Small holder Conservation Agriculture in Kenya
Improving Small holder Crop Yields and Levels of Income in Laikipia and
Makueni Districts through increased and better use of Conservation
Agriculture Technology and Crop Protection Products (CPPs)

2nd Year Progress Report (2008)
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1. **Introduction**

Starting April 2007, CETRAD and Syngenta have been implementing a stewardship project whose goal is to improve small holder crop yields and incomes through the use of Conservation Agriculture (CA) technologies and Crop Protection Products (CPP).

CA is a way of farming which emphasize minimum soil disturbance, soil cover and crop rotation. All over the world, these three principles have been shown to, over time; improve soil health to a point that low input agriculture can ensure food security. In marginal areas, these principles make the difference between harvests and total crop failures.

Despite the demonstrated impacts of CA, its adoption is limited, especially among small holder farmers due to a range of social and economic factors. On the other hand, CA is a new way of farming that many small holder farmers do not know about. In Kenya, factors such as lack of skills, lack of appropriate tillage tools and low income have limited the adoption of CA. The current project run by CETRAD and SYNGENTA attempts to address these issues.

2. **Project goals and objectives**

The goal of this project is to improve small holder farmer crop yields and livelihoods through the use of CA and CPP. It has five objectives i.e. to:

- Document and map the spread of CA practices among small holder farmers in the study areas.
- Improve small holder knowledge and skills on CA practices and safe and efficient use of CPP.
- Assesses impacts of CA and safe and efficient use of CPP on environment, crop production and farmer income.
- Up-scale the experiences gained in other marginal areas i.e. from Laikipia to Makueni and Mwingi Districts.
- Sharing knowledge and experience gained with stakeholders in the study areas and elsewhere in Kenya.

3. **Lessons learnt in 2007**

In the first year i.e. April to December 2007, the project concentrated in the Laikipia area and made major strides in improving farmer skills in CA and CPP, assessing the impacts of CA and CPP on yields and documenting and mapping the spread of the technologies among small holders in the area. The following are the key lessons learnt in 2007 and recommendations which also formed part of the work plans for 2008 and guided the strategies that were adopted in 2008:

i. Initially, objective 1 had proposed the mapping of the spread of CA in the study area and elsewhere in Kenya. From the work that had been done, it was
observed that the work of mapping CA spread across the country would be a huge exercise requiring extra resources, it was therefore suggested that the mapping work to concentrate on the study focal areas.

ii. The current project was to collaborate with other CA stakeholders so as to learn from each other and to complement each other. A special case for consideration was the FAO CA-SARD Project.

iii. There was need to provide and facilitate the acquisition of equipments i.e. rippers, sprayers etc to enhance faster adoption of the technologies.

iv. It was suggested that the CA and Stewardship training modules be summarized into a package of Swahili and English handouts to be distributed to beneficiary farmers.

v. There was also a view that the project should support farmer groups improve their capacity to training fellow farmers and disseminating the knowledge and skills gained.

vi. To improve the monitoring of the impacts of CA and CPP, it was suggested that data collection should be based on larger plot sizes.

vii. A suggestion was also made to transfer rainfall stations from farmer fields to nearby schools. The school would be able to use the stations in their teaching while collecting rainfall data for the project. However, it was realized that this move required additional funds to install the stations and train the teachers. This change has therefore not been effected so far.

4. Accomplishments in 2008

The work plan for 2008 is presented on annex 8. The achievements made in 2008 are summarized below under the five objectives of the study.

4.1 Documenting and mapping the spread of CA practices among small holder farmers

Mapping of small holder farmers practicing CA and CPP was carried in the eight focal areas in Laikipia. The exercise was a continuation of the mapping work started in 2007. In 2008, 200 farmers were interviewed on their CA and CPP experiences. Additionally, GPS coordinates were collected for spatial mapping of the distribution of farmers practicing CA and CPP. See table 1, Figure 1 and 2

The exercise in 2008, mainly focused on eight focal areas, these are the four for 2007 (Kalalu, Ngenia, Sweetwaters and Mathagiro) and the new areas (Njoguini, Neturukuma, Segera and Akorino) within the district. Of the 200 farmers, 27% are from Kalalu, 24% from Njoguini area, 17 from Ngenia, 13% from sweet waters, 8% from Neturukuma, 6% from Mathagiro and 3% from Akorino and Segera areas each.

<table>
<thead>
<tr>
<th>Area</th>
<th>Kalalu</th>
<th>Ngenia</th>
<th>Mathagiro</th>
<th>S.water</th>
<th>Njoguini</th>
<th>Segera</th>
<th>Akorino</th>
<th>Neturukuma</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>23</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2008</td>
<td>53</td>
<td>34</td>
<td>12</td>
<td>26</td>
<td>48</td>
<td>5</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>% increase</td>
<td>130</td>
<td>385</td>
<td>71</td>
<td>333</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Figure 1: Spread of CA and CPP practicing farmers in the focal areas in 2007

Figure 2: Spread of CA and CPP practicing farmers in the focal areas in 2008
It is worth noting that some of the new areas have recorded higher adoption rates as compared to some areas where the project started with. This has been due to the training strategy that we adopted this year and the attention that was geared towards these farmers. The new figure show over 400% increase in the number of farmers adopting CA and CPP. In terms of the CA practices observed, over 80% of the farmers used ripping and safe and effective herbicide application. 15% combined mulching and herbicides. 14% of the farmers used other types of CA practices.

4.2 *Improving small holder knowledge and skills on CA practices and safe and efficient use of CPP*

4.2.1 A new training strategy

We changed our training strategy to pass the message more clearly and effectively. The training now is organized at three levels: first theoretical training is held to introduce CA and CPP, then demonstrations are organized where CA practices and safe and efficient use of CPP are demonstrated on farm to group members and lastly, farm exchanges are organized to allow farmers exchange experiences with other practicing farmers. For the farm visits, due to logistical constrains, only selected farmers participate as ambassadors for their group. These three levels of farmer training are further elaborated below.

- **‘Theoretical’ training:** The theoretical training covers all aspects of CA and CPP. This is done using the training modules developed in 2007 (See module 1), which have been further improved to cover other emerging farmer needs. Two new modules have been added, one on farming as a business and the other on draught animal power. Posters, hand outs and power point presentations are used for the training.

- **On farm demonstration of the CA technology and CPP practices:** After the ‘theoretical’ training, a demonstration is organized for group members within the area. The demonstration is conducted by one of the contact farmers. The demonstrations cover many aspects of CA and safe and efficient use of CPP. On the CA side, topics includes harnessing of oxen for ripping, effective use of rippers, converting mould ploughs into rippers, locating hard pans, ripping and sub soiling. On the CPP side, topics include selection and use of agrochemicals, personal protection, knapsack calibration and safe storage of agrochemicals among others.

- **Farm visits:** Farm visits use a participatory approach where farmers exchange their experiences on CA and safe and efficient use of CPP. In each group, 10 to 15 ambassadors are selected to represent their group in the farm visits. The small number of farmers involved from each group is restricted by transport constrains. When the group ‘ambassadors’ come back from the farm exchanges, they organize a session where they train the other members of their group on what they learned. The farm visits helps the groups to further enhance their skills in CA and CPP. The exchanges also help extend the use of CA and CPP by helping farmers build confidence and trust by seeing what other farmers have done. Seeing successful examples motivates the visiting farmers to want to improve what they
are already doing. Finally, the visits also build relationships and networks among the groups and farmers.

### 4.2.2 Farmer training

Building on the work done in 2007, farmer training continued within the four focal areas (Ngenia, Kalalu, Mathagiro and Sweetwaters) and also in other areas of Laikipia and adjacent districts. In total, 1204 farmers were trained through group training, field days and an exhibition organized by the Laikipia District Stake Holders’ Forum (LACODEV).

Additional information was included in the training modules and the modules were further adapted on the basis of the experiences gained in 2007. Two new modules were developed, one on animal draught power for training contract rippers and the other on farming as a business.

**Training through Self Help Group:** Currently we are working with 36 farmers groups, 13 of which are new groups. We now cover eight areas, having expanded to four new areas: Nturukuma, Segera, Akorino and Njoguini. Six of the new self help groups are from these new areas that we have expanded to. The 36 groups have under gone training on both the Conservation Agriculture and the safe and effective use of chemicals and crop protection products.

For the 23 groups who had been trained in 2007, we continued to work with them to increase adoption rate among members mainly by enhancing their skills and exposing them to other farmer experiences through the exchange visits.

Table 2 list the names of the 13 new groups by areas and the number of farmers trained. A complete list of the farmers trained is summarized on Annex 5.

**Table 2: List of new groups by areas and number of farmers trained**

<table>
<thead>
<tr>
<th>Focal area</th>
<th>Groups trained</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woni out growers</td>
<td>21</td>
<td>7</td>
<td></td>
<td>28</td>
</tr>
<tr>
<td>Kalalu woman’s guild</td>
<td>0</td>
<td>21</td>
<td></td>
<td>21</td>
</tr>
<tr>
<td>Snap beans farmers</td>
<td>17</td>
<td>6</td>
<td></td>
<td>23</td>
</tr>
<tr>
<td>Tree Nursery group</td>
<td>10</td>
<td>3</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Nyarigino farmers group.</td>
<td>7</td>
<td>1</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Nturukuma Holticulture group</td>
<td>12</td>
<td>14</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>Mazingira group</td>
<td>5</td>
<td>8</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Mutirithia CA group</td>
<td>12</td>
<td>24</td>
<td></td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>135</td>
<td>129</td>
<td></td>
<td>264</td>
</tr>
</tbody>
</table>

**Field days:** In 2008, we attend 5 field days including the world food day on 16th October 2008. We were actively involved in planning and organising field days within the
District. In total, close to a thousand farmers were involved in the field days (see Table 3).

**Training of trainers:** To ensure sustainability and continuity of the project, we have trained 35 farmers as trainers. The farmer trainers will help in disseminating CA and CPP information hence increase adoption. To motivate these trainers, we generated a reward scheme where the winner will be provided with all inputs for 1 acre of their farm for one season. We have started awarding grade to the farmer trainer, based on the number of farmers the trainer has trained or engaged. The trainer who will have trained or engaged the highest number of farmers in all aspects of CA and CPP will be rewarded (See annex 6).

**Table 3: Field day by areas and number of farmers trained**

<table>
<thead>
<tr>
<th>Focal area</th>
<th>Approach</th>
<th>Lead agent(s)</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ngenia</td>
<td>World food day – 16th Oct</td>
<td>All stake holders</td>
<td>121</td>
<td>173</td>
</tr>
<tr>
<td></td>
<td>Field day</td>
<td>Cetrad, Syngenta</td>
<td>118</td>
<td>107</td>
</tr>
<tr>
<td>Kalalu</td>
<td>Field day</td>
<td>CETRAD and Syngenta</td>
<td>54</td>
<td>20</td>
</tr>
<tr>
<td>S. waters</td>
<td>Exhibition</td>
<td>All stake holder</td>
<td>55</td>
<td>34</td>
</tr>
<tr>
<td>Nturukuma</td>
<td>Field day</td>
<td>Ministry of Agriculture, CETRAD, Syngenta</td>
<td>14</td>
<td>84</td>
</tr>
<tr>
<td>Segera</td>
<td>Field day</td>
<td>Ministry of Agriculture, CETRAD, Syngenta</td>
<td>44</td>
<td>77</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>406</td>
<td>495</td>
</tr>
</tbody>
</table>

**Training of rippers:** As we continue to train farmers on CA and CPP, the number of farmers willing to try the technology has been increasing. Currently, the farmers with ripping skills are only three and are unable to meet the demand for ripping services. To respond to this challenge, we are training 15 farmers on ripping and sub soiling and other CA tillage related issues. The trainings include animal harnessing, use of CA equipment including rippers, planters and sub soiler and ways of identifying hard pans on the field. The farmers being trained were selected from all the focal areas. All of them have oxen and were previously practising conventional tillage.

**4.2.3 Model farms**

At the beginning of the year, six model farms we identified to be used as training centers for the farmer and groups from within their locality and adjacent areas. So far, these farms have been used for CA and CPP demonstrations as well as for the farm visits and exchanges. Through these farms, farmers have been able to learn good farming practices including farm planning, record keeping, farm enterprise gross margins, conservation agriculture, personal Protection equipment and CPP. Visiting farmers get to meet their counterparts who face similar social, economic and ecological challenges as they do but have managed to reap utmost benefit due to good practises.

One of our model farm owned by Joshua Muriungi was rated the best small scale farm in Laikipia east district by the ministry of agriculture. This has increased other farmers enthusiasm in adopting and practicing CPP and CA techniques. We hope to support similar initiatives in all the focal areas.
4.3 Assessing impacts of CA and safe and efficient use of CPP on environment, production and farmer welfare

In March, just before the onset of the long rains, we identified and established 20 demonstration plots to collect data to assess the impacts of CA and safe and efficient use of CPP on the environment, production and farmer welfare. The selected farms also act as demonstration sites for CA practices and safe and efficient use of CPP.

In 2007, we experienced difficulties when extrapolating results obtained from the demonstration plots, which were too small, to a standard reporting unit i.e. 1 acre. This year, to avoid this problem, we set up much bigger demonstration plots, ranging from 0.25 acre to 1.5 acres.

Generally, the long rains performed poorly and in Sweetwaters and Njoguini there was a total crop failure and half of the demonstration plots failed completely. The other plots performed dismally.

In most instances, CA plots performed better than the conventionally tilled plots. In Ngenia for example, Rose Guantai managed to harvest 32 bags (12.8 bags/acre) of maize from a 2.5 CA plot compared to 2 bags she got from a 1 acre conventional plot. The trend was similar in the rest of the focal areas with CA plots registering a measure of success far above the conventional plot in respect to yields.

The short rains experienced in Ngenia, Kalalu, Mathagiro and Nturukuma have delayed the harvesting of the long rains crop. For estimated gross margin, see Table 4 and Annex 2.

Table 4: Demonstration plots monitored for the 2008 growing rains (March-October)

<table>
<thead>
<tr>
<th>Focal area</th>
<th>Farmers</th>
<th>size (acre)</th>
<th>CA treatment</th>
<th>Crops</th>
<th>Grain yield (Kgs)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweetwaters</td>
<td>Jane Simon</td>
<td>0.25</td>
<td>Ripping and Mulching</td>
<td>Maize, Nil</td>
<td>Nil</td>
<td>Total crop failure</td>
</tr>
<tr>
<td></td>
<td>Alice Maina</td>
<td>0.25</td>
<td>Herbicide, ripping, shallow weeding</td>
<td>Tomatoes</td>
<td>1615</td>
<td>Irrigated the crop hence harvested</td>
</tr>
<tr>
<td></td>
<td>Peter Karwigi</td>
<td>1</td>
<td>Ripping</td>
<td>Maize</td>
<td>Nil</td>
<td>Total crop failure</td>
</tr>
<tr>
<td>Sirimon</td>
<td>Rose Guantai</td>
<td>2.5</td>
<td>Ripping, herbicide</td>
<td>Maize, beans</td>
<td>2,880</td>
<td>Harvested</td>
</tr>
<tr>
<td></td>
<td>Joseph Njeru</td>
<td>1</td>
<td>Ripping, herbicide</td>
<td>Garden peas</td>
<td>2,256</td>
<td>Irrigated and harvested</td>
</tr>
<tr>
<td></td>
<td>Joseph Maina</td>
<td>1</td>
<td>Ripping, herbicides, inter-row spray of Gramoxone</td>
<td>Maize</td>
<td>1,007</td>
<td>Harvested</td>
</tr>
<tr>
<td>Maili Saba</td>
<td>Joshua Muriungi</td>
<td>0.25</td>
<td>Ripping, herbicide, Shallow weeding</td>
<td>Maize, Beans</td>
<td>540</td>
<td>Harvested</td>
</tr>
<tr>
<td></td>
<td>Henry Mwiti</td>
<td>0.75</td>
<td>Ripping, herbicide</td>
<td>Maize</td>
<td>1440</td>
<td>Harvested</td>
</tr>
<tr>
<td></td>
<td>Stanley Muriuki</td>
<td>1</td>
<td>Ripping, herbicide</td>
<td>Maize</td>
<td>1231</td>
<td>Harvested</td>
</tr>
<tr>
<td></td>
<td>Francis Karobia</td>
<td>1</td>
<td>Ripping, herbicide</td>
<td>Wheat</td>
<td>640</td>
<td>Harvested</td>
</tr>
<tr>
<td></td>
<td>Esther Wamucii</td>
<td>1</td>
<td>Ripping, herbicide</td>
<td>Maize, beans</td>
<td>946</td>
<td>Harvested</td>
</tr>
<tr>
<td></td>
<td>Joseph Maina</td>
<td>1</td>
<td>Ripping, herbicide</td>
<td>Maize</td>
<td>900</td>
<td>Harvested</td>
</tr>
<tr>
<td></td>
<td>Silvester Kinyua</td>
<td>0.25</td>
<td>Ripping, herbicide</td>
<td>Maize</td>
<td>270</td>
<td>Harvested</td>
</tr>
</tbody>
</table>
For the short rains which started in October, we established five demonstration plots in Sweet waters and Njoguini. The rains started off well but later subsided considerably, with the current conditions, the performance of the five demo plots may not be as expected. The results are expected by the end of February 2009.

To provide a basis for assessing the impact and performance of CA and CPP demonstration plots, we have been monitoring and recording rainfall in the five focal areas since the beginning of the project. The monitoring is done by farmers who had been trained to read the rain gauges. Figure 1 shows a plot of the monthly rainfall data recorded in the five focal areas between December 2007 and November 2008.
Each of the five focal areas showed a different rainfall distribution pattern. This rainfall variability within this small region was also observed in 2007. Mathagiro area had the worst rainfall distribution followed by Sweetwaters thus explaining the crop failure in all the demos in these regions. In all five areas, April had very poor rainfall distribution which could have caused difficulties in crop establishment and which in some cases could have necessitated replanting.

Considering the long rains i.e. March to September, three areas: Ngenia, Sirimon and Maili Saba recorded over 350mm but poor monthly distribution. The other two areas had much less rainfall i.e. 252mm and 137mm for Sweetwaters and Sweet waters respectively.
4.4 **Up scaling CA and safe and efficient use of CPP to Makueni district**

We rolled out the Makueni component of the project in June 2008. A reconnaissance survey was carried out by the project team in June. The purpose of the survey was to familiarize with the farming situation in the district, identify and orient team member to this component, introduce the project to the relevant institutions in the District and mobilize farmers for training.

Following the reconnaissance survey, we undertook an inventory of 36 farmers self help groups with the aim of selecting representative farmer groups to work with. From the 36 groups, we selected 10 groups and started training them towards the end of August. The training lasted one month and was completed on 20th September 2008. 231 farmers benefited from the training (See annex 5).

The project has been mainstreamed by the ministry and one field officer has been attached to the project. This collaboration will expose the project to other stakeholders that work together with the ministry of Agriculture.

For the training, the modules developed in Laikipia were modified to suit the situation in Makueni. The training follows the new strategy which consists of three parts: a theory class, on farm demonstration and exchange visit. The training content covered:

- Principles of Conservation Agriculture (permanent cover, minimum soil disturbance and crop rotations)
- Weed management
- Manure management - composting and application
- Farming as a business - Kilimo Biashara
- Aflatoxins and agronomy - seed selection, planting depth and crop husbandry

Table 5 lists the groups trained in the five cluster areas and the number of farmer trained in each cluster.

*Table 5: Self help group trained in CA and CPP practices in Makueni District*

<table>
<thead>
<tr>
<th>Date</th>
<th>Cluster area</th>
<th>Groups Name</th>
<th>No. of Farmers</th>
</tr>
</thead>
<tbody>
<tr>
<td>25-26 Aug</td>
<td>Itumbule</td>
<td>1. Wikwayo wa Itumbule</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Taa Wa Aimi</td>
<td></td>
</tr>
<tr>
<td>27-28 Aug</td>
<td>Miangene</td>
<td>1. Mutethya women group</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Miangene Women group</td>
<td></td>
</tr>
<tr>
<td>29-30th Aug</td>
<td>Mathangathi</td>
<td>1. Ndulumoni SHG</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Kandulyu SHG</td>
<td></td>
</tr>
<tr>
<td>1-2nd Sep</td>
<td>Kwa- Kavisi</td>
<td>1. Ngomano/Kasayani</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Kasau ka King’ang’i</td>
<td></td>
</tr>
<tr>
<td>3-4th Sep</td>
<td>Kanzokea</td>
<td>1. Kanzokea Melon growers</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Kaola ukya</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>231</strong></td>
</tr>
</tbody>
</table>
One of the ToT from Laikipia Project, was brought in during the second week of training to share his experiences and train on some of the practical aspects of the project. We adopted this approach to make the training more farmers friendly.

To facilitate and strengthen the project we bought and distributed 10 sub soilers and 10 jab planters. Each of the 10 group received a sub Soiler and a jab planter.

Just as is the case in Laikipia project, we also set up demonstration plots to enhance the technology uptake. We established a total of 10 plots; all cropped with Duma 43 and DH 2 maize varieties. Six plots totally failed due to rainfall failure but it should be noted that farmers have noted a significant difference between the CA demonstration plots and the conventionally tilled farms. A specific case worth mentioning is of a farmer who took care one of the demo plots. Initially he tended the plot with the usual skepticism of any farmer being initiated into conservation tillage, but by the fourth week of the crop he swore to sell his plough and replace it with a sub Soiler. Over the short period in which the project has been active in Mwingi district, we have managed to:

- Bring the experience of the Laikipia farmers on CA and CPP to Makueni
- Demonstrate how small holder farmers with limited tools and resources can implement CA and CPP
- Highlight to Makueni farmers the critical aspects on CA and CPP including identification and removal of hard pans
- Train oxen to transform from use of ploughs to rippers
- To enhance Makueni farmers participation in the project by bringing a farmer trainer who is at their level.

4.5 Sharing of the knowledge and experiences gained with farmers and stakeholders

As in 2007, sharing of knowledge and experiences was integrated in to the training program. Initially, when the project was being conceived, sharing of knowledge and experiences was planned to take place at the end of each season through field days. However, since 2007, it became obvious that we could not separate sharing of knowledge and experiences with training i.e. Objective 2.

During the development of the 2008 project work plan, field days and exchange visits were planned to take place throughout the year. We attended six field days, some of them organized by other stakeholders in the District. Field days provided a platform for sharing ideas, knowledge and experiences gained in the season to farmers and other stakeholders in the focal areas. These have also become the best forums to train farmers. We ensured that all the field days were held on selected demonstration plot where farmers can see CA technology and CPP in practice. (See table 2 for details)

To facilitate farmer to farmer exchange of ideas, knowledge and experiences gained during the season, we organized ten exchange visits which benefited over 100 farmers in the project area.
5. Complementary Activities

5.1 Fodder and livestock improvement

In 2007, we introduced fodder trees in the project area to reduce the demand for crop residue as fodder. The aim was to reduce competition for mulch material for fodder, which would subsequently enable farmers to use mulch for CA. However, due to prolonged dry spells in 2007, most of the fodder tree seedlings that had been transplanted dried up. Following our experiences in 2007 and after talking to the farmers, we realized that was a viable solution to the problem of limited mulching materials for the CA plots and hence decided to revive this activity.

All the farmers who had been involved in the project in 2007 are planning to replant their fodder trees. To address the problem of prolonged dry spells, we identified three species of fodder shrubs that can do well under dry weather conditions and which will be introduced in the study area.

These species include *Gliricidia sepium*, *Luceana Divestifolia* and *Calliandria calothrysus*. *Gliricidia sepium* is known as the fertilizer tree or tree of life in Africa. It rapidly grows back after pruning, it replenishes soil nutrients and increases soil organic matter and improves degraded land. It can be used as fodder, as firewood, as hedge and as a source of medicine. *Luceana Divestifolia* is good for fodder and also for fixing nitrogen in the soil.

5.2 Manure management

Manure management has been a major challenge in the project area. Farmers are not consistent in covering their manure so as to minimize nitrogen and phosphorous losses. Another problem is that of water logging in the decomposition pits leading to nutrient leaching in the rain season. Farmers end up spending a lot of money to purchase inorganic fertilizers since their own manure is of poor quality. To address this problem, we incorporated aspects of manure management in the training modules since 2007.

This year, we restructured the manure management aspects of the training and added materials on composting. This entails use of materials of high nutrients values to produce compost manure. The materials used for composting include crop residual, trees and fodder shrubs.

We are planning to collaborate with Kisima farm to introduce liquid manure production to small holder farmers. Liquid manure has a high nutritive value. Kisima farm has a model earth worm breeding system and has agreed to train small holder farmers in the project area on earth worm breeding and liquid manure production. Training is scheduled to start early 2009.

5.3 Scythe Fabrication

The scythe was introduced to the project area in 2007 to help in the control of weeds in CA fields and the management of pastures. The tool has been well accepted by farmers
within the project area. We have tried to fabricate this tool to ensure their availability to farmers but this has not worked as expected. One fabricator tried his best but the quality of the metal used was not the right one hence the scythe fabricated could not perform as well as the original. It seems that the metal used to fabricate the original scythe is a special one, being light but durable.

To ensure the tool’s in use by every farmer in need, we generated, together with the farmers an agreement where one is allowed to use it for a day and pay one hundred shillings for maintenance until we are able to come up with more.

5.4 Stakeholders forum

Institutions and individuals with development and farming interests in Laikipia East have formed a forum commonly referred to as LACODEV (Laikipia East Community Development) stakeholders’ forum. The aim of the forum is to harmonise development activities to avoid duplication of efforts and benefit from synergies. Within the CA and CPP project, we collaborate with LACODEV in field days, exhibitions and seminars. As shown on Annex 3, in 2008, we worked hand in hand with 10 stake holders.

5.5 Project monitoring and evaluation missions

There were a number of monitoring and evaluation missions to the project in the course of the year. These are briefly discussed below.

- In May, a team from the Syngenta Global Stewardship department and Syngenta East Africa visited the project for end of the year (2007) assessment. The outcome of this major assessment mission can be summarized in three ways i.e.
  
  a. What was good about the project: (1) Integration of CA and CPP had a significant impact on participating farmers. It would have been difficult to promote CA and Water Conservation without understanding the value and need for CPP, (2) The project benefits were cascading to neighboring farmers and there was evidence that more farmers were starting to adopt the practices, (3) The farmers in the project were able to quantify the benefits they were getting from the project, (4) The youth were getting interested and becoming motivated to do agriculture, (5) The farmers were able to reinvest their profits in other forms i.e. education, increasing areas under production and engaging in alternative enterprises and (6) There was a gradual reduction in manual labour
  
  b. What needed to be done differently: (1) It was necessary to change the mindsets of some farmers so as to be able to see the economic benefits of CA and the project as a whole on their farms, (2) It was necessary to develop an approach to break the dependency syndrome from the farmers, (3) It was necessary to increase the capacity building of the TOTs and facilitating the dissemination of project benefits through them, (4) It was necessary to linking fabricators of implements to stockists, (5) It was necessary to train farmers on sound financial management, (6) Syngenta was to avail small packs of agrochemicals so as to enable small scale farmers to access them easily, especially for the herbicides and further enhance the availability of both
selective and non-selective herbicides and (7) In the more arid areas, techniques were to be developed for water harvesting, storage and irrigation.

c. What was difficult: (1) Lack of good rainfall was having a significant impact on the success of the project. The benefits of the project in some areas were not quite visible due to the very poor rainfall in two years, which severe limited adoption, (2) Farmers were still over dependent, (3) There was a poor reputation of former CA projects in some areas which made some farmers to be resistant the technology, (4) In some areas there was a belief that CA was an alien concept in contradiction to traditional belief, (5) Availability of power for CA equipment was a challenge in some areas and (6) Farmers needed time to understand that the benefits of CA would take time to be fully realized.

- In June Roose Shanti from Syngenta AG visited the project to see the benefits of Syngenta East Africa’s UWEZO (small packs) strategy and also to see the benefits of the CA project.

- In July Cristianne Close from Syngenta Foundation visited the project to assessing the possibilities and modalities of out scaling the project benefits to other Districts within the country.

- Lastly in August, Rose Goslinga from Syngenta Foundation visited the project to explore the possibilities of introducing drought insurance for small holder farmers in the project area.

All these missions had a chance to go to the field and meet with the beneficiaries of the project.

6. **Important observations**

As regards Laikipia district, the following observations should be noted:

**Waste disposal pits** – Farmers have taken up the idea of disposing herbicides containers in disposal pits but the question of the sustainability of these pits has cropped up. The pits proposed only measures 3× 3 × 3 feet and they may fill up within a short period. With so much farm work to do and lack of alternative measures, the farmers may easily revert back to unsafe methods of disposal. To solve this problem, the idea of building community incinerators has been raised. After consultation with farmers, suggestions have been made to construct one incinerator in each of the five focal areas to be used by all farmers in the area. Once or twice in a year, farmers would empty their disposal pits and destroy the containers in the community incinerators.

**Water harvesting pans** – Although CA is a water conservation technology, the study areas is a very dry and in the event of a severe dry spell, even the farmers practicing CA will experience crop failure. However, over the severe dry spell experienced in the last two years, we observed that some farmers were able to avoid complete crop failure by supplementing rainfall using water harvested in water pans. Having noticed the difference the water pan can make, there is a big interest to integrate them into the project. This fits within the overall principle of conservation.
agriculture i.e. a holistic and integrated farming system. Again, water pans can also be used for other purpose including livestock watering and small scale fish production.

One problem with water pans in the area is that of water seepage. Some farmers are using polythene lining on the pan but in some cases, this has resulted in high evaporation losses since the liners are black and therefore absorb heat. A more practical solution is to seal the floor and wall of the water pan using stone slabs and concrete. This is practical in this since the materials and skills required are available locally. Compared to liners, the solution will also last for a long time and will cost less to maintain.

**Planting equipments** – After the first year of the project, we observed that although the awareness on CA technology had increased, its adoption was being limited by the lack of equipments. In response, we provided farmers with rippers and jab planters. This has since accelerated to uptake of the technology. So far, the use of Jap Planters has increased to the point that the demand has encouraged a local stockiest to stock them. Jap Planters are however effective for planting maize and for other crops such as wheat, different planting equipment is required.

An appropriate solution is the Fitarelli direct planter which can use different seed discs depending on the size of the seeds to be planted. It also can be adjusted to reduce or increase spacing and subsequently reduce the cropping density. The planter is also animal driven.

Currently there are two Fitarelli planters in the project area, one is owned by a farmer's group and the other is provided by the Ministry of Agriculture. The area served by the two planters is big and we feel that availability of more such planters would facilitate a more rapid uptake of the technology.

Additionally, as awareness on CA increase, it would be appropriate to consider other machinery such as hand drawn tractors and boom sprayers. Hand drawn tractors would be more appropriates in the areas where animal power is limited.

**Bio-gas production** – Our manure management training helps farmers preserve manure in the most efficient manner. We train farmers on how to avoid nutrient loss through exposure of manure to sunshine and use of decomposing pits for quality manure.

Our observation during the last two years is that farmers who started implementing the manure management skills have encountered hitches. The decomposing pits are water logged during rainy season, which interferes with the decomposing process. One solution would be to integrate bio-gas production where the farmer gets both cooking gas and quality manure. A simple “Do it Yourself” bio digester will cost the farmer Kshs 10,000 including labour.

**Need for more CPP training** - A survey carried out in September showed that despite the trainings that had been done, farmers still face many crop protection issues. Specifically, farmers identified the need for skills to identify pests and control them (See annex 7 for details on the questionnaire and analysis done).
Further analyses were done to identify the particular aspects that the farmers felt should be given emphasis. These areas will be addressed in future training.

**Use of visual aids in the training** – One of the big challenge facing farmers is that of effectively controlling pests and diseases in their farms. This has limited the benefit they could draw from CA technology. Teaching them about pests and diseases theoretically has also been an uphill task. To solve this problem, photos of common pests and diseases in the district were taken and incorporated into the CPP trainings modules. This helped farmer to easily understand and learn faster. A whole database of the common pests and diseases in the district is now available and can be used to disseminate information in the Stewardship websites.

As regards Makueni district, the following observations should be noted:

**Animal power and equipment** - Though most farmers have oxen, their animals need training. Sub soiling is difficult and requires strong and well trained bulls. The oxen in the project area are used to ploughing to a depth of 3 inches whereas sub soiling goes four times deeper i.e. 12 inches. Therefore, just as in Laikipia, there is a need for a thorough training for both the animals and the people guiding the animals.

**Problem with termites and squirrels** – Unlike in Laikipia were termites are not a major challenge, in Makueni, use of mulching attracts termites and may poses a serious problem since there will be a concentration of termites in the CA plots. Another problem in the area is that of squirrels which dig up the seeds immediately after sowing.

**Literacy levels** - Most farmers in the area have a low literacy level, meaning more time is required to undertake training.
7. Annexes

Annex 1: Farmers Training Modules

Annex 2: Gross Margin Analysis for Conservation Agriculture

Annex 3: Project Partners and Collaborating Stake holders

Annex 4: Programme

Annex 5: Farmers Trained on CA and CPP in Laikipia and Makueni District

Annex 6: CA and Stewardship Award Scheme

Annex 7: 2009 Activity Plan
Annex 1
Module 1 - Production challenges in dry environments

1.1 Introduction
• Arid and semi arid environments cover over 80% of the Kenya land areas. Most of the Population in these areas depends on agriculture for their livelihood.
• Despite this dependency on agriculture, farming in these areas is major challenge, mainly due to unfavorable rainfall, high temperatures and evaporation losses and soil mining (continuous cultivation without use of manure or fertilizers).
• If farmers in these areas have to be food secure, they need to use appropriate farming methods.

1.2 Challenges facing small holder crop production in arid and semi arid environment
• Hostile production environment (bio-physical and social economic)
• Low input continuous cultivation => heavy pressure on soil and water resources
• Increasing population and food demand (immigration from surrounding high potential areas) => expansion of cultivation to more marginal areas
• Limited knowledge of impacts of land use on natural resources and lack of tools to assess and demonstrate options for improving land productivity

1.3 Farming environment in the study area (Laikipia East)
• Laikipia East is on the leeward (rain shadow) side of Mount Kenya.
• There are two distinct zones in terms of rainfall distribution, i.e. an area with two rather short and distinct rainy seasons (Sweet waters) and an area with one extended rainy season (Kalalu, Ngenia and Mathagiro).
• Rainfall is not very low (averages 650mm per annum) but its distribution is very unreliable. The onset can delay by up to 2 months while in some seasons there is not clear onset.
• In general, unfavorable rainfall is the single most important factor limiting crop production.
1.4 Why CA has a potential in arid and semi-arid areas (the case of Laikipia East)

- Although seasonal rainfall distribution is unreliable, the annual amount averages 650mm. This amount is adequate to grow a maize crop if well conserved.

- The deep clay soils in the area have a very good potential for storing rain water. By the end of the rain season, these soils can store up to 250mm within the maize rooting depth.

- Long term research show that between 65% and 76% of the rainfall received is lost as evaporation. This can be easily be controlled through CA hence increasing drastically the productive potential of the area.

- Trails by farmers for over five years have provided consistent evidence that despite the fact that this area is a marginal areas, CA has the potential to enable the farmers to be food secure and even enable them generate income from their farms.
2.1 What is Conservation Agriculture?

- Conservation Agriculture (CA) is the simultaneous practice of **permanent soil cover**, **minimal soil disturbance** and **crop rotations/associations**.

- It takes time for a farmer to establish a complete CA system. Farmer can enter into this system through any of the three areas. In many cases, the entry may be that of changing tillage so that there is minimum soil disturbance. System mainly emphasizing tillage may be referred to as conservation tillage (CT). In the long run, a well established CA system will have well developed aspects the three components of CA.
- Show photographs of CA systems.

2.2 Benefits of CA

- **Health soil**: Your soil will become more fertile. It will be richer in organic matter, and more earthworms and other soil life. That means healthy crops and higher yields.
- **More water**: A healthy soil with good amount of organic matter and good physical structure will both take in more water and also hold the water for a longer period. That means better yields in dry seasons and high yields in the average and good seasons.
- **Less water and wind erosion**: CA helps develop a good and continuous soil cover which prevents water and wind erosion. This ensures long term sustainability of the farming enterprise.
- **Low fertilizer and herbicide application**: A healthier soil means a healthier crop and subsequently low fertilizer and herbicide application. This leads to a cleaner and safer environment.
- **More income**: Higher yields while using fewer or less inputs leads to more income for the farmers. Due to the enhanced productive capacity of the land, your fields may also
produce more products e.g. fodder shrubs, cover crop, firewood which you can use or sell. Examples are fodder shrub and cover crop seeds, firewood and forage

• **Less labour**: CA is not labour intensive. Reduction in labour can be as much as 50% compared to conventional farming practice. You have more time that you can use in other ways such as running a business, taking better care of your livestock, etc.

• **Self enhancing**: CA is a self enhancing system with the benefits accelerating with time. It is also a holistic farming approach which seeks to address the whole system i.e. integrating livestock and crop production.

### 2.3 The three key principles CA

- **Permanent soils cover**: CA practice should ensure a permanent soil cover. This is achieved using mulch (previous crop residue or imported from outside the farm) and cover crops. Even during fallow periods, a CA practices should ensure a good soil cover.

- **Minimal soil disturbance**: CA practice should ensure minimum soil disturbance either by avoiding tillage completely or by undertaking minimum tillage mainly to prepare the seed bed.

- **Crop rotations and associations**: CA practice should encourage crop rotation and association to minimize crop pests and take advantage of other crop rotation benefits such as nitrogen fixation by legumes. Crop rotation and associations can be achieved through a variety of approaches including intercropping and sequencing.

### Photos

| Permanent cover | Permanent soil cover (mulch, cover crop)  
|                 | Different varieties of cover crops  
|                 | Direct soil evaporation on a bare soil  |
| Minimum soil disturbance | Photos of mould board plough vs ripper  
|                         | Ripping in progress  
|                         | Ripped vs ploughed plot  
|                         | Direct seeding in large scale farms  |
| Crop rotation & association | Photo / Diagram of healthy soil – good cover, deep soil layer, good soil structure, micro-organisms, etc  
|                         | Fodder shrubs – different varieties  |

**2.4 CA practice in summary**

- **Step 1- Preparing the land**

  => Like any other tillage method, CA starts with land preparation. CA generally discourages any form of mechanical land preparation such as use of ploughs. This ensures minimum soil disturbance hence conserving soil moisture. Land preparation therefore involves cutting down of after harvest to ensure weeds don’t produce seeds in the field and use of herbicide to control remaining weeds or weeds that may emerge after
harvesting. Glyphosates such as Touchdown are used after harvest and at the onset of the rains.

- **Step 2 – Preparing the seed bed and planting**
  => After land preparation, the next step is preparing the planting seed bed. For smallholders, the seed bed can be prepared with a ripper or by hand using a hoe. This helps to enhance water infiltration. In case of hard crust farmers can use a sub Soiler to break the hard pan.

- **Step 3 - Planting**
  => After land preparation and ripping, the next step is planting. Farmers can use different kind of equipment including hand used equipment such as Jembe, panga or Jab planter or animal drawn equipment such as direct planter or mechanized equipment such as direct seeder. The Jab planter is hand held but is more efficient than Jembe or Panga and it also allows application of fertilizer at the same time as planting is being done. The direct planter is pulled by an ox and also allows application of fertilizer at planting. The direct seeded is pulled by a tractor and allows seeds and fertilizer to be drills directly to the soil with the land being ripped first. This is the planting method under zero tillage.

- **Step 4 – Controlling weeds**
  => To control weeds, shallow weeding is recommended. Emerging weeds can be controlled using Gramoxone. To apply between crop rows, a shield is used to prevent drifting of the chemical to the crops. Mulch cover also controls weeds very effectively. On mulched soil, emerging weeds can also be controlled by uprooting. Weeds should be uprooted before they produce seeds. A Panga or Scythe can also be used to slash weeds before they produce seeds. It good practice to leave slashed or uprooted weeds on the plot to provide mulch.

- **Step 5 – Harvesting**
  => Once the crop is ready, the farmer can harvest leaving as much material on the plot as possible.
2.5 Converting from conventional tillage to CA (Laikipia Situation)

Step 1: Plant fodder shrubs (Calliandra, Sesbania, and Trichandra)
=> Many farmers need to user crop residue for fodder and therefore can not leave this material on farm as mulch. To address this problem, plant 500 fodder shrub trees per cow per year. See a pamphlet by ICRAF entitled “Plant fodder shrubs for more milk and cash”.
=> When the fodder shrubs are well established, you will not have to import mulch into your shamba. You then feed the fodder shrubs to your animals and only harvest 50% or less of the stalks for fodder. The rest will be available to mulch your plot.

Step 2: Start by mulching one part of your shamba
=> It may not be possible to appreciate the impact of mulching until you try. Start by mulching one part of your shamba to see for your self the benefits of mulching. If you bring mulch material from outside the farm, ensure the mulch does not introduce seed into the soil. If the season is okay, the mulched part will give you more biomass. Leave at least 50% of the biomass as mulch.
=> Apply manure from the livestock to your plot and ensure that the mulch covers the manure and soil. Under this environment, soil micro and macro organisms can do the work of converting mulch and manure into nutrients. Next season your soil will be already fertilized and ready for planting.

Step 3: Convert the mulched plot into CA
=> Prepare the land using the available technology. If possible, use a ripper to rip the soil and improve infiltration. If you have a hard pan, use a sub Soiler to break up the pan. You can hire a ripper from the neighborhood.
=> If you have a hard crust on your plot, which inhibits water from infiltration, consider ripping it with a Magoye Ripper. If you do not have a Magoye Ripper, try to find out who provides this service in your area or see the box on the bottom of this pamphlet.
=> Planting by hand using a Jembe or Panga or use a “Jab Planter” “5. Planting using a Jap Planter makes it easy to plant. You can also hire a Fitarelli direct planter by hiring the service from farmers in the neighborhood who may have the equipment.
=> If the plot is well mulched, the weeds are well controlled. The weeds that come up can be controlled by uprooting them. The weeds should be uprooted in their vegetative phase before they form seed. This will help to reduce the seed bank in the soil. The scythe is a very efficient tool to slash weeds before they produce seeds. Leave the slashed or uprooted weeds on the plot as mulch.

Step 4: Convert the rest of your shamba step by step
=> As you gain experience with CA, target and convert the rest of your shamba part by part.

2.6 Crop rotation and association
• Crop rotation and association is one of the three principles of CA. Crop rotation and associations minimize crop pests and take advantage of other crop rotation benefit such
as nitrogen fixation by legumes. Crop rotation and associations can be achieved through a variety of approaches including intercropping and sequencing. Crop rotation and association also improves the soil structure and fertility.

- Crop rotation means changing the type of crops grown in a field each season – for example, planting maize one season and beans the next.
- Figure below shows a simplified hypothetical 4 years crop rotation. A crop rotation system should be well planned to meet the needs of the farmer, both in terms of yields, soil protection and improvements and pest and disease control.

The crop rotation system may include intercropping where two or more crops are planned in the same field in the same season. Intercropped crops may be mixed or planted on alternate rows.

(See pictures on crop rotation, associations and inter cropping)

2.7 Advantages of crop rotation

- **Improves soil structure**: Different crops have different rooting systems. While some may help improve the soil structure, others may not. To improve the soil structure, it is important to rotate crops and not to grow the same crop season after season. Overall, crop rotation helps aerate the soil and recycles nutrients.

- **Improves soil fertility**: Legumes (such as beans, peas, Calliandra, Sesbania and Trichandra) fix nitrogen in the soil. This nitrogen can be used by other crops such as maize or Napier grass in subsequent seasons resulting in higher, more stable yields.

- **Destroys weeds, pests and diseases**: Crop rotation minimizes the chances of a crop being invaded by weeds, pests and diseases because it breaks the life cycle of the weeds and pests. This can easily happen where the same crop is planned on the same field season after season.

- **Gives more products and higher yields**: Crop rotation helps the farmer produce more crops (grain, beans, vegetables and fodder) and helps increase yields. Some of these can be sold for income.

- **Reduces risk**: A single crop may fail because of drought, may be attacked by pests or may fetch a low price in the market. Producing several different crops reduces these risks.
Enhances soil cover: Well planned crop rotation ensures that there is biomass and permanent soil cover (See Figure below).

2.8 Selecting the right crops and varieties
- CA advocates a holistic approach where the farmer gradually moves towards self sufficiency. Farmers should select a good number of crops to produce to meet their specific individual needs but which are appropriate to the farmer’s physical (climate/soils), economic and cultural environment.
- For the selected crops, farmers should try different varieties to reduce the risk of failure. For example, different maize varieties have different resistances to drought, pests and diseases. In case of a drought or disease out break, the resistant variety will survive.

2.9 List of suitable crops for Laikipia East
- For starch:
  1. Maize (*Zea mays*)
  2. Potatoes (*Solanum tuberosum*)
  3. Wheat (*Triticum aestivum*)
  4. Sweet potatoes (*Ipomoea batatas*)
  5. Cassava (*Manihot esculenta*)
  6. Sorghum (*Sorghum bicolor*)
  7. Grain Amaranth (*Amaranthus* spp.)
  8. Quinoa (*Chenopodium quinoa*)
- For protein:
  1. common bean (*Phaseolus vulgaris*)
  2. Chick pea (*Cicer arietinum*)
  3. Pigeon Pea (*Cajanus cajan*)
  4. Groundnut (*Arachis hypogaea*)
  5. Cow pea, black eye bean (*Vigna unguiculata* cv. group Unguiculata)
  6. Green gram (*Vigna radiata*)
  7. Lima bean, Sieva bean (*Phaseolus lunatus*)
- For oil
1. Sunflower (Helianthus annuus)
2. Indian mustard (Brassica juncea)
3. Safflower (Carthamus tinctorius)
4. Sesame (Sesamum orientale)
5. Nigerseed, Nook (Guizotia abyssinica)

• For vegetables
1. Broccoli (Brassica oleracea var italica)
2. Brussel Sprouts (Brassica oleracea var gemmifera)
3. Sweet pepper (Capsicum)
4. Carrots (Caucus carotal)
5. Chillies of Hot Peppers (Capsicum annum)
6. Kales (Brassica oleracea var acephala)
7. Leeks (Allium porrum)
8. Onions (Allium cepa)
9. Tomatoes (Lycopersicon esculentum)
10. Sunflower (Helianthus annuus)
11. Amaranth (Amaranthus spp.)
12. Headed cabbage (Brassica oleracea cv. groups White and Red Headed Cabbage)
13. Pumpkin, Squash (Cucurbita spp.)

• For fruits
1. Avocado (Persea americana)
2. Guava (Psidium guyava)
3. Mulberry (Morus)
4. Passion fruits (Passiflora edulis)
5. Pawpaw (Carica papaya)
6. Mango tree (Mangifera indica)
7. Pineapple (Ananas comosus)
8. Watermelon (Citrullus lanatus)

• For spices:
1. Chilli, Pilipili (Capsicum spp.)
2. Garlic (Allium sativum)
3. Coriander (Coriandrum sativum)

• For fodder
1. Calliandra (Calliandra calothyrsus)
2. Sesbania (Sesbania sesban)
3. Tricandra (Leucaena tricandra)
4. Leuceana (Leucaena leucocephala)
5. Desmodium (Desmodium uncinatum and intortum)
6. Guatemala Grass (Tripsacum laxum)
7. Mulberry (Morus spp.)
8. Lablab (Lablab purpureus)
9. Tithonia (Tithonia diversifolia) – high Nitrogen content, thus good for composting

• For cash
1. Artemisia (Artemisia annua)
Module 3 - Farm Recording Keeping

3.1 Introduction

- Farmers should approach farming as a business but not as a culture. Today, profitable farming will need inputs from outside which will cost the farmer money. It is therefore important that the farmers keeps a good record of inputs and outputs and make assessment where their farming is profitable or not.

- Record keeping helps the farmer to:
  => Track inputs, outputs, assess profitability and make the right decisions
  => Learn, compare and contrast traditional and new methods and make the right changes
  => Track change and the improvements being made

- Record keeping generally involves recording of inputs and outputs.

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Seeds (what kind, price)</td>
<td>• Production (yield per crop, yield per plot, in case of IC yield per kind of crop and combined yields)</td>
</tr>
<tr>
<td>• Fertilizer and manure (what kind, what crop, what plot, amount, price)</td>
<td>• Home consumption (put a monetary value on it – what you would have gained in case of actual market prices)</td>
</tr>
<tr>
<td>• Crop protection (what kind, what crop, what plot, date and time of application, what was the weather like, amount, price)</td>
<td>• Sales made</td>
</tr>
<tr>
<td>• Labour- hours of work put (all production related activities should be included).</td>
<td></td>
</tr>
</tbody>
</table>

- The ultimate goal for keeping records is to assess if farming (called out in the way the farmer is currently doing) is profit. Profitability is calculated my subtracting inputs from outputs.

- Assessing whether the farming is profitable helps the farmer make decision on what to change. The record helps the farmer to know what they can increase or reduce.

- Using these records, farmers can discuss and learn from each other therefore move towards profitable farming.
3.2 Sample record keeping card

<table>
<thead>
<tr>
<th>Date</th>
<th>Description of activity/purchase</th>
<th><strong>Input</strong> (seed, fertilizer, crop protection, labour, etc)</th>
<th><strong>Output</strong> (including all pre-harvest sales / consumption)</th>
<th>Detailed comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Amount</td>
<td>Cost (Kshs)</td>
<td>Amount</td>
</tr>
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</tr>
</tbody>
</table>

3.3 Record keeping in practice

- Although farmers are encouraged to keep records of their farming business and even sometimes provided with record keeping books, they generally tend to trust their God given recording tool – their head.
- While it is true that farmers keep records very well this way, it is also true that this approach can not help them make serious assessment of their farming investments.
- It is important to encourage farmers to move from general observation to serious record keeping. This will only happen if record keeping easily integrates in to the farming work and is not tedious.
3.4 Enhancing record keeping among small holder farmers

- Majority of small holder farmers may not be keen to keep research kind of record books. Although some farmers can be very meticulous with their records, most farmers trust their heads. These farmers should be encouraged to simple record sheets.

- Farmers can be encouraged to adapt the record sheet to their work habits. It is unlikely that farmers will record things on a daily basis. Farmers could mark activities on a general calendar and transfer this information in to the actually record sheet once a week or once a month.

3.5 Using records to assess and plan

- Farmers will more likely keep records if they can easily use the records to assess their performance and better plan coming seasons.

- Farmers should be encouraged to use their records to compare their different plots / crops / trial at the end of the seasons.

- Farmers should also be encouraged to use this assessment to make changes in their way of farming and also better plan coming seasons.

- Farmers should also get together and using their records, discuss and exchange ideas between themselves.
Module 4 - Manure Management

4.1 Introduction

- Plants macronutrients are Nitrogen (N), Phosphorus (P) and Potassium (K) i.e. NPK. Those elements are essential for normal plant growth. N is mainly found in urea of cows, goats and sheep. P and K are found in the dung of cows, goats and sheep.
- N is very volatile – if urea or slurry is exposed to direct sunshine and heat, the N will evaporate and will not be available to plant. P can be fixed on to soil particles when soil pH is low. K can be washed out when rainfall is ample and intensive. It is therefore crucial to protect Urea / Slurry / Manure / Compost from direct sunshine.
- Benefits of manure manage includes saving on mineral fertilizer cost, healthier soil with high biological activity, higher crop yields and cleaner environment through minimal use of fertilizer and reduce soil erosion through better soil structure.
- The manure management module is about how to preserve N and how to produce high quality manure-compost.

4.2 Manure Management - Storage using earth pits

- **Step 1**: Dig 3 holes at the side of your cattle-shed. Keep the soil from those holes close to the pit, because you are going to need it later. The holes are 2 feet (0.6 m) deep and 4 feet (1.2 m) wide and the length of the holes is chosen according to the number of cattle you have and the amount of feed they get i.e. 2 feet per cow. If space is limited, you can increase the depth of the holes.
  
  ![Arrangements of Manure Pits. Leave a space of 2.5 feet between pits and plant grass on the space for stability and erosion control. Never leave the bottom of an empty pit bare, always cover with mulch.]

- **Step 2**: Every morning, before the sun shines on the cattle-shed, collect the manure with a shovel and throw it into pit nr. 1. This daily work is the reason why the holes are close to the shed. You can as well add organic kitchen waste and ash to pit. Never throw in plastic paper bags and such.
- **Step 3**: After having cleaned the shed, cover and protect the manure in the pit with a slim soil layer and with mulch (leaves of Calliandra, Tricandria, Sesbania, Grevillea, maize stover, bean stalks and such). The mulch cover is protecting the manure, preventing the nitrogen from evaporating and it is increasing the biomass and the quality of the manure. You can facilitate your daily work in collecting mulch material and keeping it in a bag aside the pit.
- **Step 4**: After 3 to 4 weeks transfer the manure from pit 1 to pit 2. If there is no rainfall, irrigate the layers. This is important for the process of decomposition. The
manure-compost should be moist not wet. In a dry spell, sprinkle 20 liters of water over the pit every 3 days.
• **Step 5**: After another 3 to 4 weeks, transfer the compost-manure from pit nr. 2 to pit nr. 3 and from pit nr. 1 to pit nr. 2, for further decomposition. The turning of the manure-compost enhances decomposition.

The “thermometer” stick in the compost helps you to control the decomposition process. After 3 days, the stick should be warm and moist. If it is cold, then there is no decomposition taking place. If the stick is whitish, you have to sprinkle water. The holes in the compost allow air to circulate in layers.

• **Step 6**: After again 3 to 4 weeks you can apply the Manure-Compost from pit nr. 3 to your crops or to any kind of vegetation (Napier grass strip, trees, shrubs) and continue to shift again. As an option, you can plant fruit trees between the manure pits to capture nutrients, which might get washed out, if rainfall is ample. The trees also give shade to the holes and structure to the walls. Always cut roots that penetrate the walls.

**4.3 Manure Management - Application**

- The better the manure-compost is protected from direct sunshine, the more N is available to plants. Cover the manure-compost with mulch and on application, work the manure / compost into the soil.
- You can apply the manure / compost after harvesting. For example, if you had planted maize, harvest the main produce (maize cobs, bean pulses, etc.) and 50% of the stover (for your animals). Distribute the manure / compost evenly between the remaining rows then slash down the stalks of the remaining rows to produce a mulch cover.
After harvesting the main produce and 50% of the maize stover, apply the manure between the rows and then cover the manure by mulching with the remaining stover.

- You can also apply the manure/compost to your napier grass or fodder shrub hedge by making a furrow with a pointed jembe then distributing the manure/compost into the furrow and covering the furrow again with soil and mulch.
Module 5 - Weed Management

5.1 Introduction
- Weed management is an important aspect of crop production. Weeds reduce yields and can lead to total yield loss if not controlled.
- Under CA, the principle of minimum soil disturbance requires that farmers find ways to manage weeds without disturbing the soil. Initially, it is not possible to manage weeds without disturbing the soil. This is only achieved in the long run as the CA system stabilizes.

5.2 Weed management option under CA
- A number of weed control methods are available. The choice made depends on the farmer’s ecological and socio-economic condition. Attempt is made to reduce the weed seed bank in the soil by clearing weed before it bears new seed. The available weed management options includes:
  => Mechanical control through pulling, slashing and superficial weeding.
  => Chemical control through the use of herbicides.
  => Biological and cultural control through intensifying soil cover through mulching using previous crop residual and planting of green manures and cover crops. Also, farmers can increase crop density and nitrogen rates to attain a dense and strong crop and hence out-compete the weeds.
- A good weed management strategy should have a long term perspective and will combine different options.

5.3 Mechanical weed control in CA
- Mechanical weed control on CA includes pulling, slashing and shallow weeding. As the field was not ploughed, weeding has to start early. Shallow weeding can be done using a hoe or Panga. Some special attachments can be made to animal drawn rippers to modify them to weed.
- Timeliness of weeding is crucial in reducing competition with crops and preventing seed production.
- Evidence from research suggests that two weeding carried out 2 and 6 weeks after crop emergence is the ideal.
- If animals are to be used for weeding, crops have to be planted in rows with appropriate spacing.
- To prepare the land for planting, weeds can be controlled through slashing. Any plants growing in the field are slashed before making the basins (planting pits) or planting furrows (in animal power systems).

5.4 Biological and cultural weed control in CA
- Various biological and cultural means can be used to control weeds in CA. These methods include:
  => Crop rotation: A sound crop rotation system prevents the build up of noxious weed populations.
  => Seeding rates: Crop density is an important component of the crop’s ability to compete with weeds. If high seed rate is used as a means to control weeds, the farmer should ensure the soil is fertile or manure and fertilizer are used.
  => Intercropping: Intercropping can contribute to a faster and denser ground cover which will suppresses weed growth. Spreading and creeping type of crops such as pumpkins and cowpeas have a high capacity of suppressing weed growth.
Green manure and cover crop: Growing green manures or cover crops planted in the minor season or as a relay crop efficiently suppresses weed growth. Since this is a cost and labour efficient, green manures are sometime called the “herbicides” of small farmers. Perennial grasses such as (Imperata cylindrica, Cynodon dactylon) and weeds such as (Striga spp, Chromolaena odorata) can be controlled by growing green manure and cover crops in subsequent seasons.

5.5 Chemical weed control in CA
- Chemical weed control methods are covered in details in the modules on safe and efficient use of crop protection products developed for this project by Syngenta. Please refer to these modules.

5.6 Concerns about use of herbicides by small scale farmers
- One of the issues that need to be addressed when introducing CA to small holder farmers is their concerns about the use of herbicides. There are three areas of concern i.e. environment, cost and safe and efficient use.

=> Environment: Small holder farmers fear the use of herbicides because they feel that the use results in negative environmental impacts. However, if used safely, herbicides should not have negative environmental impacts. Most herbicides are formulated in a way that negative environmental impacts are minimized. Furthermore, through the use of herbicides, farmers can avoid using ploughs thereby eliminating environmental problems brought about by use of plough such as soil structure breakdown and erosion.

=> Cost: Use of herbicide has an economic advantage in terms of reduction of labour requirements which leads to reduction in production costs. On the other hand, chemical weed control cost depends on the costs of the herbicides, the cost of equipments used, the weed pressure, the required frequency of applications. In some case, a farmer may face herbicide resistance necessitating use of expensive formulation. Farmers’ strategies to reduce the costs of chemical weed control is to try to reduce the number of applications and the quantity of herbicides by used by combining chemical weed control with other weed control methods such as minimized mechanical control and biological and cultural control methods. Farmers can also limit herbicide use to spot application to kill noxious weeds. As the farmer CA system becomes established, the farmers drastically reduce frequency and application rates, as the weed pressure declines.

=> Safe and efficient use: One of the most challenging areas regarding small holders’ use of herbicides regards their safe and efficient use. Many small holders lack the knowledge and skill to use herbicides safely and efficiently. The rates used may be far above or below the recommended rate. The equipment used may not be well calibrated and the farmer may expose themselves to the chemical in an unhealthy way. The storage of the herbicides may also be dangerous. This area is well addressed in this project through the training modules focusing on safe and efficient use of crop protection products.

5.7 Combining different weed control methods in CA
- Conservation tillage does not necessarily mean use of herbicides. Although it is necessary to use herbicides as a farmer transits from conventional farming to CA, gradually, biological and cultural weed control methods play important roles in weed control.

- Innovation being made in improving safe and efficient use of CPP should be able to reach small holder farmers. For example, the “Weed Wipe” is a really simple tool that permits late application of Roundup in a maize crop. Such simple equipment can help the farmers use herbicides safely and efficiently.
• Farmers have also to learn that not all weeds are noxious and that weeding should be selective. Farmers should be trained to combine all possible methods of controlling weeds and use environmentally friendly herbicides.

**Module 6: Animal draught power**

Animal draught power is useful for small- and medium-scale farmers with limited income: those who cannot afford to buy or hire tractors. Draught animals can be used for many purposes: mowing, ploughing, weeding, harvesting, transportation and pumping water. Many types of animals have been used as draught animals, including cattle (or oxen), donkeys, mules, camels and horses.

Animal draught power is particularly useful for smallholder farmers who practice sustainable agriculture. The animals provide a good source of organic manure, and grass and tree fodder can be used to feed them. Using animal traction to prepare the land, and for weeding and other field work helps to avoid the compaction and physical destruction of the soil that can be caused by tractors.

**Advantages**

• Draught animals reduce the amount of physical labour and makes farming a more appealing occupation. It thus encourages farmers to stay on the farm and not to migrate to the towns.
• Replacing hoes with draught animals and equipment increases productivity. Farmers can double or triple the area cultivated, thereby increasing crop output at low cost.
• Animal draught power is not expensive. The animals and equipment are cheap compared to tractors. The investment can pay for itself in a few years.
• Animals compact the soil less than do tractors.
• The animals and equipment can be supplied locally, thereby creating less dependence on external resources.
• Draught animals do not require radical changes in cropping patterns or labour. Although they reduce labour needs in some field operations, the savings are not drastic, and labour can shift to other activities, such as planting, harvesting and caring for animals and harnesses.
• The use of animal draught-power can create work opportunities by stimulating the development of artisans, increasing jobs for local blacksmiths, carpenters and leather-makers who produce the equipment needed.
• Farmers can hire out their teams and equipment for transport, water-pumping and tillage.
Disadvantages

- Using draught animals is more labour-intensive than tractors.
- Although they are cheaper than tractors, the equipment and materials can still be too expensive for small-scale farmers.

Using donkeys for draught power in Kenya

Manor House Agriculture Centre, located in the Rift Valley province of Kenya, uses donkeys for animal power. It chose to work with donkeys for several reasons:

- Donkeys are more resistant than other species to many tropical diseases, such as those carried by ticks.
- Donkeys do not eat as much as ruminant species.
- Donkeys learn quickly; they can be trained in about 3–4 weeks.
- Both sexes of donkeys deliver equal amounts of power (females need a 6-month work rest during and after a pregnancy).
- A donkey can pull 25% of its body weight for 4 hours in the morning and 3 hours in the afternoon, for a total of 7 hours per day. Oxen can only pull 18% of their body-weight and only for 4–4.5 hours per day. Oxen need more time for chewing the cud to allow for proper digestion. So donkeys take less time to convert food into power.
- In arid and semi-arid areas, the cost of keeping oxen is often too high to make them a feasible source of farm power; donkeys are less costly to keep.
- Donkeys can work for as many as 30 years; oxen can work for only about 15. Since donkey meat is not valuable, there is no reason to slaughter them, so they live for a long time.
- Donkeys can usually be acquired from local markets at a lower cost than oxen and horses.

Requirements for a donkey harness

- Leather: for harness straps.
- Canvas cloth: for canvas pads. Since donkeys do not have natural padding to absorb the pressure of the equipment, yokes are not used. Rather, a collar harness is used to enable them to pull loads more comfortably and efficiently.
- Wood: for harness frames and hames.
- Ropes or chains: for the link between the animal and the load.

Training donkeys to work as draught animals

Young animals (about 2.5–3 years old) of either sex are the best age for easy training. Although they are more difficult to train and it takes longer, mature donkeys can also be trained to provide draught power. A young animal can be trained in 3–4 weeks; it takes 6 weeks to train a mature animal.
Over a period of a month or more, the owner should aim to develop friendship and a good working relationship with the animal. This would include feeding and providing water to the donkey, grooming it, leading the animal to shelter or to pasture, and other general care.

The training starts by having the animal wear a light harness and bridle for 2 hours in the morning and 2 hours in the afternoon. The farmer can train the donkey to take the bridle by opening its mouth with his fingers. The bridle has a rein which allows the farmer to train the animal to obey commands: steer, turn, stop, and move backwards. This training will take about 3 weeks, depending upon the trainer.

When the donkey reaches the age of 4 years, the animal can take on light duties, such as mowing and transporting light loads. Once the animal has reached the age of 5, the work can be gradually increased: for example, ploughing for 2 hours in the morning and 2 hours in the afternoon. Young draught animals should only do light duties because the animal’s body tissues are still growing and developing.

**Do’s**

- Provide adequate feed for the animal, especially grass, grains and grain by-products.
- Provide adequate water and salt to the animal. Draught animals need to replace water and minerals lost through sweating during work.
- Deworm the animal regularly, about every 3 months.
- Allow the animal adequate rest. Work the animal in the morning, then let it rest at least 4 hours during midday (you can give it feed during midday). You can work again in the afternoon for 3 more hours.
- Train the animal in the language that will be used by the owner.
- Provide adequate shelter for the animals.
- Trim the hooves regularly. Trim them at least twice during the rainy season. Do not trim them during the dry season as they may crack.
- Ensure proper harnessing to avoid health problems such as galls, wounds and burns which can reduce the animal’s performance.
- Although donkeys are hardy, they still require general grooming and should be kept in a clean environment. Treat diseases and wounds promptly.
- Use a cart rather than transporting loads on the animal’s back, as this can harm the animal.

**Don’ts**

- Don’t overwork the animal, as it may kick or become stubborn.
- Don’t work pregnant female donkeys for 3 months before and for 3 months after they give birth. This allows proper nutrition for the foal.
- Don’t mistreat the donkeys when harnessing, so that the animals begin to feel comfortable when performing their duties.
Annex 2: Gross Margin Analysis for Conservation Agriculture

Annex 2a - Henry Mwiti’s farm - 0.75 acre maize

<table>
<thead>
<tr>
<th>Category</th>
<th>Item description</th>
<th>Unit Cost</th>
<th>Amount Used</th>
<th>Total cost</th>
<th>Equivalent Hectare %</th>
</tr>
</thead>
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<td>a) Inputs</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>- Seeds</td>
<td>- 6 Kgs hybrid maize</td>
<td>200</td>
<td>6</td>
<td>1,200</td>
<td>3,954</td>
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<td>- 1 Kgs bean</td>
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<td>1</td>
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<td>20</td>
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<td>- Weeding - 1 man day</td>
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<td>2</td>
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<td>- Processing harvest - 4 man days</td>
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<td>4</td>
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<tr>
<td>b) Outputs</td>
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## Annex 2b - Joshua Muriungi farm - 0.25 acre Maize

<table>
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<th>Farmer's Name</th>
<th>Joshua Muriungi</th>
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<tr>
<td>Focal Area</td>
<td>Kalalu</td>
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<td>a) Inputs</td>
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<td>10.7</td>
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<td>300</td>
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### Annex 2c - Stanely Muruiki farm - 2.47 acres maize

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Annex 2d - Silvester Kinyua's farm - 0.125 acre maize and runner beans

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Small holder Conservation Agriculture in Kenya_2008
Annex 2e - Joseph Maina’s farm - 0.75 acres maize

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<th>Equivalent Hectare</th>
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**Annex 2f - Francis Karobia’s farm - 1 acre wheat**

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Annex 2g - Joseph Gatuchi’s farm - 1 acre maize

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Annex 2h - Rose Guantai's farm - 2.5 acres maize

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<td>- Herbicides</td>
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|                | 89,060 | 88,029 |
Annex 2i - Wilson Ruheni’s farm - 0.5 acres snow peas

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<th>Farmer's Name</th>
<th>Wilson Ruheni</th>
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<tr>
<td>Focal Area</td>
<td>Ngenia</td>
<td>Minimum tillage with herbicides, ripping and effective use of CPP</td>
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<tr>
<td>Area cropped (acres)</td>
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<td>- Herbicides</td>
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Robet Kandenge’s farm - 0.125 acres snow peas

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<td><strong>c) Gross Margin</strong></td>
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<th>Equivalent Hectare</th>
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Small holder Conservation Agriculture in Kenya_2008
Annex 3: Project Partners and Collaborating Stake holders

1. Ministry of Agriculture- The extension officers of the ministry of agriculture have been instrumental in information dissemination. In each focal area there is an officer permanently on the ground and each of them have undergone training on both CA and CPP. This eliminates the possibility of contradicting information being passed to the farmers by our team and by ministry officers. The ministry is also part of our exit strategy since it will remain on the ground after the project is over. The ministry organizes field days which we and other stake holders are always invited to.

2. District Development Implementation team- We are liaising with the District Development Implementation team to persuade farmers to prioritize CA and CPP practices. The team consists of farmers and government officers charged with the implementing social and development projects in the district.

3. Laikipia Dairy Goats Association – We are working with Laikipia Dairy Goats Association to promote CA. Dairy goats provide milk to farmers at a lesser cost – they need less grazing field and feeds compared to cows and far lower cost to maintain. They therefore will combine well with CA practices especially because farmers with dairy goats will find it easier to leave weed and crop residues in the farm as mulch.

4. Laurie Sessions (Lengetia Farm) - Sessions is a large scale wheat farmer who has for years produced wheat under CA. Session has been involved in sensitizing farmers around his farm about the positive attributes of CA. He has innovatively developed simple tools for use by small scale farmers. We have been collaborating with him on the equipment aspect. Recently we acquired several scrapers to be used for shallow weeding by the farmers who can not afford selective herbicides.

5. Kisima farm – The project is collaborating with Kisima farm, a large scale farm, on manure management especially making of liquid manure and earth worm production.

6. Equity Bank Ltd - We are collaborating with Equity Bank Ltd during field days where the bank is involved in training farmers on the financial aspect of farming. Equity bank is a local bank which is popular with small scale farmers due to their friendly lending and saving schemes.

7. Faulu Kenya – Many of our farmers are members of Faulu Kenya, a micro finance organization working with low income earners. Some farmers in the project area have been able to obtain soft loans from Faulu to fund their farming activities.

8. Focal Area Development Committee – The Focal Area Development Committee serves the same role as District Development Implementing Team at the focal area level.

9. Mount Kenya Produce Marketing Organization - This is a newly formed organization whose role is to organize farmers to market their produce. Apart from rainfall failures, market failure is the other major drawback to farmers. Price fluctuations and middle men have minimized the profit to farmers. The marketing organization aims at bringing farmers together to have a strong bargaining power. The organization will minimize or completely eliminate the role of middlemen.

10. Kenya Agricultural Research Institute - KARI has been providing us with literature and advises on the right variety of fodder shrubs to grow in the project area. The institute has also been involved in CA training in the District.
**visit programme -NANYUKI**

**Thursday 22\textsuperscript{nd} May**

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<th>ACTIVITY</th>
<th>RESPONSIBILITY</th>
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<td>BK,JK,NG,EN,</td>
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<tr>
<td>1045 - 1115</td>
<td>Travel</td>
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<tr>
<td>1115 - 1130</td>
<td>Jane Simon (group discussion with farmers, Farm tour)</td>
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<tr>
<td>1130 - 1200</td>
<td>Travel</td>
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<tr>
<td>1200 - 1230</td>
<td>Alice Maina (Farm tour to observe application of CPP and CA)</td>
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<td>1230 - 1245</td>
<td>Travel from sweetwaters to town</td>
<td>BK</td>
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<tr>
<td>1245 - 1315</td>
<td>Lunch break</td>
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<td>1315 - 1330</td>
<td>Visit Contact farmers in Maili Saba Area</td>
<td>BK,JK,NG,EN,</td>
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<td>1330 - 1530</td>
<td>Travel to Maili-Saba</td>
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<tr>
<td></td>
<td>a) Joshua Muriungi (Group discussion with farmers, Farm tour to observe application of CA and CPP)</td>
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<td>b) Sylvester Kinyua (CPP and CA, Manure management)</td>
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</tr>
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<td></td>
<td>c) Joseph Maina Gatuchi (Farm tour to observe application of CA and CPP)</td>
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<tr>
<td>1530 - 1600</td>
<td>Visit one contact farmer in Ngenia Area</td>
<td>BK,JK,NG,EN,</td>
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<td>1600 - 1630</td>
<td>Travel to Ngenia</td>
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<tr>
<td></td>
<td>Ruheni (Mastyle) (Group discussion with farmers, Farm tour to observe C.A &amp; C.P.P)</td>
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**Visited Farmers Profile**

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<th>Name</th>
<th>Profile</th>
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<td>Sweetwaters</td>
<td>Jane Simon</td>
<td>• She participated in the CA and CPP training at the beginning of the project.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• She is one of the early adopters in the area.</td>
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<tr>
<td></td>
<td></td>
<td>• Despite her willingness to practise CA, Jane predicts crop failure this season due to lack of rainfall in the area.</td>
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<td></td>
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<td>Note: Unlike other parts in sweetwaters, there is no possibility of accessing water for irrigation in Jane’s region.</td>
</tr>
<tr>
<td></td>
<td>Alice Maina</td>
<td>• Trained on CA and CPP</td>
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<td></td>
<td></td>
<td>• Previously she practised CA but failed hence reverted back to conventional tillage.</td>
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<td></td>
<td></td>
<td>• After training she realised where she went wrong and she is one of the farmers being encouraged to adopt the practice.</td>
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<td></td>
<td></td>
<td>• Unlike Jane’s case, Alice has access to water for irrigation.</td>
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<td></td>
<td></td>
<td>• She finds it easier to use the Ripper since she owns a hand drawn tractor.</td>
</tr>
<tr>
<td>Maili-Saba</td>
<td>Joshua Muriungi</td>
<td>• Trained on CA and CPP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Well integrated farm on CA and CPP practices</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• One of the Case study farms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Practices mixed cropping therefore has challenges in herbicide application.</td>
</tr>
<tr>
<td></td>
<td>Sylvester Kinyua</td>
<td>• Trained on CA and CPP</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• One of the farmers whose cattle shed was converted from traditional model to a modern one for easier management of manure.</td>
</tr>
<tr>
<td></td>
<td>Joseph Maina Gatuchi</td>
<td>• Highly innovative farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Well integrated on CA and CPP practices</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Practises inter-row application of Gramoxone.</td>
</tr>
<tr>
<td></td>
<td>Ngenia Ruheni (Mastyle)</td>
<td>• Highly innovative (he attended a brief training session and adopted CA practices on his own initiative).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• An example of CA practice in Horticulture.</td>
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<td></td>
<td></td>
<td>• He is an influencer of other farmers in Ngenia region.</td>
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</table>
Annex 5: Farmers trained on CA and CPP in Laikipia and Makueni District.

Laikipia District.

Woni farmers’ growers – Trained on 7th and 27th of March 2008 at Isaac Mugira’s Farm

1. Isaac Mugira
2. Jackson Kingori
3. Julius Mwiti
4. Francis Njoroge
5. Charles Kabiru
6. Peter Njuguna
7. Stephen Kamau
8. Stephen K. Mutua
9. Paul Mwuve
10. Jericha Mpinda
11. Annstacia
12. Martha Muthoni
13. Wilson Ruheni
14. Joseph Weru
15. David Macharia
16. Jackson Kaiga
17. Shadrack Nkonge
18. Mwangi Kamau
19. Henelitah W. Ngumo
20. Dennis Mugambi
21. Geoffrey Kinyua
22. Mwangi Gikonyo
23. Stephen Kamau
24. Peter Kahingo
25. Eunice Kinonu
26. William

Naromoru Farmers – Trained on 4th March 2008 at Jane Mugo’s farm.

27. Kanyari John
28. Kimani David
29. Michael Mwangi
30. Matindi
31. Joseph Kinyua
32. C. Njogu
33. A. Mati
34. M. Kamuyu
35. S. Nduhiu
36. P. Muthee
37. Maina Moffat
38. Jane Mugo
39. Warutere
40. Charity Wanjohi
41. Muruki
42. Esther Wamuhoro
43. C. Ndigerigi
44. Eunice Mrefu
45. Maina Moffat
46. H. Wanjiru

Nyarigino farmers – Trained on 29th March 2008

47. Christopher Muchemi
48. Isaac Waweru
49. Anastacia T. Wanyika
50. Joseph N. Mwaura
51. Robinson Mbora Mwaura
52. David M. Njuguna
53. Joseph Muthee
54. Daniel Ndungu

Ngenia PCEA woman’s guild – Trained on 8th April 2008 at Emily’s farm

55. Mary Michael
56. Emily Wanjohi
57. Jerioth Muita
58. Catherine Wanjiru
59. Louise Ndgitirigi
60. Alice Gatere
61. Margaret Gathogo
62. Cecilia Muriuki
63. Tabitha Wambugu
64. Margaret Ng’ang’a
65. Alice Kinyua
66. Faith Kimunge
67. Anne Githinji
68. Grace Samuel
69. Veronica Munyaka
70. Mercy Kabogo
71. Mary Gakenge
72. Grace Kamundia
73. Beatrice Mutungi
74. Monica Mararo
75. Margaret Waweru
76. Margaret Ndegwa
77. Charles Kariuki
78. Susan Kinoti
79. George Weru
80. Eric Karugi
81. Stanley Mbugua
82. Gilbert Riungi
83. Charity Ndubi
84. Naomi Nkunja
85. Jacob Ncubiri
86. Lawrence Wanjohi
87. Magdalene Wagithi
88. Alice Mwangi
89. John Mwangi
90. Nancy Wairimu

Panda miti mingi SHG – Trained on 18th June 2008 at Segera

91. Josphat Nakuyo
92. Benson Ndung‘u
93. Hiram Mbugo
94. Simon Ntongai
95. Denis Wambugu
96. Ann Wanjira
97. John Maina
98. Kelvin Ndungu
99. Rucha Karimi
100. John Ndungu
101. Grace Wambugu
102. Wachira

Njoguini farmers group – Trained on 14th and 24th July 2008 held at Njoguini borehole

103. Jane Kiama
104. Irene Wangui
105. John Ware
106. Bernard Kinyua
107. George Ngatia
108. Bernard Kinyua
109. Lucy Nyamburu
110. Junice Ruguru
111. Billiam Muthoni
112. Peter Karwigi
113. Esther Wangechi
114. Naomi Wambui Nderitu
115. Mary Njeri
116. Nancy Nyaguthii
117. Nancy Wangari
118. Mary Nyawira
119. Charity Gathoni
120. Joseph Kaluoya
121. Lucy Nyaguthie
122. Idah Njoki
123. Judith Kariuki
124. Benard Kaviru
125. Simon Kadiro
126. Mrs. Nyingi
127. Helen Wambui
128. Jane Ngina
129. Mary Kagiri
130. Junis Ruguru
Mutirithia Farmers – Trained on 21st July 2008 at Mutirithia

131. Peter Ngoroge
132. Charles Wambugu
133. James Kimathi
134. Joseph Maina Kanji
135. John Maina Karegu
136. James Wanjohi Mbaya
137. Florence Wanjiru Muchoki
138. Agnes Wangui Wanjohi
139. Annastacia W. Kariuki
140. Eunice Wamaitha Maina
141. Space Njeri
142. Simon P. Mwangi
143. Rose Nyambura
144. Cecilia Wahito
145. Nancy Gathoni
146. Geresa Wangari
147. Dorcus Muthoni
148. Agnes Njeri
149. Carolline Mumbi
150. Charity Wacheke
151. John Githinji
152. Grace Wambui
153. Cecilia Wahl
154. Lucy Waruguru
155. Miriam Wambui
156. Paul Gathu
157. Purity Wanjiru Karagu
158. Gaterina Kagendo
159. Lydia Wanjugu
160. Charity Waruguru
161. Zachary Kibui
162. James Wahome
163. James Ndii

Mazingira CA Farmers field school – Trained on 29th August 2008 at Muiga’s farm

164. Stephen M. Kabuchu
165. Charles Wanjohi
166. Josephine Gathaka
167. Regina Nyokabi
168. Milka Wanjui
169. Paul Gichuki
170. Moses Kaimenyi
171. Janice Muiga
172. Nancy Muthoni
173. Teresa Wanjiku
174. Mary Nderitu
175. John Kiguta
176. Mary Mwangi

Snap beans farmers – Trained on 28th August 2008 at Ruheni’s compound

177. Wilson Ruheni
178. David Maina
179. Peter Nderitu
180. Jonah Nderitu
181. Paul Gicwiri
182. Mary Wahito
183. Peter Njoguna
184. Joseph Maina
185. Robert Kibuchi
186. Mathai Kadenge
187. Jacob Maina
188. Wangui Sara
189. Agnes Wangare
190. Charles Ndegwa
191. Robert Wachira
192. Miano Christopher
193. Mathayo Amuhada
194. Jesse Mareithi
195. Penina Githinji
196. Theresa Nyaguthii
197. Samuel Maina
198. William Kamau
199. Monica Njeri

Burugutia farmers – Trained on 5th August 2008 at Muchemi’s farm

200. Joseph Muchemi
201. Mr Ngatia
202. Peter Wanjohi
203. John Macharia
204. Hellen Wairimu
205. Mariam waweru
206. Jane gathoni
207. Wambugu
208. Milka Muthoni
209. Lydia Wangari
210. Perris Wangu
211. Grace Wanjari
212. Jane Muthoni
213. Fredrick Murithi
214. Mary wangari
215. Chono Karuri
216. wambui Munuhe

Kalalu tree Farmers group – Trained on 19th September at Anthony Maina’s Farm

217. Anthony Maina
218. John Kulu
219. Martin Kinsathi
220. Miche Gitonga
221. John Muchiri
222. Peter Rungurua
223. Joseph Kiambu
224. Susan Nyambura
225. Daniel Mutheu
226. George Kiambi

Wastuga water and sanitation SHG – Trained on 17th October 2008 at water pan station

227. Esther N Ndiritu
228. Esther Kariuki
229. Isaac Waweru

FAOs CA Farmers field schools – trained on 7th-8th October 2008 at Simbas hotel

230. Stephen Ngatia
231. Wilson Ndegwa
232. Peter Karuru
233. Jane Wangu
234. Margaret Wangu
235. John Ndegwa
236. John Gitaura
237. John Wacira
238. George Njuguna
239. Joseph Maina
240. Dominic Muitui
241. Stephen Maina
242. Lydia Nyambura
243. Jane Wangechi G.
244. Christopher Mathenge
245. Jeremiah Wanguondu
246. Mary W. Karuri
247. Eunice W. Nderitu
248. Charles M. Kande
249. John Kamaria
250. James Ndii Nderitu
251. Margaret W. Gathatia
252. Pauline Wacuka
253. Maria Jebet

254. Charles Wanjohi
255. Joseph Mwangi
256. Stephen Muriuki
257. Nancy Muthoni
258. Janice Muthoni
259. Wamere Wahome
260. Daniel Nzomo
261. John Maina
262. Peter N. Mwanzi
263. Ann Wanjiru
264. Johnson Kahuho
265. Esther Wanjiku
266. Benjamin Maina
267. Daniel Mathenge
268. Rose Murigu
269. Anthony Gatungu
270. Muchengi Njagi
271. Baraka Okoba
272. Philip Mwangi
273. Mutua
274. Kamau Kiruri
275. Samuel Mungai
276. Gitonga J. J.

Farmers Trained through Field days

Nkando field day held on 6th march 2008 at Mama Ndaba's farm

277. Eunice Mumbi Gichiki
278. Agatha Muthoni Mworia
279. Irene Gathoni
280. Marata Wangui
281. Catherine Wandia
282. Beatrice Nyambura
283. Charity Njeri
284. Allan Macharia
285. Lucy Wangui
286. Purity Wangui
287. Alice Karota
288. Margaret N. Waiganjo
289. Penasia Wangombe
290. Rose Maina
291. Ann Githeu
292. John Kibuchi
293. Justus Gakuru Ngugi
294. Teresia Muthoni
295. Rose Muraguri
296. Veronica Nyaruai
297. Rebecca Njogu
298. Martha Wanjiru
299. Anna Wanjugu
300. Agnes Gacengo
301. Charity Maina
302. Marette Evanjeline
303. Joseph Mwangi
304. Jane Wandia
305. Agnes Mumbi
306. Celina Wangeci Maina
307. Inda Mumbi
308. Glory Mukiri
309. Susan Njeri
310. Mary Wangari Ndiritu
311. Jennifer Mbaya
312. Nancy Thuita
313. Ann Macharia
314. Christine Gakuiya
315. Mercy Kariuki
316. Agnes Maina
317. Helen W. Mwangi
318. Grace Kinyua
319. Jane Gatheni
320. Evagi Ngeyeta
321. Isabella Ndira
322. Njoki Lucy Kirima
323. Mary Kimathi
324. Sippoke Mwai
325. Jane Wambui
326. David Wakaro
327. Miriam Wanjiku
328. Naomi N. Ndirangu
329. Jane Nyagaki
330. Kingori Githinji
331. Purity Wangui
332. Ruth Nkirote
333. Grace Ngatia
334. Phoebe Wangari
335. Rahab Muthoni
336. Agela Thuguri
337. Cecilia Ngima
338. Margaret Kanyi
339. Beatrice Ngatia
340. Esther Kamau
341. Gladys Muthoni
342. Mary Nyambura
343. Charity Muhoro
344. Cecilia Wanjira
345. Rose Wanguru
346. Lydia Wanjiru
347. Purity Mukindia
348. Grace Macharia
349. Joyce Wairimu
350. Lucy Mwai
351. Gideon Magambo
352. Geoffrey Marangu
353. Jane Ngunjiri
354. Grace Wanjiru
355. Perpetua Gathoni
356. Florence Gakuru
357. Waithera Gachaga
358. Susan Njeri
359. Catherrine Dan
360. Elizabeth Nyambura
361. S. Nduru
362. Scholar Kibui
363. Zam Makungu
364. Josephine Wangui
365. Virginia Mumbi
366. Joan Wangombe
367. Beth Nyaruai
368. Veronica NJiru
369. Grace Wambui
370. Celina Wanja
371. James Kinyua
372. John Kiama
373. James Munyiri
374. Joyce Thaka
375. Nicholas John Waigi
376. Geoffrey Kogu
377. Joseph Kamau Maingi
378. Doris Wangu
379. George Wamu
380. Jesse Kamau
381. Peter Irungu
382. Stanley Kariuki
383. Lydia Nyaguthii
384. Bernard N. Kamwaro
385. Margeret Wanjau
386. Jeremiah Karanja
387. Joseph Kamau
388. Jafas Ngatia
389. Thomas Kaburu
390. Ann Wamuyu
391. Charles Muturi
392. Jane Kiraguri
393. Jane Wangechi
394. William Mugo
395. Veronica Ngima
396. Margeret Wambui Kinyua
397. Wanderi Wahome
398. Grace Wan'gondu
399. wachira Kinyua
400. Joseph Ngatia
401. Rose Wamuyu
402. Esther Wairimu
403. Susan Gichohi
404. Catherine Waruguru Buuri
405. Priscila Wanjua
406. Susan Muthoni
407. Rose Wamuyu
408. John Macharia
409. Geoffrey Kamau
410. Agnes Wangui
411. Peris Warui
412. Jackline Wamuyu
413. Charity Nyawira
414. Esther Wangari
415. Theuri Kiago
416. Patrick Mureithi
417. Lucia Muchina
418. John Ndegwa
419. Joseph Mulihi
420. Peter Njoroge
421. Margaret Wambui
422. Stephen Chege
423. Edward Mbaya
424. Joseph Wahome
425. Augustine M. Wambugu
426. Stephen Macharia Wamgii
427. Joram Njoroge
428. Grace Wanjiru
429. Faith Wamgii
430. Simon Kabuchu
431. James Chege
432. Lucy Wanjiku
433. Wangui Maina
434. Mary Wamgii
435. Fredrick Njogu
436. Charles Kinyua
437. Michael Gichuki
438. Michael Thairu
439. Michael Maingi
440. Veronica Mahiru
441. Joseph Miriti

Prison farm Exhibition held on 14th and 15th March 2008 at Nanyuki prisons farm

375. Nicholas John Waigi
376. Geoffrey Kogu
377. Joseph Kamau Maingi
378. Doris Wangu
379. George Wamu
380. Jesse Kamau
381. Peter Irungu
382. Stanley Kariuki
383. Lydia Nyaguthii
384. Bernard N. Kamwaro
385. Margeret Wanjau
386. Jeremiah Karanja
387. Joseph Kamau
388. Jafas Ngatia
389. Thomas Kaburu
390. Ann Wamuyu
391. Charles Muturi
392. Jane Kiraguri
393. Jane Wangechi
394. William Mugo
395. Veronica Ngima
396. Margeret Wambui Kinyua
397. Wanderi Wahome
398. Grace Wan'gondu
399. wachira Kinyua
400. Joseph Ngatia
401. Rose Wamuyu
402. Esther Wairimu
403. Susan Gichohi
404. Catherine Waruguru Buuri
405. Priscila Wanjua
406. Susan Muthoni
407. Rose Wamuyu
408. John Macharia
409. Geoffrey Kamau
410. Agnes Wangui
411. Peris Warui
412. Jackline Wamuyu
413. Charity Nyawira
414. Esther Wangari
415. Theuri Kiago
416. Patrick Mureithi
417. Lucia Muchina
418. John Ndegwa
419. Joseph Mulihi
420. Peter Njoroge
421. Margaret Wambui
422. Stephen Chege
423. Edward Mbaya
424. Joseph Wahome
425. Augustine M. Wambugu
426. Stephen Macharia Wamgii
427. Joram Njoroge
428. Grace Wanjiru
429. Faith Wamgii
430. Simon Kabuchu
431. James Chege
432. Lucy Wanjiku
433. Wangui Maina
434. Mary Wamgii
435. Fredrick Njogu
436. Charles Kinyua
437. Michael Gichuki
438. Michael Thairu
439. Michael Maingi
440. Veronica Mahiru
441. Joseph Miriti
Kalulu Field day Held on 27th May 2008 at Joshua Muriungi’s farm

Muriungi’s farm in Ngenia October 2008 at Mureithi’s World food Day Held on 16th October 2008 at Mureithi’s farm in Ngenia

World food Day Held on 16th October 2008 at Mureithi’s farm in Ngenia

537. Jane Wamaitha  
538. Cathline Gathoni  
539. Beatrice Watetu  
540. Eunice Wanjiru  
541. Monica Njeri  
542. Sofia Waruguru  
543. Isaac Kiboi  
544. Samuel Maina  
545. Elizabeth Wanjiru  
546. Julius Muriuki  
547. Robert Kibuchi  
548. William Kamau  
549. Martin Mutuma  
550. Naftaly Gituma  
551. Solomon Mwangi

552. Virginia Wanjiru  
553. Jerusha B. Nkatha  
554. Margaret Muthoni  
555. Serah Wangeci  
556. Hellen Maina  
557. Lucy Wachira  
558. Lucy Nyokabi  
559. Alice Kanona  
560. Hellen Gotabi  
561. Lucy Mumbi  
562. Martha Muciri  
563. Jane Muthoni  
564. Beatrice Gathoni  
565. Esther Njukobi  
566. John Murage  
567. Stephen Ndirangu  
568. Doreen Kathare  
569. Wanderi Wahome  
570. Justus K. Waigwa  
571. Alice W. Gachari  
572. Jane W. Munuhe  
573. Jane W. Nduungu  
574. Gladys W. Wachira  
575. Peris Mumbi  
576. Duncan M. Waikwa  
577. Ann Wangari  
578. Charity Gachugu  
579. Catherine Karamu  
580. Mercy Ngerote  
581. Stephen M. Kuruma  
582. John Kaimenyi  
583. Patrick Mukiri  
584. Hellen Nyambura  
585. Hosea Kihara  
586. Lady Wambui  
587. Evangeline Nderenya  
588. Flora Muringi  
589. Isaiah Kimathi  
590. Patrick M. Kanyangi  
591. Lilian W. Wahome  
592. Rachel Wangeci  
593. Rachael Wangu  
594. John Macharia  
595. Elisha Mwangi  
596. Richard Kinyua  
597. Newton Ndirangu  
598. Hellen ndirangu  
599. Gerrald Nkanata  
600. Collins Gita  
601. Isaac K. Waweru  
602. Joe Mwangi  
603. Paul Macharia  
604. Gabriel Makumi  
605. Beatrice Mathenge  
606. Millcent Nyamu  
607. Susan Wanjiku  
608. Margaret Wanjiku  
609. Perisina Waithira  
610. Maina Gichuhi  
611. Regina Njukobi
| Small holder Conservation Agriculture in Kenya_2008 | 58 |

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<tr>
<td>612. Susan Wanjiku</td>
<td>672. Simeon Githinji</td>
<td>732. Charity Kihuri</td>
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<td>613. Jerioth Wambui</td>
<td>673. Wilson Ruheni</td>
<td>733. Duncan Mathai</td>
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<td>616. Susan Nyamathira</td>
<td>676. Arthur Wahome</td>
<td>736. Mary Wanjia</td>
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<td>618. Benard weru</td>
<td>678. Beatrice N. Gatuma</td>
<td>738. Mary wangu</td>
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<td>624. Angelina Mwathira</td>
<td>684. Amos Mwangi</td>
<td>744. Jecinta Ncoro</td>
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<td>625. Joe Mwangi</td>
<td>685. Margaret Nyokabi</td>
<td>745. Holliet Ruguru</td>
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<tr>
<td>627. Faith Wamuyu</td>
<td>687. Simon Gitau Chege</td>
<td>747. Francis Mwangi</td>
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</table>
Njoroge’s Farm

28th October 2008 at

Mutirithia Field day held on

830. Charles Njama mutahi
831. James Kimathi
832. Lucy Wairimu
833. Keneth Wairegi
834. George Murage
835. Michael Wachira
836. George Maina
837. Simon Mundia
838. Joseph Ekwan
839. Samuel Wangondu
840. Zackaria Ndiritu
841. John Kitoe
842. Ann Paul
843. Virginia Wangari
844. Mary Akori
845. James Ebbagon
846. Lydia Wairimw
847. Esther Nyambura
848. Rose Wairimu
849. Benendecta Wango
850. Jane Muthoni
851. Francis Karani
852. Susan luyuyu
853. Margret Lodano
854. Jennifer Wambui
855. Regina Daniel
856. Wanjiku Kiuru
857. Aborem Longale
858. Mary wanjeki Kihara
859. Paulina Acua
860. Cecilia Wahu Katabo
861. John Kuria
862. James Wahome
863. James Wanjohi
864. David Muriuki
865. Josaph Maina
866. Charles Wandeto
867. Susan Wanjiku
868. Benendecta Wamuyu
869. Miriam Wamuyu
870. Regina Adu
871. Ephrim Mwangi
872. Margret Wangu
873. Nancy Wanjiru
874. Alice Wanjiku
875. Anastasia Wangu
876. Kibiu Kamau
877. Isabel Kamau
878. Teresia Wangari
879. Christopher Ndirangu
880. Florence Wambura
881. Zipporah Nkrote
882. Anastasia Nkrote
883. Mary Kahiga
884. Mwangi Karanja
885. John Maina
886. Sallas Katya
887. Margret Njoki
888. Notoni Iomuga
889. Raphael Ekathe
890. Ann kipeus
891. Esther Wanjiru
892. Reah Kopia
893. Stephen Mwune
894. Gladys Wangechi
895. Mwariri Wangechi
896. Mary opogori
897. Wanyiagae Loboyo
898. Elegance Keroa
899. Matuta Wachira
900. Solomon Lundukoe
901. Esther Wanjiru
902. Priscilla Muthoni
903. James Ndi
904. Agness Rona
905. Florence wanjiru
906. Florence wanjiru Maina
907. Jane wanjiuru
908. Charles Wambugu
909. Charles Wontere
910. Ann Wamburu
911. John Kgwen
912. Chora Mwoni
913. Samuel Meshami
914. Elizabeth Ashua
915. Mary Wairimu
916. Susan Lopalua
917. Maina Gichuri
918. Wangechi Mwihuri
919. Alice Wangechi
920. Pastor Wambugu
921. Spce Darus
922. Purity Njiri
923. Tabitha Wanjiru
924. Nancy wangiari
925. Teresia Gathoni
926. Caroline Mumbi
927. Margret Wamuyu
928. Judy Gathundu
929. William Wambui
930. Githinji Mwereri
931. Susan Endapu
932. Lawrence Muthomi
933. Pascalan Wanjiru
934. Jennifer Wanjiru
935. Cecilia Magut
936. Ivoto Muhlu
937. Rose Muguene
938. Peter Wanjohi
939. George Githinji
940. Agnes Njeri Wanjiku
941. Millicent Wanjiru
942. Lydia Njeri
943. Marry Wamgu
944. Ruth Ngendo
945. Veronicaah Njoki
946. Nancy Gathoni
947. Lucy wangiui
948. Agnes wangiui
949. Beth Gathoni
950. Isaac Mwangi

Ngenia Field Day held 6th November 2008 at Gituto Wachira’s farm

951. Muriuki Njogu
952. Jackson Wachira
953. Joseph M. Gichoki
954. Eldad Karume
955. Erustus Wachira
956. Jotham Njuki
957. Joseph Mwangi
958. Harry Thuku
959. Muriuki Njogu
960. Jefferson Murimi
961. Lucy Wambeti
Training of trainer’s conference held on 29th July 2009 at CETRAD Conference

1172.  Joe N. Mwangi
1173.  Charles K. Kanyoni
1174.  Alice Wanjiru
1175.  Veronica Njeri
1176.  Margaret K. Ndegwa
1177.  Stephen M. Kabuchu
1178.  Robert Kibuchi Migwi
1179.  Christopher Miano Be
1180.  Alice Muthambure
1181.  Joseph Maina ruheni
1182.  Wilson Ruheni Githii
1183.  Stephen Kagwa
1184.  Stanley Muriuki
1185.  Henry Mwiti
1186.  Francis Karobia
1187.  Sylvester Kinyua
1188.  Joseph Maina (110)
1189.  Githinji Kirigi
1190.  David Mutwiri
1191.  Jane Simon
1192.  Elizabeth Wanjiru
1193.  Jackline Wamuyu
1194.  Joseph Maina Gatuchi
1195.  Rose Guantai
1196.  Joshua muriungi
1197.  Martin Kimathi
1198.  Christopher Muchemi
1199.  Margaret Karimi
1200.  Joseph Muchemi
1201.  David mung’ania
1202.  Esther Wamuchii
1203.  Rebecca Ng’u
1204.  Esther Thoithi
1205.  Pastor Wamburu

MAKUENI DISTRICT

ITUMBULE CLUSTER
1206.  Beth Martin
1207.  Kiminzi Mwatu
1208.  Bernard Muli
1209.  Miriam Makua
1210.  Mbulwa Mulungi
1211.  Alice Paul
1212.  Annan Sammy
1213.  Muthoni Mutua
1214.  Wayua Suni
1215.  Kituku Mutisso
1216.  Magdaline John
1217.  Kameme Munguti
1218.  Rose Kisulil
1219.  Luice Makenzi
1220.  Margaret Mutua
1221.  Tabitha Kiminzi
1222.  Eunice Mwanzani
1223.  Catherine Maliti
1224.  Josephine Katolo
1225.  Joshua Muthokea
1226.  Nzula Nyamai
1227.  Nzau Kimoende
1228.  Bernard Kavita
1229.  Jonathan Kilonzo
1230.  Elizabeth Mwelu
1231.  Lena Peter
1232.  Angelina Musyoka
1233.  Alice Mutua
1234.  Kasua Kiminzi
1235.  Sebeth Nguku
1236.  Damaris San
1237.  Monica Wambua
1238.  Lucy Mbevi
1239.  Belita King’oo
1240.  Margaret King’oo
1241.  Josephine Mumo
1242.  Anna Muasya
1243.  Rhoda Muete
1244.  Mary Musyoki
1245.  Serah Philips
1246.  Mary Mutua
1247.  Ben Muthui
1248.  Monica Mwania
1249.  Teresa Munguti
1250.  Kiminzi Mwatu
1251.  Nzula Nyamai
1252.  Agnes Munini Sekeni
1253.  Munda Mule
1254.  Nzesi Ngeti
1255.  Mary Kanunga
1256.  Regina Daniel
1257.  Miriam Mutui
1258.  Kasoo Ndolo
1259.  Paul Mutisya

Kwa Kavisi Cluster
1260.  Nzamuluya Kinyili
1261.  Kambua Muteti
1262.  Mutena Nzuali
1263.  Ndululu Ngamu
1264.  Musiki Mumo
1265.  Philip Muli
1266.  Margaret Ndolo
1267.  Beatrice Mwende
1268.  Mwikali Luveni
1269.  Mose Kimani
1270.  Monica Nzinga
1271.  Ndinda Nzaka
1272.  Nduma Mwata
1273.  Mbukulka Mbithuka
1274.  John Malamba
1275.  Muthoka Nzavi
1276.  Benedetti K. Mutuku
1277.  Rosalia N. Sila
1278.  Nduku Kimeu
1279.  Katua Mwikya
1280.  Syometho Kiseko
1281.  Andrew M. lumbyi
1282.  Hellen M Kimuyu
1283.  Joseph M. Lumbi
1284.  Mutundu Kavuu
1285.  Shadrack M. Makiti
1286.  Michael Musau
1287.  Musyoka Muthungu
1288.  Ruth N. Musyoka
1289.  Joyce M. Ngumbau
1290.  Masila
1291.  John Muthoka
1292.  Silas Mwili
1293.  Monica kisoi
1294.  Kalondo Kithuka
1295.  kivuva Ngumu
1296.  Monica Mbeva
1297.  Kambamba watha
1298.  Josephine Ngilu
1299.  Mutua
1300.  Mbura Musyoka
1301.  Boniface saiti Mutuku
1302.  Musyoki Mwanganio
1303.  Mutunga Mutune
1304.  Betty Mbithi
1305.  Mathika Kyango
1306.  Agnes Ndaka
1307.  Ndululu Ngumu
1308.  Paulina Mwen
1309.  Jacinta Mwanzia
1310.  Teresa Wetha

Small holder Conservation Agriculture in Kenya_2008
Stella M Mutuku
Francisca M. mutua
Eva M. Mwini
Joyce W. mutinda
Patricia W. Kieti
Beatrice Kaluku
Rose Kimanyi
Patrick M. Mutisya
Christopher m
Kathika Mutua
Titus ndeti
Muendo Maithya

Miangeni
Esther Maendo
Margaret Kiilu
Salome Kiio
Esther Waema
Mwikali Sila
Josephine Kilatya
Justine Philips
Beatrice Daniel
Lillian John
Angelina Kasyoka
Dorcas Muendo
Elizabeth Pius
Milca Kizee
Redempta Mumo
Anne Kasimu
Margaret Kyallo
Joseph Ndunga
Vivian Musenga
Regina Mbithi
Mukonyo Mwathi
Caroline Matheka
Tabitha Pius
Anne Yeng’e
Ruth Sikuku
Vivian Mwova
Angela Musango
Elizabeth Kinyasye
Florence Musyoka
Caroline Kiteto
Mary Muturi
Mueni Nthakyo

Ndululu Kimeu
bendetta Musyimi
Mukeli Nthiwa
Sammy Mwatu
Rebecca Ndinda
Peter Mutisya
Patrick Kyambuu
Onesmus W Katulu
Rosalie M. Mutuku
Janet Muema
Rosemary Mutunga
Samson Musyoka
Lazarus Kathanza
Redempta Mutuku
Justus Musyimi
Nyamai Mweleva
Kyallo Mutie
Monica Mbithi
Phoebe Kitsya
Mbisi Musau
Mutindi Simon
Rael Munywoki
Boniface m. Ngumu
Josphat k. Kasiya
Dominion Mbolonzi
Lazarus Mutisya

Kanzokea Cluster
Josiah M. Muinde
John M. Mutisya
Francisca M. Mulili
Mulele Waema
Rael Munywoki
Monica Musyimi
Martin Kinyae
F.M. Mohaa
Kinyili
Katumi Muli
Joseph Maweu

Mueni Mbithi
Victoria Muema
Agnes Maluviu
Joyce David atyo
Angeline Muendo
Christine
David Ngumbi
Nzula Kasuni
Kisumu Kyengo
Agnes Mulei
Rael Mbithi
Priscilla Munywoki
Musingila Kalia
Mwansa Kiema
Kyenze Ndolo
Wiliam Muchina
Peter K. Mwania
Kailu
Katku Mue
John K. Kisini
Mutfwi William
Daniel N. Mbaluka
Kattu Ngotho
Musyoka Kimo
Kyawe
Mwangangi

Mutuko Kini
Elizabeth Kyumwa
Rose W. Mutisya
Agnes M. Mulwa
Damaris Muendo
Alex kituku
Kitusi Ngunda
Ephraim Meti
Julius Mbithi
Richard M. Kioko
Sammy Ngunga
Musyoka Kingondu
Masila Mavindu
Moses M. Ndunda
Jones M. Mulwa
Juliana Mwolo
Mathias Matuti
Annex 5: CA and Stewardship Award Scheme

In recognition of the trainers’ effort and to encourage them to train as many farmers as possible, we have developed an awarding scheme as detailed below. To qualify for the award the trainer should fulfill the following:

- Train as many farmers as possible within the project area.
- Ensure his trainee implements both CA and Stewardship practices e.g. minimum tillage (ripping and sub soiling), permanent soil cover (mulching, cover crops), and safe use of agrochemicals (PPE, safe storage, and safe disposal).

The scores will be awarded as follows:

- Safe storage. (25 points)
- PPE (face shield, gloves, gumboot, vest) (20 points)
- Disposal pit. (15 points)
- Ripping/sub-soiling. (20 points)
- Permanent soil cover (mulching/cover crops). (10 points)
- Farm planning (This is on the trainers’ farm). (10 points)

Total (100 points)

Trainers will be ranked as per the points scored. The awards will include:

- Up to 1 acre of land fully funded with agrochemicals for the first position
- A Knap sack sprayer, and if available, PPE for the second position

The point will be recorded on a trainer score card shown below.

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<thead>
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<th>Store</th>
<th>PPE</th>
<th>Disposal Pit</th>
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<th>Mulch</th>
<th>Farm plan</th>
<th>Total Points</th>
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Grand Total
Annex 5: Year 2009 activity plan

Year 2009 activities for the project are listed below under each of the five objective of the project.

Objective 1: Documenting and mapping the spread of CA and CPP practices among small holder farmers in the study area and elsewhere in Kenya

i. Continue mapping of the spread of CA and CPP in the focal areas within Laikipia and Makueni to monitor the adoption of CA and CPP technologies by the farmers.

Objective 2: Improving small holder knowledge and skills on CA Practices and safe and efficient use of CPP.

i. Continue training farmers on CA practices and safe and efficient use of CPP- target at least 3000 farmers by the end of the year.

ii. Look into the potentiality of upscaling to other areas within Laikipia, based on outcome, act accordingly.

iii. Identify additional groups for training and continued follow up of the groups that are already in place.

iv. Organize for more exchange visits to accelerate adoption of the technologies and further exchange of ideas and knowledge amongst the farmers themselves.

v. Produce a package of handouts on CA and safe and efficient use of CPP in English and Kiswahili. The CPP modules have already been translated, and are waiting to be published into a manual for distribution.

Objective 3: Assessing impacts of CA and safe and efficient use of CPP on environment, crop production and farmer income

i. Continue collecting and analyzing data, assessing the impacts of CA and CPP use on environment, production and farmer income.

Objective 4: Up-scaling CA and safe and efficient use of CPP to selected tests areas within Makueni District

i. Continue training farmers on CA and safe and efficient use of CPP.

ii. Continue to identify more groups and follow up on those already trained.

iii. Organize for an exchange visit for the farmers to Laikipia

Objective 5: Sharing knowledge and experience gained with small holder farmers and other stakeholders in the study area and elsewhere in Kenya

i. Write a draft paper for publication in a recognized journal based on the results of the three years of the project.

ii. Continue taking raw video and photo footages to be used in information dissemination.

iii. Intensify collaboration with other stakeholders especially the KARI CA project.