control the progress the farmer trainers make. Among other things a monitoring questionnaire, developed by the author B. Okumo, is used as a control instrument. This questionnaire can be found in the appendix. It contains questions concerning the borrowed tools and the trainings which were carried out by the farmer trainers (questionnaire no. 2). In order to guarantee the control on the level of the project approximately two follow-ups should be done by an employee of the project. Hence the contact with the farmer trainer will also be improved. The rest of the follow-ups is carried out by an employee of the Ministry of Agriculture.

The costs for a follow-up carried out by an employee of the Ministry of Agriculture are listed below:

- transport and fuel
- lunch for District Crop Officer (D.C.O.) and driver
- night out for D.C.O. and driver

The cost of fuel and the night out allowance vary and depend on the distance that has to be covered. Additional expenses, e.g. for seedlings, the costs for obtaining them (in connection with that fuel and night out allowance) are not included in the calculation.

Due to organizational reasons only one budget request from Suba (see appendix) came in. Thus the amount of money requested in it is taken as average value.

The amount of money was: 5,400/= KSHS

The costs for a follow-up carried out by an employee of the project is calculated on the base of the ITFSP Allowance Guidelines as follows:

Tour of six days:

| | |
|------------------|-------------------|
| A) ITFSP officer | |
| Day allowance | 600/= KSHS |
| Night allowance | <u>900/= KSHS</u> |
| | 1,500/= KSHS |

1,500/= KSHS * 6 = 9,000/= KSHS

| | |
|-----------------|-------------------|
| B) ITFSP driver | |
| Day allowance | 300/= KSHS |
| Night allowance | <u>600/= KSHS</u> |
| | 900/= KSHS |

900/= KSHS * 6 = 5,400/= KSHS

Sub total: 9,000/= KSHS (officer) + 5,400/= KSHS (driver) = 14,400/= KSHS

Way of calculation

For the different types of farmer trainers different ways of calculation are used.

"Additional income" of the farmers (bad farmer trainers)

Since there is no increase of capital or additional food with regard to the definition "bad farmer trainer" there is no calculation done for this category.

"Additional income" of the farmers (normal farmer trainers)

A simple way of calculation is used for this type of farmer trainer. No additional capacity of work is needed because the fruit production is quite small. Besides investments for material and other things are so little and even covered completely by the project so that they are not taken into account in the calculation. Yet in the following example for the "good farmer trainer" these mentioned aspects cannot be left out of consideration.

This calculation can only serve as an example because due to climate conditions it was not possible to keep to schedule. Hence the course of trainings and follow-ups in Nyanza could not be kept and there was not enough data to get an exact registration of the costs on the part of the project. A group of 20 farmer trainers was assumed. By dint of integrating improved fruit varieties additional receipts should be achieved in the form of capital proceeds by selling bigger fruits which are "improved in taste". Usually the former local varieties only crop fruits after eight to nine years. They can be sold for cheap prices or consumed by the farmer families themselves.

New cultivations improve fruit varieties, as it is done for example with the new banana culture, the variety "Uganda Green". But also grafting improves fruit varieties, as for example the grafted mango variety "Van Dyke". These improved varieties are not only tastier and crop bigger fruits but they already crop fruits for the first time after three to five years. The juvenile period of the tree is passed over by grafting scions which have already passed the juvenile period. So it occurs that trees are in blossom just one year after the grafting, but they shed their blossoms again because they are too small and do not deliver enough nutrients for the blossoms and the fruits developing of the blossoms. Apart from that the trees are kept smaller so that the harvesting is easier.

According to the Horticultural Crops Development Authority (HCDA) the prices for local and improved mangoes on Kenyan markets per fruit are:

| <u>local varieties</u> | <u>improved varieties</u> |
|------------------------|---------------------------|
| 0.5 to 2/= KSHS | 3 to 12/= KSHS |

When exporting the fruits to Europe or the USA 4 to 5 \$ are paid per case (free on board). This corresponds to an amount of 4.5 to 5 kilogrammes. According to some observations mango-fruits of the improved varieties were sold for 60/= KSHS per kilogramme (about two fruits) at the "Ya Ya Centre" in Nairobi. The prices vary depending on the season. For instance, if mangoes from Asia or South Africa arrive on the Kenyan market, the prices of the improved varieties go down up to 3/= KSHS per fruit. If no imports from other countries are possible due to climatic reasons, the prices rise up to 12/= KSHS.

The number of trees a farmer plants is of major importance for the additional income of a farmer. Concerning the mango species "Haden" and "Sensation" which are taken in this example Griesbach (1992) states that there are 125 mango-trees per hectare. It is assumed that the aim of a "normal

farmer trainer" is to reach a tree-population of 23 mango-trees per farm. It will be discussed later in this chapter how this aim is to be realized. At this point an example of a female farmer from Embu/Iria Murai is given. She has "only" got 12 mango-trees on her plot of land. In 1998 these 12 trees were in their eighth year after planting and in 1997 the proceeds of the sold fruits were 20,000/= KSHS. One box, which contained about nine to twelve fruits, was sold for 150/= KSHS. If the average value of fruits per box is supposed to be 10.5, the woman got 14.30/= KSHS per fruit. Yet in the following calculation according to HCDA an average price of 7.5/= KSHS per fruit

is assumed. These 7.5/= KSHS correspond to the amount of money a farmer gets from a wholesaler. It is conceivable that in the future some farmers join together and found producers' or marketing co-operatives in order to get better purchase and selling possibilities.

Calculation on the part of the project

The following table shows the expenses for trainings, material and follow-ups.

Table 2: List of costs at the different levels

| Level | Single | Sum |
|---------------------------------|----------------|-------------------------|
| I | | |
| 3 Trainings | 161,545/= KSHS | 484,635/= KSHS |
| 2 Follow-ups government officer | 5,400/= KSHS | 10,800/= KSHS |
| 2 Follow-up ITFSP officer | 14,400/= KSHS | 28,800/= KSHS |
| Tools * | 5,200/= KSHS | 104,000/= KSHS |
| II | | |
| 2 Trainings | 161,545/= KSHS | 323,090 |
| 2 Follow-ups government officer | 5,400/= KSHS | 10,800/= KSHS |
| 2 Follow-ups ITFSP officer | 14,400/= KSHS | 28,800/= KSHS |
| III | | |
| 2 Trainings | 161,545/= KSHS | 323,090KSHS |
| 2 Follow-up Government Officer | 5,400/= KSHS | 10,800/= KSHS |
| 2 Follow-up ITFSP Officer | 14,400/= KSHS | 28,800/= KSHS |
| Total | | <u>1,353,615/= KSHS</u> |

* For tools 20 secateurs (2,100/= KSHS), 20 pruning saws (1,500/= KSHS) and 20 grafting knives (1,600/= KSHS) were calculated respectively.

Income on the part of the farmers

The following table indicates the performance of some important mango cultivars planted in the Central Province of Kenya.

Table 3: Different mango cultivars and their yield potential

| Cultivar | Average Fruit weight (g) | Average number of fruits/kg per tree per year | | | | | | |
|-------------|--------------------------|---|----------|----------|-----------------|-----------------|-----------------|-----------|
| | | 2nd | 3rd | 4th | 5 th | 6 th | 7 th | 8th |
| "SENSATION" | 310 | 50/15,5 | 120/37,2 | 176/54,6 | 360/111 | 250/77,5 | 311/96,4 | 579/179,5 |

| | | | | | | | | |
|------------|-----|---------|----------|-----------|-----------|-----------|-----------|-----------|
| "KENT" | 610 | 17/10,4 | 108/65,9 | 137/83,6 | 210/128 | 382/233 | 266/162,3 | 148/90,3 |
| "HADEN" | 398 | | 44/17,5 | 135/53,7 | 204/81,2 | 178/70,8 | 410/163,1 | 157/62,5 |
| "MAYA" | 335 | | 33/11 | 74/24,8 | 286/95,8 | 60/20,3 | 160/53,6 | 176/58,9 |
| "SABINE" | 511 | | 112/57,2 | 216/110,4 | 328/167,6 | 452/230,9 | 420/214,6 | 275/140,5 |
| "VAN DYKE" | 283 | 12/3,4 | 73/20,7 | 98/27,8 | 84/23,8 | | | |

Reference: Griesbach (1992)

The table shows the average number of fruits per year and tree for the different mango cultivars. Additionally the average fruit weight is given. According to Griesbach's observations the trees in their second year after planting already bear fruits. During my stay in Embu I discovered that even after the third year after planting the trees often grew no fruits at all or only very few fruits. Similar observations could not be made in Nyanza because the trees were only in their first or second year after planting. The productivity of the trees depends on numerous different influencing factors. As it is demonstrated in the table there are even differences of productivity between the different cultivars. Moreover weather and climate conditions, the height above sea level, soil conditions, pest infestation, disease spread and fertilizer usage have an enormous influence on the productivity. Griesbach's observations were made on prison farms in the Central Province. The prison was at 1,150 m above sea level. Nyanza is 1,135 to 1,600 m higher and additionally the climate is influenced by the cooling effect of Lake Victoria. This could also be the reason for the occurrence that trees in Nyanza only crop in their third or fourth year after planting.

Since the project in Embu (Iria Murai/Kamurugu) started in 1995 and should serve for making comparisons the average number of planted mango-trees per farm in Embu is used as comparing value with regard to the group of "normal farmer trainers" in Nyanza. The average number of planted mango-trees per farm in Embu was 23 trees. Supposing the trees crop from the fourth or fifth year after planting on and Griesbach's statements for the cultivars "Sensation" and "Haden" are taken over, the result after ten years would be the following.

Table 4: "Sensation"

| Year after planting | Fruits per tree | Total of fruits (23 trees) | Proceeds per fruit (7,5 KSH) |
|---------------------|-----------------|-------------------------------|---------------------------------|
| 1 | - | - | - |
| 2 | - | - | - |
| 3 | - | - | - |
| 4 | 50 | 1,150 | 8,625/= KSHS |
| 5 | 120 | 2,760 | 20,700/= KSHS |
| 6 | 176 | 4,048 | 30,360/= KSHS |
| 7 | 360 | 8,280 | 62,100/= KSHS |
| 8 | 250 | 5,750 | 43,125/= KSHS |
| 9 | 311 | 7,153 | 53,648/= KSHS |
| 10 | 579 | 13,317 | 99,878/= KSHS |
| Total | | | <u>318,436/= KSHS</u> |

Table 5: "Haden"

| Year after planting | Fruits per tree | Total of fruits (23 trees) | Proceeds per fruit (7,5 KSH) |
|---------------------|-----------------|-------------------------------|---------------------------------|
| 1 | - | - | - |

| | | | |
|-------|-----|-------|-----------------------|
| 2 | - | - | - |
| 3 | - | - | - |
| 4 | - | - | - |
| 5 | 44 | 1,012 | 7,590/= KSHS |
| 6 | 135 | 3,105 | 23,288/= KSHS |
| 7 | 204 | 4,692 | 35,190/= KSHS |
| 8 | 178 | 4,094 | 30,705/= KSHS |
| 9 | 410 | 9,430 | 70,725/= KSHS |
| 10 | 157 | 3,611 | 27,083/= KSHS |
| Total | | | <u>194,581/= KSHS</u> |

The cultivars "Sensation" and "Haden" were chosen because there are yield differences, but their average weight only differs slightly ("Sensation" 310 g; "Haden" 398 g).

Comparison of costs and income

The table below demonstrates the comparison of the expenses of the project and the income after ten years by means of planting improved mango-trees.

Table 6: Representation of costs and earnings

| year | Expenses on the part of the project per farmer | Income of the farmers („Sensation„+„Haden„) |
|-------|--|---|
| 1 | 31,412/= KSHS | - |
| 2 | 18,135/= KSHS | - |
| 3 | 18,135/= KSHS | - |
| 4 | - | 8,625/= KSHS |
| 5 | - | 14,145/= KSHS |
| 6 | - | 26,824/= KSHS |
| 7 | - | 48,645/= KSHS |
| 8 | - | 36,915/= KSHS |
| 9 | - | 62,187/= KSHS |
| 10 | - | 63,481/= KSHS |
| Total | <u>67,682/= KSHS</u> | <u>260,822/= KSHS</u> |

However it should not be forgotten that the older trees get the more care they need and that farmers have to buy tools, e.g. a pruning saw.

6.6 "Additional income" of the farmers (good farmer trainers)

The integrated improved fruit varieties were intended to be used by the farmers as "cash crop". Hence for the group of "good farmer trainers", where the stock of trees was higher than 23, an estimate of investment profitability had to be undertaken. Thus the comparison included outside labour force and material (pesticides, material for grafting, pruning saws).

The method of calculation is similar to the static method of investment analysis. The dynamic procedure cannot be applied as due to lacking data too many assumptions were made and under Kenyan conditions it did not seem possible to include annuities (interest rate and repayment) in the calculation. Thus the aspect of time was neglected.

Cash crop plantations are often cultivated by farmers that have joined together in a group. In this case it were difficult to calculate the payment for outside workers since the work could be distributed in the way that no workforce apart from the labour forces of the group members was necessary. So regarding the following calculation it is only looked at one single farmer who is cultivating his land with the help of outside workers. According to HARKSMANN and VAN DE LANGE , both managers on farms for flower production in Kenya, the wage for one worker on a farm is about 2\$ per day. In village communities it also happens that a worker is paid in natural goods, i.e. food. The 2\$ which are paid on a Kenyan farm underlie this calculation.

The calculation on the part of the project is the same as in the section "additional income of normal farmer trainers". It is directly taken over.

The following table represents the expenses on the part of the project for the trainings, follow-ups and tools for a group of 20 farmers.

Table 7: List of costs at the different levels

| Level | Single | Sum |
|---------------------------------|----------------|-------------------------|
| I | | |
| 3 Trainings | 161,545/= KSHS | 484,635/= KSHS |
| 2 Follow-ups government officer | 5,400/= KSHS | 10,800/= KSHS |
| 2 Follow-up ITFSP officer | | |
| Tools * | 14,400/= KSHS | 28,800/= KSHS |
| | 5,200/= KSHS | 104,000/= KSHS |
| II | | |
| 2 Trainings | 161,545/= KSHS | 323,090 |
| 2 Follow-ups government officer | 5,400/= KSHS | 10,800/= KSHS |
| 2 Follow-ups ITFSP officer | | |
| | 14,400/= KSHS | 28,800/= KSHS |
| III | | |
| 2 Trainings | 161,545/= KSHS | 323,090KSHS |
| 2 Follow-up Government Officer | 5,400/= KSHS | 10,800/= KSHS |
| 2 Follow-up ITFSP Officer | | |
| | 14,400/= KSHS | 28,800/= KSHS |
| Total | | <u>1.353,615/= KSHS</u> |

6.7 Profit contribution of the farmer

The profit contribution expresses which amount (of money) the relevant product adds to the cover of the fixed special costs and over head expenses and to the profit of the whole farm.

The profit contribution is calculated by subtracting the variable expenses, which are connected with the product manufacturing, from the performance of a product on the market. These costs are mainly variable special costs. In addition to direct cost of material and sales cost the variable expenses for work (seasonal wages, rent for machinery, cost of fuel, cost of energy etc.) and variable rents are also taken into consideration.

In our example this concerns among other things seasonal workers which are needed for harvesting.

The calculation of the profit contribution is done according to the following pattern.

| |
|---|
| <p style="text-align: center;">proceeds</p> <p style="text-align: center;">minus</p> <p style="text-align: center;">direct costs</p> <p style="text-align: center;">equals</p> <p style="text-align: center;">direct cost-free performance</p> |
|---|

Direct costs include all cost for materials which are directly proportional to the output (e.g. fertilizer, young plants, substratum, culture vessels,...).

The expenses for fertilizer and pesticides and the costs for young plants which are bought during the first year are the direct costs.

As our calculation includes external workforce which is listed as special costs, the profit contribution is calculated as follows.

Direct cost-free performance

| |
|--|
| <p style="text-align: center;">minus</p> <p style="text-align: center;">variable special costs</p> <p style="text-align: center;">minus</p> <p style="text-align: center;">profit contribution</p> |
|--|

The starting position is a farmer who owns a fruit plantation of two hectares. On this plantation 100 trees are to be planted of which 90 trees have to be bought additionally. According to my own observations the average price for a grafted young plant is about 40/= KSHS. Although the farmer knows how to graft plants he buys all trees in a close tree nursery in order to be able to harvest earlier. If he had to grow the root-stocks himself, he would have to wait at least one or two years longer until the first harvest. Later on more trees can be propagated by himself. Then he can also use his own scions. Since the investment of such an undertaking is quite big and the farmer cannot afford any loss the stock of trees has to be kept as free of diseases and pest insects as possible. To reach this spray applications with herbicides are carried out. In order to guarantee an optimal plant growth the usage of fertilizers cannot be avoided.

Another factor is the soil which is to be tilled. It is not easy to get land because there is an overpopulation in this part of the country. Indigenous people say the prices per hectare vary depending on the condition of the soil between 100,000/= KSHS for fertile soil and 50,000/= KSHS for less fertile soil. In chapter 6 it was described that the father shares out the land between his sons. But it is also possible to lease land. It is rather uninteresting to lease an area for a culture of several years, e.g. mango-trees, since this land would have to be leased for decades and it will be difficult to find a lessor. It was also explained in chapter 6 that it would not be allowed to build huts or domiciles and to plant trees because they would become the property of the lessor without the tenant being able to fight against this.

In the following calculation it is assumed that land is at free disposal. It is not assumed that land has to be bought additionally as the farmers would often not be able to pay the amount and in most cases a simple farmer does not get any loan of his bank. Or the whole trade would be carried out by exchange.

Conditions:

Expenditure for:

- young plants
- fertilizer and plant protection
- seasonal wages

Fertilizer requirement:

The most important elements are nitrogen and potassium. A young tree should not be fertilized during the first year after it has been transplanted. The following table indicates the amount of fertilizer in accordance with the age of the tree. The fertilizer can be divided up into two applications (dryland). Producers are advised to apply half of the fertilizer in January (after harvesting) and the rest in March, i.e. during the rainy season. Applications must be followed by thorough irrigation. Fertilizers must be applied in the drip area of the tree, but not against the trunk.

Table 8: Fertilizer dressings per tree and year

| Tree age (years) | LAN (28%) | Superphosphate | Potassium chlorid | Total (100 trees) |
|------------------|-----------|----------------|-------------------|-------------------|
| 1 | 0.25 | 0.25 | - | 50 kg |
| 2 - 3 | 0.5 | 0.5 | - | 100 kg |
| 4 - 5 | 0.75 | 0.75 | 0.5 | 200 kg |
| 6 - 7 | 1.0 | 1.0 | 0.75 | 275 kg |
| 8 - 9 | 1.25 | 1.25 | 1.0 | 350kg |
| 10 and older | 1.5 | 1.5 | 1.25 | 425kg |

These applications are only to be used as a guideline. The correct fertilizer requirements can only be determined by means of leaf and soil analyses.

Jacob and v. Uexküll (1963) also state that in case of applying NPK fertilizers (15:5:15) 500-1,500 g of fertilizer should be given to young trees and 4,500-6,500 g should be given to bearing trees.

Due to the fact that from Germany it was not possible to find out Kenyan prices for fertilizers and sprays, after careful consideration the same prices as in Germany were taken as a basis. It was already observed during the field study that prices for technical equipment in Kenya were at the European level.

The price for NPK fertilizer was fixed at 0.90 DM per kg. So with regard to table 8 the following amounts arise for year five and year ten:

| year | Amount in DM German Marks + /= KSHS |
|------|--|
| 5 | 180 DM - 6,300/= |
| 10 | 382.5 DM - 13,387.5/= |

6.8 Plant protection:

For plant protection it is distinguished between diseases and pests. The main diseases are:

The main pests are:

- ? Powdery mildew (*Oidium magniferae*),
- ? Blossom blight and fruit anthracnose (*Colletitrichum glieosporioides*),
- ? Bacterial black spot (*Xanthomonas mangiferae-indicae*).

The main disease are:

- ? Mango weevil (*Sternochetus mangiferae*),
- ? Fruit fly (*Ceratits rose*, *Ceratitis capitata*, *Ceratatus cosyra*),
- ? Coconut bug (*Pseudothraupis wayi*),
- ? Mango scale (*Aulacaspis tubercularis*).

Regarding plant protection it is important to plan ahead. Therefore the following "plant protection calendar" shows which pests or diseases occur at what time. Correspondingly it is necessary to act early.

Table 9: Plant protection calendar

| | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-----------------|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Disease control | Blossom scorch | | | | | | X | X | X | X | | | |
| | Powdery mildew | | | | | | X | X | X | X | | | |
| | Anthracnose | X | X | | | | | | X | X | X | | |
| | Bact. Black spot | X | | | | | | | | X | X | X | X |
| Pest control | Mango weevil | | | | | | X | X | | | | | |
| | Fruit fly | X | X | X | | | | | | | | X | X |
| | Mango scale | X | | | | | | | | | | | |

The following table presents the time at which a treatment with a certain plant protectant should be carried out.

Table 10: List for pest control at mango-trees

| Disease or pest | Blossom scorch | Powdery mildew | Anthracnose | Bact. Black spot | Mango weevil | Fruit fly | Mango scale |
|---------------------|--|--|---|---|---|---|-------------|
| Time of application | 3 weeks after petal fall and after fruit set every 3 weeks | Flowering stage or when the first symptoms are noticed | From fruitset until 14 days before harvesting | From fruitset until 14 days before harvesting | When egg laying is noticed on small fruit | 3 weeks and again 10 days before harvesting | mid October |
| Reco- | Mancozeb | Benomyl | Mancozeb | Copper | * Fenthlon | Fenthlon | Phentho- |

| | | | | | | | |
|--------------|---|--|--------------------------------|--|----------------------------------|---|---|
| mmen-dations | (80% WP) Manib (80% WP) 200g/100l water | (50% WP) Triforine (19%EC) 100ml/ 100l water | (80% WP) 200g/100l water | oxychlorid(85% WP) 300g/100l water | (50% EC) 100ml/ 100l water | (50% EC) 100ml plus 25ml Citowett/ 100l water | ate (50% EC) 150ml/ 100l water |
|--------------|---|--|--------------------------------|--|----------------------------------|---|---|

* Mango weevil: orchard sanitation is important for the control of mango weevil as well as fruit fly

Griesbach (1992) explains that 125 trees of the mango cultivar "Haden" and "Sensation" can be planted on one hectare of land. But in this example 125 trees were planted on two hectares of land. Nevertheless it was calculated with the application rate of plant protectants for one hectare.

Table 11: Prices for plant protectants

| Plant protectant | Applic-ation rate | Price/kg | Price/year in DM +/- |
|--------------------------------------|-------------------|----------|--|
| Mancozeb = Dithane Ultra WG | 3kg/ha | 20 DM | 4 spray applications 240 DM = 8.400 /= |
| Manib = Maneb Spritzpulver | 3kg/ha | 15 DM | 4 spray applications 135 DM = 4.725 /= |
| Benomyl = Du Pont Benomyl | 0,45kg/ha | 83 DM | 3 spray applications 112 DM = 3.922 /= |
| Triforine = Saprol Neu | 1,5kg/ha | 45 DM | 3 spray applications 203 DM = 7.105 /= |
| Copper oxychlorid = Kupferoxychlorid | 3kg/ha | 25 DM | 4 spray applications 300 DM = 10.500 /= |
| Fenthion = Lebaycid | 1,5kg/ha | 82 DM | 2 spray applications 246 DM = 8.610 /= |
| Citowettl | 1,5kg/ha | 10 DM | 2 spray applications 30 DM = 1.050 /= |
| Phenthoate = Cidial oder Elsan | 1,5kg/ha | 50 DM | 1 spray applications 75 DM = 2.625 /= |
| Total | | | <u>46.937 /=</u> |

Seasonal workers:

Seasonal workers are only needed for harvesting. Works like regulation of fruit load, management, spray applications and fertilization are carried out by the farmer and his family.

"Due to the different ecological zones where mangoes are grown, the ripening season in Kenya extends mainly from November to June." (Griesbach 1992).

Griesbach explains that concerning the cultivar "Haden" January and February and concerning the cultivar "Sensation" February are the months when the fruits are full ripe. According to Fröhlich (1981) the best ripening stage for the export is generally reached when the full-grown fruits show first signs of ripeness, but still have a light green skin colour.

The following table shows the harvest dates regarding different mango cultivars. The harvest times presented in the table are in Transvaal between November and March. They almost correspond to Griesbach's statements in Kenya.

Table 12: Harvest periods for all cultivars in the different production areas of Eastern and Northern Transvaal

| Area | Harvest date (Week of the month) | |
|------------------------|-------------------------------------|-----------|
| | Beginnig | End |
| Tshipise | 4 Nov. | 4 Jan. |
| Hoedspruit | 4 Nov. | 1 Feb. |
| Kaapmuiden | 4 Nov. | 2/3 Feb. |
| Hazyview (Lisbon) | 2/3 Dec. | 4 Feb. |
| Ofcolaco/Trichardtsdal | 4 Dec. | 2/3 March |
| Letsitele | 4 Dec. | 2/3 March |
| Levubu | 1 Jan. | 2 March |
| Nelspruit | 1 Jan. | 4 March |
| Hazyview (Town) | 1 Jan. | 2 Apr. |

The average yield that can be expected per tree is 100 to 200 kg from the eighth to the tenth year of life. But higher yields are perfectly possible (Fröhlich 1981). This is confirmed by Griesbach's evaluations (1992). He states that the harvested produce for the cultivar "Sensation" is 22.44 t per hectare in the eighth year after planting. This means for 125 planted trees on one hectare the harvest yield per tree is about 180 kg.

No values in man-hour/hectare concerning work performances for harvest works (picking + transport) are existing. Values in man-hour for apple plantations are existing, yet after careful consideration they were not used to draw comparisons. The basic conditions for a comparison were not existing as the yield performance of apple trees is bigger (more apples per tree) and mangoes have to be treated with more care. Even slightest injuries can lead to a quick rotting process of the fruits. In the fifth year after planting there would be about 1,700 fruits and in the tenth year about 8,000 fruits to be harvested. The harvest time of the fruits for the consumption in the country of production and for the export is stretched out over the months November, December, January and February. The calculation of the labour costs for the seasonal workforce was done this way: in the fifth year one worker was employed for 30 days and in the tenth year two workers were employed for 50 days. The daily wage was 2 dollars.

Calculation:

The profit contributions for the fifth and the tenth year are calculated. These years were chosen since on the one hand data on the number of fruits per tree were found and on the other hand a tree of the fifth year is in the period of yield increase and a tree of the tenth year approaches the period of full bearing. Hence two different yielding stages are covered in the calculation.

young plants 90 young plants = 3,600/= KSHS
(only calculated for the fifth year)

fertilizer and plant protection in the fifth year = 46,937/= KSHS + 6,300/= = 53,237/=
fertilizer and plant protection in the tenth year = 13,387.5/= + 46,937/= = 60,324.5/=

| | | |
|-----------------------------------|---|----------------------------|
| seasonal wages | = | 2\$ / day † 120/= / day |
| | = | 3,600/= in the fifth year |
| | = | 12,000/= in the tenth year |
| expected sales in the fifth year* | = | 61,500/= KSHS |
| expected sales in the tenth year* | = | 276,000/= KSHS |

Table 13: Profit contribution in the fifth year

| | |
|---------------------------------------|-----------------|
| profit contribution in the fifth year | |
| proceeds or sales in the fifth year | 61,500 /= |
| minus direct cost | 53,597 /= |
| equals | 7,903 /= |
| minus seasonal wages | 3,600 /= |
| equals | <u>4,303 /=</u> |

Table 14: Profit contribution in the tenth year

| | |
|---------------------------------------|---------------------|
| profit contribution in the tenth year | |
| proceeds or sales in the tenth year | 276,000 /= |
| minus direct cost | 60,324.5 /= |
| equals | 215,675.5 /= |
| minus seasonal wages | 12,000 /= |
| equals | <u>203,675.5 /=</u> |

* The sales were calculated in the same way as for the "normal farmer trainers".

Thus the profit contribution for the fifth year is 2,151.5 /= per hectare and for the tenth year 101,837.5 /= per hectare.

However, the fifth year is the year when the first income is expected, as long the culture has not suffered severe damage through uncontrollable factors, e.g. environmental influences. Though up to the fifth year there are still enormous expenses for the farmers for fertilizer and plant protectants which have to be used before. The following table indicates these expenses in comparison to the proceeds during the first ten years.

Table 15: Income effects for the farmers

| year | Proceeds in /= | sum in /= | expense in /= | sum in /= |
|------|----------------|-----------|---------------|-----------|
| 1 | - | | 3600 | |
| 2 | - | | 40,427 | 40,787 |
| 3 | - | | 40,427 | 81,214 |
| 4 | 18,750 | | 53,237 | 134,451 |
| 5 | 61,500 | 80,250 | 53,237 | 187,688 |
| 6 | 116,625 | 196,875 | 55,599 | 243,287 |
| 7 | 211,500 | 408,375 | 55,599 | 298,886 |
| 8 | 160,500 | 568,875 | 57,962 | 356,848 |
| 9 | 270,375 | 839,250 | 57,962 | 414,810 |
| 10 | 276,000 | 1,115,250 | 57,962 | 472,772 |

On closer examination of table 15 it is discovered that the culture shows a profit from the seventh year on. In this connection it should not be forgotten that no annuities were included in this calculation and neither rent for land nor purchasing of land were taken into account. When counting interests and compound interests towards the capital put into the culture, the period of time up to the profitability of the culture would be extended.

9. Discussion of the Results

The aim of this paper was to ascertain the efficiency of the project which was worked out by ITFSP in order to integrate orchard crops into small farming systems. The examination in the host country Kenya was divided up into a phase of preparation and several field surveys. The following evaluation of the collected data was done in co-operation with the Technical College Wiesbaden in Germany. It was planned to establish an impact monitoring from which the efficiency of the project was to be examined. Due to lacking data, as notes got lost during the field study and the data acquisition of the project was incomplete, such an impact monitoring could not be carried out.

This was also the fault of the questionnaire which was elaborated for this purpose. At this point the efficiency of the questionnaire has to be discussed. The questionnaire, which is marked as questionnaire 1 in the appendix, was intended to interview farmers during the workshops and later during the visits of farms. The questionnaire contained more than 40 questions and in retrospect it turned out that it was completely unusable. In order to fill in such a questionnaire several hours would have to be taken up. None of the farmers was willing to invest so much time for this task. Some questions were also useless because they digressed from the topic, even though they were considered necessary in the beginning. It was planned that the questionnaire was to be filled in during an interview. But as there was not enough time, each participant got a questionnaire afterwards and was asked to fill it in until the end of the workshop. On the last day of the workshop the questionnaires were collected. When evaluating them it was noticed that most of the farmers had already given up after the third page. Besides the questionnaires were filled out very incompletely and they were unusable for an evaluation. In order to prevent this in further investigations it should be taken care that only a few specific questions are asked. Furthermore the questionnaire should be elaborated with the help of the project manager or a responsible person.

Thus this paper is mainly based on the observations made during the field study and the evaluation of existing data. The aim of the ITFSP concept is the integration of tree cultures into small farming systems. Similar concepts have already been established in different developing countries by other aid organisations. The objective of many projects was the agroforestry in order to increase the standard of living of small scale farmers. Yet the concept developed by ITFSP intends to integrate no forest-trees but fruit-trees into small farming systems as further developed useful plant. Fruit-trees which are suggested by ITFSP are not the conventional local fruit-trees, but grafted and cultivated trees bearing improved fruits. The fruits are bigger, the taste is improved and they have other advantages which were mentioned before. Another exception is the sustainability and continuous effect of the concept. So-called farmer trainers are to be trained in workshops. They train farmers close to their own farm and disseminate their knowledge and skills to these farmers so that they become farmer trainers as well who again train other farmers living in their surroundings. So the integration of improved fruit-trees into a certain area is done in accordance with the accumulative process.

In the workshops farmers are taught the basics of fruit growing. Depending on the level (see chapter 2) different topics are dealt with. To my mind no more than four years should pass by until the project

is handed over to the responsible officer of the district. After these four years the farmers should be able to run a fruit grove, either by themselves or with help of their "extension officer". This includes the management of the trees as well as the harvest and the marketing of the fruits. A factor which makes the whole process more difficult are the trees. They need a certain time to leave the juvenile period and enter the period of yield increase and later the period of full-bearing. According to some observations there were trees which were older than four years and did not yet bear any fruits. Therefore the programme of the workshop included a visit of a farm. During these visits the participants were also shown how to deal with full-grown trees. As described in chapter 2 a level can consist of several trainings. The number of trainings should be decided by the instructor as he can best evaluate the intelligence of the participants. In case there are farmers without any interest in the workshop they should be removed and replaced by others. Such a step should be made at latest at the second level. The course and the sequence of the levels are also to be stringently paid attention to. I made the observation that this was not always the case.

According to the project manager the mango-tree was supposed to be an eyecatcher. Later on other fruit-trees were to be added into the concept. In the trainings this happened with the citrus-tree. Among other fruits oranges, grapefruits, mandarins and lime belong to the group of citrus fruits. Although there was enormous loss concerning citrus-trees by dint of the "greening diseases" and Griesbach (1992) emphasized this, in every training the citrus-tree was presented as one of the favourite cash crops. Simply the fact that many farmers complained about the damage of their citrus-trees should be reason enough to take into consideration if maybe other fruit plants, as e.g. avocados, papayas or bananas should be preferred. As during the trainings or farm visits farmers constantly worried about the enormous shortage of water on their farms it should be considered to explain some methods for water storage. As it was observed in Embu the farmer there use several types of small earthwork structures, such as micro catchments, contour ridges or infiltration ditches.

It was striking that only very few farmers in Nyanza had tried to graft mangoes on their farms. They all said the reason for this was the lack of proper tools. Another reason was the difficulty to get scions for grafting. It has to be noted that ITFSP had promised the farmers to put a limited amount of tools like grafters, secateurs and grindstones at their disposal. Therefore these tools were also distributed at the trainings when I took part. The tools were seen as loan and did not become the property of the farmer trainer. The farmer trainers had to commit themselves to give the tools to interested farmers and to maintain them. Though during my farm visits in Embu I realized that farmers carried out all graftages with normal kitchen knives better than the farmers in Nyanza with their delivered special tools. Hence in my opinion it is not necessary to distribute these tools since under Kenyan conditions it is definitely possible to manage with the tools that are available on each farm. Among other things these tools constitute a major expense. Besides I cannot agree to the statement that it is problematic to get scions for grafting. The fact that there is a prison farm in each bigger town where it is possible to buy scions supports my claim. The behaviour of the farmers in Nyanza indicates a lacking initiative of their own.

In order to keep a better overview it is important to carry out several follow-ups. Though the follow-ups carried out by DCO do not have to include a farm visit. It is enough if the follow-ups carried out

by ITFSP personnel include a farm visit. The officers could as well meet with their farmers at a central place and discuss existing problems or ideas there.

After having compared the cultivated areas of the Luos with those of the Embus it becomes discernible that the Embus have a better thought-out system for cultivation. The laid out fields of the Embus indicate that they have a higher developed system. An explanation for this could be the history of the Luos. The nomads, cattle breeder and fishermen had to adapt in the course of the time and they had to farm the land as well. Whether this change was more difficult for them than for the Embus should be examined in another study and would go beyond the scope of this paper. The results however show that the Embus have more agricultural potential than the Luos.

For the economic assessment there is a distinction made between "normal" and "good farmer trainers". The calculation for both types can only be regarded as example calculations since exact data is often missing. Therefore it is also not possible to make an exact cost balancing. The intention is rather to demonstrate the expenses and income on the part of the project and on the part of the farmers. When looking at the example for the normal farmer trainer it can be seen that it would be profitable even for small farming systems to integrate mango-trees into their cultivation. Supposedly there are 23 trees it is possible to have a permanently increasing income by putting in a comparably small effort. Trees are cared for as little as possible and loss is replaced by new trees.

In the fifth year the good farmer trainers achieve a profit contribution of about 4,303/=. In this example the profit contribution can be treated as equivalent to the calculatory profit/loss, since no fixed labour costs are existing and machines, greenhouses and cost of soil are dropped. So the 4,303/= would only serve the backing of family labour cost. In the tenth year the profit contribution is 203,675.5/= which would represent an enormous profit. However in table 15 it can be seen that with the taken values the culture would only make profit for the first time after seven years. To my mind it is impossible to explain a trained farmer that he would have to invest money into an undertaking for six years which would only be profitable in the seventh year, supposed that nothing unforeseen happens. Particularly as only very few farmers are able to raise 200,000/=. Maybe the calculated values could be reduced a bit by taking less seasonal capacity of work, including the farmer himself as workforce or using Kenyan prices for plant protectants in the calculation. But it should also not be forgotten that no harvesting loss or other unexpected obstacles that can occur during such a long cultivation time are taken into consideration. Additionally there could be difficulties concerning the water supply of young trees. These trees need watering to survive the first years. But if the farmers have to cover several kilometres to the next river, it will not be possible for them to water all their trees. Especially as the water which is needed for the whole family is treated as a matter of priority. Another study on fruit-growers in Mackakos, who are already importing tropical fruits into other countries, could give information on the size of the farms one has to start out from in order to possibly enter the trade. If the result were that 23 to 30 trees per farm are enough, it should be considered if the trainings are not too intensive, since up to now the successes in Embu were obtained with less effort. However, I have to note here that the Kamurugu Project was quite reserved towards many questions and it is to be checked with regard to its content of truth. According to my opinion the project has financial difficulties and it seemed as if people there intended only to show me the best

farmers during my stay in Embu. I am sure that the Kamurugu Project sees the GTZ and thus ITFSP as their financial backer and did not want to leave a bad impression.

It also still needs to be clarified how the marketing of the fruits will look like later on.

I think the publication of the magazine "Miti Ni Maendeleo" is a great idea which is also positively received by the farmers. The magazine comes out four times a year. Unfortunately most of the farmers were disappointed because there were still problems concerning the delivery and often many farmers only got one magazine in a year.

Many farmers expected of the project a sort of service in return for the work they had done and showed little appreciation and respect for the effort the project had taken in order to improve the standard of living of the farmers. In the farmers' view the service in return was to be an amount of money or other valuable presents. For me it was obvious that most of the farmers did not recognize the usefulness of their own work and the work the project did, and regarding foreign aid organisations they were extremely spoilt. This is probably connected with the history of development aid. From this point of view the statements of many farmers, that projects fail after the aid organisation has left, seem to be a logical consequence. If workshops are only participated in and works only carried out in order to get a contribution at the end, in whatever form, there can be no or only little success achieved. Yet it should be mentioned that the younger generation which returns from the cities to the land has a different attitude towards such projects than the older generation.

At the end of my paper I would like to express a few thoughts on the "green revolution". At that time it was tried to solve the nutritional problems in Africa by means of agrarian technologies. The methods of the green revolution are mainly based on the use of highly improved seed and the application of special soil cultivation techniques, seeding methods, fertilizing practices and pest control methods which only make it possible that the improved seed to flourish. Unfortunately only later the pollution of the environment became visible. The fertilizing of the poor tropical soil was unsuccessful, since the soil could not store any nutrients. The highly improved seed was more prone to pests and needed the application of plant protectants. These however damaged the population of beneficial insects. Monocultures lead to more soil erosions. The farmers were not able to apply the new technical methods. It was visible that in contrast to the experiences of African farmers the new cultural methods ignored the rules of tropical plant cropping. In spite of enormous investments and much effort it was not succeeded to bring African agriculture up to date. ITFSP should take care that the highly improved seed is not changed through improved fruit varieties.

Summary

Considering progressive desertification and food shortage strategies are to be developed for the conservation and improvement of the ecological potential and the nutrientsaving in Kenya. ITFSP developed for these reasons a concept, which anticipates the integration of new fruit varieties in small scale farms. To record the problems, successes and errors of the concept, this study was produced. The study includes the evaluation the three-month field survey in the districts South Nyanza, Kisumu, Siaya and Embu in Kenya.

Investigations show, that mangos are grown already long in Kenya. Herewith it deals however mostly with the local sorts, which bring in only slight prices on the local markets. Many farmers accept the new mangovariety as new food and possible additional cash and the cultivation of small stocks presents no problems for the resident farmers. The stocks should not be indeed large like 20 to 25 trees per farm.

Although the concept worked out by ITFSP is assumed by the farmers in Nyanza, to recognize is nevertheless a slight initiative on the part of the farmer clear. The expectations of ITFSP, which the work and the initiative affects the educated Farmertrainer, is not fulfilled from this. In lieu of the promised tolls, which did not prove as necessary, should hand are one the farmertrainer as reward of their services small presents e.g. in form of books or deeds, which very popular at farmers.

The field survey in Embu showed, that farmers are to be laid out also thoroughly in the position after a training fruitorchards. The success the Kamurugu of project in this region is joined well with the dependence of the project by the farmers. The project lives in part on it, to resell which specifically pulled mango at the farmers. Also the proximity of the project to the farmers could be an advantage. To the trainings of the Kamurugu project are invited prefers members or leaders of womengroups, which transmit their knowledge at the group. This concept should be taken over by ITFSP in their trainings.