African Conservation Tillage Trust

Farmers' Training Sessions – Hands-on

A CONSERVATION AGRICULTURE TRAINING REPORT OF LEAD FARMERS' AS TRAINERS, MANICA PROVINCE, MOZAMBIQUE

By

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ACRONYMS

ADP	Animal Draught Power
AF	Agro forestry
BSP	Bulawayo Steel Products
CA(WT)	Conservation Agriculture (With Trees)
DS	Direct Seeder
EGA	EverGreen Agriculture
FAO	Food and Agriculture Organisation of the United Nations
NGO	Non-Governmental Organisation
PPB	Permanent Planting Basin
SACAU	Southern African Confederation of .Agricultural Unions
SSA	Sub-Saharan Africa
UCAMA	União Provincial Dos Camponeses De Manica

1 INTRODUCTION

1.1 Background

Our changed climatic environment gives erratic/unreliable rainfall, more frequent drought/flooding oscillations, increasing temperatures, and therefore affecting agricultural production. Average cereal yields on most small-scale agricultural lands in Southern Africa are about 1 tonne/ha under current conventional farming systems of ploughing and cultivation using mouldboard ploughs or hoes respectively. These farming practices have also resulted in increasing poverty, food insecurity, deteriorating livelihoods, low soil fertility, increasing soil erosion and therefore a waning natural resource base.

Plate 1: (a) Gathering of crop residues; (b) burning of agricultural lands

In Manica province, most households depend on farming as a source of livelihood, and have used a variety of hoeing/ploughing tillage practices to prepare and weed their lands and crops respectively (Manica, Sussundenga and Baruè District profiles; 2005). These conventional systems of farming have not only resulted in rampant soil erosion of valuable nutrient-rich topsoil from agricultural lands to riverine and marine environments, but have disrupted natural ecosystems triggering a chain reaction that has reduced agricultural productivity. Soil fertility practices followed by farmers in Manica province include: limited fertilizer incorporation, fallowing, use of livestock manure (goats, cattle, chicken), crop rotation/intercropping of legumes (beans/cowpeas/pigeon peas) and cereals (maize/sorghum). (Uaiene, 2004). During the training, burning of crop stover and grass was common in the areas visited.

Whilst a number of institutions have been promoting variants of CA technologies and while farmers described many benefits in using CA there is little sign of adoption beyond the plots where NGOs provide inputs. Many farmers were of the opinion that CA performs better than conventional agriculture only if they applied fertilizer (or large quantities of compost). This constraint can be explained by the nutrient immobilizing effect caused by both reduced tillage and the retention of mulch. (Grabowski, 2011). This is a challenge that this initiative will hope to resolve.

In order to circumvent many of these new undesirable occurrences, current conventional farming practices need to change to adapt to the new situation and also to contribute towards mitigation strategies over time. Conservation agriculture promotion is one such

beneficial strategy that greatly contributes against these vagaries of change threatening the very existence of our people and environment they live on. CA also assures not just environmental mitigation but increased output in terms of production per unit area and conserves input and labour requirements (IIRR & ACT, 2005) when 'obediently' pursued.

It is therefore prudent to introduce CA in the targeted areas and among the targeted communities as a response to sustaining a new farming heritage that should stand the test of time. A total of 57 Lead farmers and facilitators were trained, as shown below in Table 1.

Table 1: Segregated Participation of the Selected Districts.

District	**Lead Farmers**		**Technical Staff**		**Total**
	Female	**Men**	**Female**	**Men**	
Manica	6	7	0	7	20
Sussundenga	7	12	0	1	20
Baruè	5	11	0	1	17
Total	**18**	**30**	**0**	**9**	**57**

1.2 The Assignment

Table 2: An Outline of the Assignment

Assignment	1. Building Capacity for Uptake of CA Technologies to Enhance Food Security and Resilience to Climate Change: A Training of Lead Farmers.
Target	Training of 50 Lead Farmers under SACAU Programmes in Manica, Sussundenga and Baruè Districts of Manica Province, Mozambique.
Duration	7th to 19th October 2013.
Terms of Reference	
1	Conduct a hands-on farmer training of basic CA concepts/approaches (principles, dealing with hardpans, intercropping with legumes, responding to crop/livestock conflicts, weed management);
2	Suggest a package for inputs and CA equipment (both hand-based and ADP-based)(Hand planters, Magoye ripper, ADP Direct seeder, Sprayers);
3	Support to establishment/layout of demonstration/learning plots of 0.2 ha;
4	Develop an action plan and backstopping system that records, monitors and evaluates implementation; and
5	Certify participation to training.

1.3 Training Objectives

1.3.1 Overall Objective

Plate 2: (i) Participants from Manica with trainers, and (ii) from Sussundenga with trainers

The overall objective of the assignment was to equip selected 50 Lead farmers of the SACAU-supported UCAMA project in Manica, Sussundenga and Baruè districts of Mozambique's Manica province with knowledge and skills on basic conservation agriculture concepts, principles and practices.

1.3.2 Specific Objectives

Plate 3: (i) A ripping demonstration, and (ii) A check on ripping depth, Manica district.

i). train 16-17 Lead farmers in each of the selected districts of Manica province in CA concepts, principles and practices before the end of October 2013;
ii). inculcate a practical orientation of CA practices through demonstrations and exposure of farmers to tools and means;
iii). expose farmers to the compatibility of conservation agriculture and agro forestry practices;
iv). train farmers on sustainable soil fertility replenishment and management in CA using nitrogen-fixing agro forestry tree species;
v). expose farmers to livestock feed (fodder technology) using agro forestry legume trees, and live fences on CA plots;
vi). instil the understanding of the benefits of CAWT; and

vii). orient each Lead farmer to establish a demonstration plot that will serve as a farmer field school to them and the surrounding farmers.

1.4 Expected Outputs and Outcomes

i). A total of 50 Lead Farmers under UCAMA in targeted districts of Manica, Sussundenga and Baruè of Manica province acquire a hands-on training of basic CA concepts/approaches (principles, dealing with hardpans, intercropping with legumes, responding to crop/livestock conflicts, weed management);

ii). A package for inputs and CA equipment (both hand-based and ADP-based) (Hand planters, Magoye ripper, ADP Direct seeder, Sprayers) is suggested;

iii). Guidelines to establishment/layout of demonstration/learning plots of 0.2 ha is given;

iv). An action plan and backstopping system that records, monitors and evaluates implementation is developed; and

v). Participants to the training are certified.

2. TRAINING PROCESSES

2.1 Methodology

Plate 4: (i) Trainer recording farmers responses on flip charts (ii) powerpoint presentations

The training was covered in two parts; the first part was theory sessions which covered definitions and explanations of the respective topics. This was administered in power point form using mostly slides in Shona version. Flip charts were also used in situational analysis and in some cases where the trainer needed an illustration of drawings.

This was followed by practical demonstrations and an orientation on how to set demo plots. A variety of methods were used to conduct the training:-

(i) After setting out (Introductions/Ground Rules/Expectations), focused group discussions were used at each site at the beginning of the training to conduct a situational analysis of the targeted people and their environment.

(ii) Using illustrated powerpoint presentations a series of topics were covered to impart knowledge and skill in the topics selected.

Table 3: Summary of Topics Delivered (*See details in Section 3*)

Main Topic	Areas of Emphasis	Achievement
Situational Analysis		√
What is CA, its principles	1) Reasons for change 2) Key CA aspects 3) Paradigm shift	√ √ √
Principle 1: Tillage	1) Minimal/Zero 2) Hardpans	√ √
Principle 2: Soil Cover	1) Permanent cover 2) Dry cover (crop residue management, mulching) 3) Green cover (intercropping, alley cropping, relay cropping) 4) Crop/Livestock conflicts 5) Termites/burning	√ √ √ √ √
Principle 3: Crop Rotations/Associations	1) Rotations 2) Associations	√ √
CA-Related Agro forestry practices (CAWT)	1) Tree/Crop/ Livestock Integration 2) Nursery establishment 3) Tree establishment 4)Utilisation of by-products from AF trees	√
Weed Management		√
Agronomic Practices	1) Change of mindset 2) Pests & Diseases 3) Compost making	√ √ √
Appropriate CA Equipment	1) Land preparation 2) Weeding	√ √
Demos/Layouts/ Record Keeping		√ √
Action Planning & Evaluation		√ √

Plate 5: (i) 'Hands-on' ripping by Mama B in Manica, (ii) 'Hands-on' spraying in Sussundenga

Says Mama Beauty Karombedzi "I am now going back to retrieve my money which I had given to my neighbour to plough my field. I am very certain that if I commit myself to CA, my yields will improve and my soil structure will improve!"

(iii) Practical demonstrations were conducted on various themes on a 'hands on' basis encouraging trainees to get acquainted. Women were particularly targeted to practice what were considered men's activities. More than half day was reserved to hold these activities.

Plate 6: Group action planning discussions, Baruè.

(iv) Group discussions were used to learn more about local conditions relating to promotion of CA.

Plate 7: A class game, of writing own's name on top of head

(v) Use of physical/awakening games formed part of the training activities to keep everybody alert.

2.2 Setting the Scene

At the start of each training site, reasons for the training were given by personnel from UCAMA, followed by formal introductions of the participants and resource persons. All presentations were made or translated in Shona, as a common medium of communication.

2.2.1 Ground Rules

A set of ground rules were made at the beginning of each training site of the arranged three training venues in Manica, Sussundenga and Baruè.

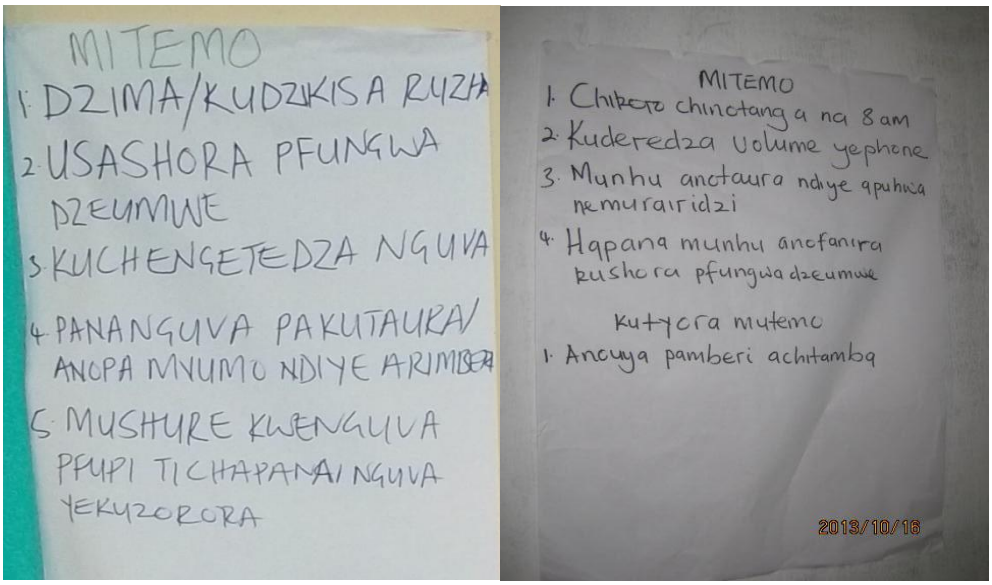

Plate 8: Set ground rules (i) Manica, (ii) Baruè training venues!

The trainers facilitated the setting up of ground rules, the farmers were asked for themselves to come up with ground rules and these were written on the flip chart.

2.2.2 Course Expectations

(i) Farmers expected to be exposed to CA principles.

(ii) Each of the trained farmers to be able to lay up to standard CA demonstration plots in their fields.

(iii) To be role models in up scaling the adoption of CA in their communities.

2.3 Situational Analysis

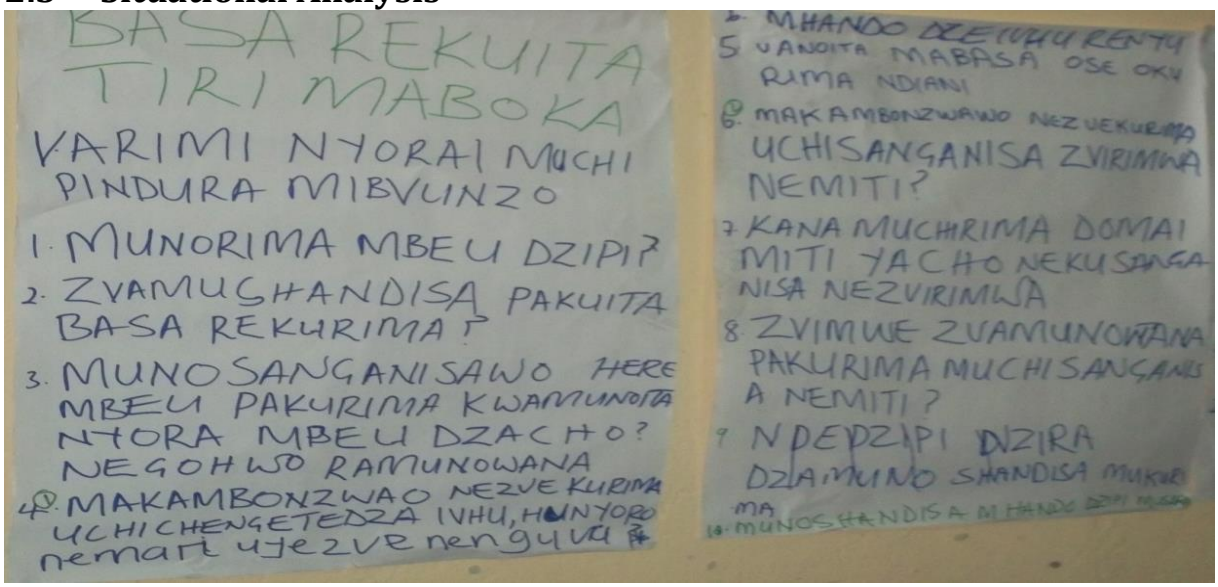

Plate 9: Questions guarding situational analysis focused group discussions.

The facilitators wrote questions on the flip charts to find out the situation in terms of farming systems in all three districts, one of the facilitators had to ask farmers while the other one recorded the responses.

2.3.1 Typical Characteristics

Every farmer was given an opportunity to answer the questions it was an interacting approach between the farmers and trainers.

Table 4: Summary of Situational Analysis

Questions/ District	Manica	Sussundenga	Baruè
Crops grown	maize, beans, soyabeans, cowpeas, millets, bambara nut, sesame, groundnuts, cassava, yams & sweet potatoes.	maize, beans, soyabeans, bambara nuts, groundnuts, sesame, cassava, sunflower, finger & pearl millet.	maize, beans, soyabeans, cowpeas, groundnuts, bambara nuts, sesame, sweet potatoes, sunflower & sorghum.
Equipment used for land preparation	hoe, ox-drawn plough, harrow, axe & cultivator.	hoe, ox-drawn plough, lashers, axe & cultivator.	hoe, ox-drawn plough, cultivator, slashers, axe & harrow.
Do you rotate crops	Yes (maize, beans & cowpeas)	No	No
Do you intercrop	maize-cowpea, maize-pumpkin, maize-beans, maize-pigeon pea.	maize-cowpea, maize-pumpkin, maize-beans, maize-pigeon pea, maize-finger millet & maize groundnuts.	maize-cowpea, maize-pumpkin, maize-beans, maize-pigeon pea, maize-sorghum & maize-sunflower.
CA with trees	Pigeon pea intercropped with maize, maize intercropped with orange, aloe vera, moringa trees.	Pigeon pea	Pigeon pea
Methods of weed control/Problem of weeds	Hoeing & burning	Hoeing & burning	Hoeing, burning & herbicides
Who does the job	father, mother & children	father, mother & children	father, mother & children but sometimes if we have money we hire labour
Type of soils	sandy, sandy loam	red clay in all sites	sandy, sandy loamy, clay loamy
Rainfall received annually	1200mm	1200mm	1200mm
Have you ever heard about CA	No	No	One farmer already practising.

2.3.2 Farmer Perceptions

(1) CA involves a lot of labour but it pays a lot if you follow its principles;

(2) Use of mulch in CA plots reduces weed pressure;

(3) There is conservation of moisture in CA;

(4) Improves soil structure;

(5) Problem of insufficient pastures for livestock, so it is difficult to leave crop residues in the field; and

(6) Use of herbicides in controlling weeds.

3 TRAINING TOPICS COVERED

3.1 Conservation Agriculture

3.1.1 CA Concepts

A variety of perspectives were used to define CA definitions to illustrate FAO's generic definition. Conservation Agriculture (CA) was defined as a 'disciplining' sustainable ecosystem-based farming of minimal soil disturbance, effective soil cover and crop sequencing that increases productivity (increased yield/sustainable resource use) through precision management in terms of labour and other inputs (seed, fertilizer, manures).

Plea for change of mindset, 'red-carding' a number of conventional farming practices (ploughing/cultivating, burning, monocropping) and their tools (mouldboard plough/discs, hoes) set the mood to introduce conservation agriculture practices to improve productivity, sustain use of available agricultural resources and for protection of the environment. A paradigm shift was advocated for:

- a change in crop management system;
- use of an implement or tool that can manage the crop residues or cover crops;
- to consider the soil as a biological and self-sustaining productive system;
- to adopt a new way of thinking as far as weed management and crop production are concerned – using herbicides or biological control;
- a shift in terms of farm power source away from labour-intensive manual systems;
- and improve the capacity to tackle new challenges and find a solution (being entrepreneurial).

Trainees were challenged to adopt new CA techniques from a selection of practices of no burning, dry season land preparation (water retention/harvesting in the ecosystem, enhancing infiltration, erosion control), crop residue retention/ mulching, reduced tillage (PPBs, Ripping, Direct seeding), early planting, precision input application (liming, fertilizer, maintaining plant populations), nitrogen-fixing legumes, soil fertility management (including agro-forestry), effective weed control (use of herbicide, use of intercropping/alley cropping techniques), crop rotations/associations, agro-biodiversity enhancement, and climate change adaptation and mitigation.

Some 5 challenges were presented to the trainees to guide decision making processes of practising good CA:

(i) maintaining permanent planting stations, which together with the soil structure;
(ii) maintaining a litter layer of decomposing leaves or crop residues;
(iii) maintaining roots of different plants distributed throughout the soil at different depths;

(iv) maintaining the major period of nutrient release by micro-organisms coinciding with the major period of nutrient demand; and

(v) maintaining nutrients recycled by deep-rooting plants and soil macro- and micro-fauna.

CA was also presented as a framework that organises economic benefits, because it spreads and saves labour (up to more than 40%); reduces inputs (number of operational rounds, seed, fertiliser, etc) up to as much as 50%; improves productivity (2-3 times); and increases production opportunities (enables to cover bigger areas in time or engaging into other empowering enterprises).

The characteristic and problem of soil compaction/pans formed from a variety of situations was highlighted, especially resulting from ploughing or hoeing at the same depth season after season. Participants were sensitised on how to tell the existence of hardpan (*see photo 8 below*)

Plate 10: The J-rooting as an indicator of soil pan problem

Ways of dealing with the hardpan were also presented, of using a ripper, subsoiler, planting basins or sowing a strong-rooted cover crop.

An introduction to the 3 CA principles was then made, of Principle 1of minimal soil disturbance; Principle 2 of permanent soil cover; and Principle 3 Crop rotations/associations.

3.1.2 Principle 1: Minimal Soil Disturbance

The following topics were covered:

- Tillage;
- Minimum Tillage (definition and advantages);

- Soil Pan;
- Use of machinery in minimum tillage;
- Range of mechanized equipment used for minimum tillage (Manual, Animal drawn and Tractor operated equipment);
- Manually operated equipment: Li seeder, Jab planter;
- Animal Drawn equipment: Ripper, Direct seeder; and
- Yoke lengths in relation to crop rows.

Plate 11: Minimal tillage techniques (i) ADP ripping, (ii) Manual DS, and (iii) DS with ADP

3.1.3 Principle 2: Permanent Soil Cover

Topics covered under this subject were:

Plate 12: (i) Dry matter mulching and (ii) Living matter cover crop techniques.

Soil cover is important to protect the soil against the unpleasant effects of exposure to rain and sun, to provide the micro and macro-organisms favourable microclimate in the soil for optimal growth and development, including plant roots. Maintaining year-round organic matter cover over the soil remains a challenge, including that of specially introduced cover crops and intercrops and/or the mulch provided by retained residues from the previous crop. Cover crops need to be managed before and after planting the main crop.

Integration of trees in conservation agriculture can also provide for soil cover and is important as the roots of tree/shrub species and the soil fauna take over the tillage function, soil nutrient mobilization and balancing. Trees also play an

important role in covering the soil, shedding of leaves add biomass and cover the soil surface; an example of such trees is *Faidherbia albida*. The important point is that the soil must always be kept covered.

3.1.4 Principle 3: Crop Rotations/Associations

Plate 13: Crop rotation and associations (maize/pigeon pea intercrop)

Crop rotations therefore have many important functions:

- they help to control pests and diseases;
- they help to maintain soil fertility;
- they help to maintain soil organic matter levels and soil structure; and
- they ensure that enough nutrients are available to different crops each year.

The importance of rotating crops was emphasized during the training on the inclusion of legumes in the rotation system. The farmers did not practice crop rotation in their farming systems. A list of crops were availed to them which included the cereals (maize, sorghum, millets, wheat), legumes (field beans, cowpeas, soyabeans, groundnuts, bambara nuts), tuber crops (irish potatoes, sweet potatoes, carrots and cassava), solanaceous crops (tomatoes, paprika & eggplant), curcubits (butternut, jam squash) and cash crops (cotton, tobacco). The farmers hinted that they were already growing most of the crops listed above but not following rotation and crop sequencing principles. The facilitator stressed the importance of including legumes in their farming system, and the roles they play in replenishing soil fertility and soil structure.

The farmers were already intercropping maize with cowpeas, field beans and pigeon peas but 30% of them were intercropping crops of the same family which include maize-millet intercrops. The facilitator discouraged this type of intercropping citing that the two crops being cropped together were both mining soil nutrients. The facilitator went on to give them an option using legumes as a second crop in intercrop since they replenished soil nutrients by its ability to fix nitrogen.

3.1.5 Weed Management

Topics covered during the theory session, by Slide show:

Definition of the weed, Characteristics of weeds, Weed identification of problematic weeds in CA, Effect of weeds on crops (% yield reduction), Weed Control Methods in CA (Chemical, Mechanical and Cultural), Calibration of knapsack sprayers (Nozzle selection, herbicide selection and calculations) and Practical on weed identification and calibration of knapsack sprayers.

Plate 14: Common weeds (i) *Cynodon dactylon*, (ii) Striga *asiatica* (Witch weed)

(i) Problem of Weeds

Weeds are a serious problem to crop production under smallholder farming conditions. Low grain yields obtained year after year in Southern Africa has been attributed to weed management problems in smallholder farming sector (Zimdahl, 1980). Delayed weed removal is the primary cause of maize yield loss in smallholder agriculture.

Weeds compete with crops for nutrients, water and space that all have negative effects on yields obtained at the end of the season (Shrestha *et al.*, 2002). Weed management in smallholder farmers have been basically practiced using mouldboard plough in families with access to draught power and through hand hoes in resource poor farmers (Siziba, 2008).

Loss of maize yield has been on gradual increase due to poor weed management practices at smallholder farms.

Uncontrolled weed growth reduces maize yields by between 34.5% and 96% in communal areas of Zimbabwe (Mabasa and Nyahunzvi 1985) The period when the crop should be free from weeds is relatively short i.e. 3 to 4 weeks after crop emergence depending on the type of weed and crop. Chivinge (1984) noted that farmers were not aware of the time when weeds affect the crop and they continue to weed even after the critical period.

Weeds producing seeds within a short period of time, these weeds are also capable of producing large numbers of seeds in this short period as shown in the shown below.

Table 5: Estimated Seed Production of Selected Weeds

Weed Species	**Number of Seeds Produced/plant**
Amaranthus hybridus (Pig weed)	235 000
Bidens Pilosa (Black jack)	3000 – 6 000
Eleusine indica(Rapoko grass)	50 000 – 135 000
Striga asiatica (Witch weed)	90 000 – 500 000

High seed numbers per plant under favourable conditions ensure that some of the seeds will survive control measures and natural adverse conditions to re-establish the weed in the following season.

(ii) Common Weed Control Practices

An integrated weed management/control approach is the best option in managing weeds in CA.

Crop rotations (facilitate weed suppression due to allelopathy), Early planting, Intercropping, Mulch, Chemical control and Other cultural practices are used to control weeds (Use correct plant population per hectare).

Preventive weed controls include:

- Avoiding seeding of weed so as to reduce the seed bank in the soil, using of well cured manure before use, cutting grass along contours and keeping the field edges clean, restricting animal movement since some of the weed seeds are fluffy (seed heads) and can easily carried away by animals. Cleaning farm machinery after use, destroying new weed patches and late weed control before harvesting or soon after harvesting.
- Use planting seed that is not contaminated by the weeds.

It is very important to have a weed management programme: (i) to enable proper weed identification as basis for control; (ii) have good knowledge of various methods of weed control; (iii) supported with knowledge of soil type; and (iv) track record of previous weed control method used.

(iii)Practical on Weed identification

- Farmers were requested to list and collect weeds that were problematic in their farming area and identification was done.
- Control method to the weeds was done for the different weed species.

Plate 15: A Training session on weed management, Sussundenga.

(iv) Herbicide Use in CA

Plate 16: Training and 'hands-on with Herbicide applications.

Most people fear herbicides because they lack confidence when using them and they are also afraid of using herbicides without making mistakes or causing phytotoxicity or completely destroying the crop. Herbicide choice depends on weed species to be controlled, so it's important to know your weeds and the weed spectrum of your field i.e. the three broad groups which are grasses, broadleaves and sedges.

Herbicide groups were discussed and these included, (a) *Pre-plant foliar applied non selective herbicides (b) Pre-emergence herbicides (c) Post emergence herbicides.*

Participants were urged to READ AND UNDERSTAND THE HERBICIDE LABEL WELL BEFORE USE or consult the Agricultural Technical officers in their areas.

3.1.6 Conservation Agriculture with Trees-CAWT (Agro forestry)

Topics covered under this subject were:

(i) Incorporation of Trees into farming Systems

CAWT/ EGA is defined by Garrity et al. (2010) as the integration of particular tree species into annual food crop systems. It has been emphasized by the same authors that the intercropped trees sustain a green cover on the land throughout the year,- maintaining (vegetative) soil cover as espoused in CA, bolster nutrient supply through nitrogen fixation and nutrient cycling, generate greater quantities of organic matter in soil surface residues, improve soil structure and water infiltration, increase greater direct production of food, fuel, fibre and income from products produced by the intercropped trees, enhance carbon storage both above-ground and below-ground, and induce more effective conservation of above- and below-ground biodiversity.

The participants were exposed to the concepts and practice of conservation agriculture with trees and they fully understand the compatibility of agro forestry with conservation agriculture especially where the Winter thorn Acacia - (*Faidherbia albida)* was shown to provide soil cover during the dry season because of its reverse or inverted phenology in addition to improved yields for crops growing under its canopy. The tree sheds its leaves during rainy season which makes it compatible with food crops as there is little or no shading. The two photos below exhibits how compatible the tree is with CA.

Plate 17: (i) *Faidherbia albida* in CA plot during dry season, and (ii) during the rainy season

(ii) Fertiliser trees

The participants were exposed to agro forestry soil fertility amelioration options such as improved tree fallows, alley or mixed cropping, relay cropping, biomass transfer and parkland system or dispersed intercropping. The following trees which include *Acacia angustissima*, *Cajanus cajan* (Pigeon pea), *Faidherbia albida*, *Gliricidia sepium, Leucaena spp*, *Sesbania sesban and Tephrosia vogelii* were pointed out as fertiliser trees which can be used by farmers. During this course, the farmers were trained on tree establishment, management and utilisation of the by-products from these trees in CA based systems. Successful examples from other fellow farmers in southern Africa particularly Zimbabwe was shared with the farmers. The farmers were advised to select from the list of options presented above which suit them and their farming community.

(iii) Tree-based fodder

Livestock problem has been cited as one of the challenges of adoption of CA by farmers in Southern Africa and other areas with agro-pastoral systems. The facilitator emphasised that livestock and CA are still compatible but proper management has to be put in place. Currently in Mozambique after crop harvest livestock are let loose to feed on crop residues. In a bid to address the challenge the author trained the farmers to establish tree fodder banks in their farming community (tree-based fodder technology). The session emphasised on reducing livestock crop conflicts by planting fodder trees. Since most AF tree species are multi-purpose the farmers were advised to use the above mentioned agro forestry tree species for livestock feed and other trees which they know. Aspects of harvesting and utilisation in relation to livestock feed were also highlighted.

Most of the AF tree species listed in sustainable soil replenishment have got the ability to produce large quantities of high-protein forage. It was highlighted that it can be used in combination with or as substitute for the commercial dairy meal. The facilitator wrapped the topic by saying "The trees grow all year round and for longer periods than grass, ensuring a continuous supply of good quality feed and other benefits which cannot be provided by grass, which include fuel wood, timber and stakes for supporting climbing crops".

(iv) Protection from livestock/boundaries

With the rampant deforestation in Southern Africa which is due to high demand of poles for constructing dead fences among smallholders and other uses such as fuel and timber, the facilitator trained farmers on live fencing. The author and the farmers discussed the criteria which can be used to select tree species to grow in their farms as live fences, which include the trees with thorns like *Dovyalis caffra and Ziziphus mauriatiana,* trees which can withstand harsh conditions or low rainfall like *Euphorbia tirucali* which can be mixed with *Moringa oleifera, Jatropha curcas* and some of the AF tree species mentioned above (*Cajanus cajan*, *Gliricidia sepium* and *F. albida*).

(v) Farmer Opportunities

1) Most of the trained farmers cannot afford to apply inorganic fertilisers consistently in their farming systems due to prohibitive prices.
2) The farmers are already using pigeon pea as fertiliser tree only so there is a need to expose them to a variety of other fertiliser trees.
3) Farmers have a problem in livestock feed especially during the dry season.
4) Farmers are using dead fence for protecting their crops from livestock which is not sustainable.
5) Mulch is scarce in their farming areas so tree leaves and use *F.albida* can be used as an alternative for soil cover.
6) Women travel long distances to catch fuel wood, however the use of agro forestry tree species at homestead can alleviate the burden of travelling long distances.
7) High rate of deforestation due to high demand of timber for construction and fuel wood.

3.1.7 Agronomic Practices

Topics covered on this subject:

(i) Farming practices

Farmers were introduced to two different farming practices namely Conventional and Conservation farming systems. Some advantages and disadvantages of the two systems were illustrated.

Table 6: A Comparative Analysis of the Two Systems

	Activity	Conventional Practice	CA Practice	Effects
1	Land preparation	Ploughs and hoes are used to turn the soil.	No turning of the soil but hoes and rippers are used for marking planting lines	Ploughing destroys the soil structure by loosening the soil, promotes soil erosion, promotes leaching of nutrients and CA improves soil structure.
2	Mulch	Burning of mulch to clear the fields	Mulch is left in the fields	Burning destroys the soil structure while mulching improves the soil structure
3	Rotations and intercropping	The plough is used for the activity	Rippers, Planters and hoes are used	Poor crop growth on ploughed plots while good crop growth on CA plots

(ii) Soil type

Farmers were advised to know their soil type, to understand the pH level of their soils.

(iii) Land Preparation

Farmers were advised to prepare their land in time from soon after harvest (winter weeding, marking out of field, mulch or crop residue management, manure or fertilizer application, compost making, planting, post plant weeding and top dressing) and this resulted in the following advantages, early planting, moisture retention and early weed control.

(iv) Planting of Maize/Soya beans and Requirements

Farmers were encouraged to use some standard planting methods, with illustrations from those used in Zimbabwe for guidance.

Table 7: Illustration of Inputs Requirements for Different Crops.

	Maize Requirements		Soya beans Requirements	
1	Seed	25 kg/ha	Seed	80-100kg/ha
2	Fertiliser, Compound D	200 kg/ha	Fertiliser, Compound D	200kg/ha
3	Fertiliser, Urea	100	Fertiliser	50kg/ha
4	Glyphosate	4 litres/ha	Shavit	1.5 litres/ha
5	Dipterex	4 litres/ha		
	Spacing	90cm by 50cm	Spacing	45cm by 5-7cm

(v) Compost Making

Compost is a key element in Conservation agriculture and helps a lot in improving the soil. The following materials are needed for compost making; dry grass, dry leaves, green plant materials, small twigs, water, animal manure, garden forks, four pegs 4m height, wheelbarrow, shovels, water buckets.

When making compost, farmers were advised to immense all the material for making compost in water and placed in one heap. Turning was to be done after every week up to two months.

(vi) Record keeping

Record keeping is a form of data capturing with the intention of monitoring, evaluation and future planning. Records help farmers to know the time for planting, fertilizers and quantities to use on specific plots, chemicals to use, amount of seed to use, type of seed to use, rainfall received per season and some yield obtained per unit area.

(vii) Rainfall records

Rainfall records are used for documenting rainfall patterns for a specific area and time. These results will enable a farmer to plan for the future, he/she will know the time for planting, crop selection and supplementary irrigation requirements if need be.

3.2 Practical Orientation

3.2.1 Preparing the Land for CA practices

(i) Demonstration Plot Layout

The Idea

Each lead farmer is tasked to establish a demonstration plot in their respective areas as farmer field school to the lead farmers themselves and the surrounding farmers.

The Layout

The treatments of each plot are indicated in diagram below.

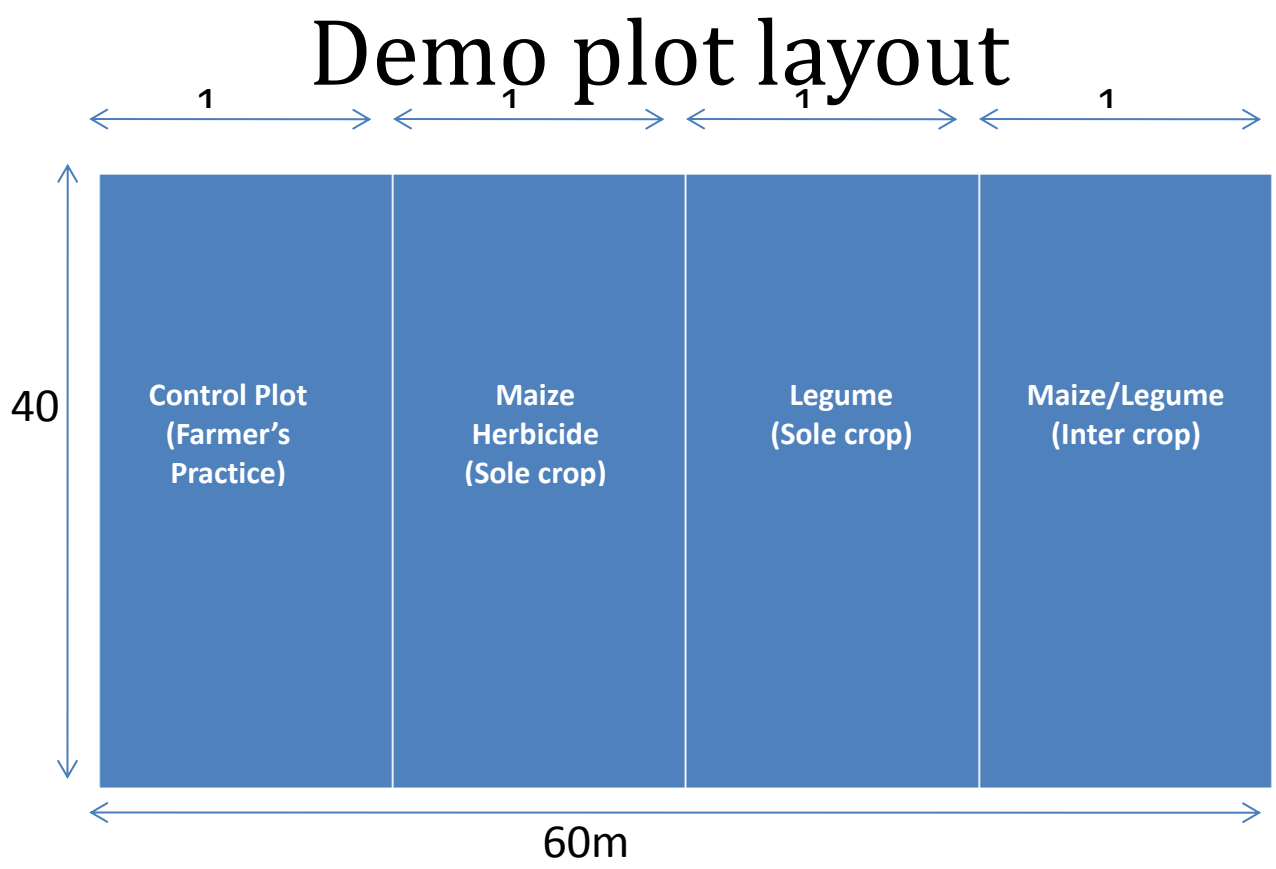

Plate 18: Characteristics of Each Demo plot

3.2.2 Minimum Soil Disturbance

1. **Tillage -** Definition and description of tillage was stated.
2. **Minimum Tillage -** A brief description of minimum tillage was covered which in it included definition in relation to conservation agriculture.

3. **Soil Pans -** This topic covered description of soil pans and their causes in land which are constantly ploughed season after season.
4. **Use of Mechanized equipment in minimum tillage -** The importance of using mechanized equipment was laid out giving reasons, minimum tillage equipment options were described their operation, maintenance and calibration.

Plate 19: (i) Hands-on assembling of equipment and (ii) Calibration tips

The ranges of available equipment which can be used in minimum tillage were stated. The ranges are Manually operated equipment (Li Seeder and Jab Planter), Animal Drawn equipment (Ripper and Direct Seeder) and Tractor operated equipment.

Plate 20: Emphasis, hands-on and dealing with challenges!

Tillage Field Demonstration Practicals - Practical field demonstrations on operation and setting for the available equipment were conducted on one lead farmer's plot.

Table 8: Observations and Recommendations on Tillage Aspects

AREA OF CONCERN	DISTRICTS			REMARKS/ RECOMMENDATIONS
	MANICA	SUSSUNDENGA	BARUÈ	
Tillage	Conventional tillage system used	Most farmers in this district have access to ADP.	Farmers in this district have limited access to ADP.	A conventional way of tillage (ploughing/digging) is being practiced in all districts.
Minimum Tillage	Practiced through conventional	Practiced in small plots around homesteads	Use of hoes is practiced	Farmers use basin system without fully incorporating all the CA principles.
Soil Pan	Noticed through J roots	Noticed through J roots	Noticed through J roots	Soil pans prevalent in most areas.
Use of mechanized equipment	Around 50% of the farmers use ox drawn ploughs	70 to 80% farmers have ox drawn equipment	Farmers with ox drawn ploughs less than 20%, while a few have NGO Jab planters	Farmers with equipment are using it incorrectly Training of animals (oxen) for draught purpose is required whilst animals are still young.

3.2.3 Weed Management

Calibration of Knapsack Sprayer:

- Special skills of calibration, mixing, and application of herbicides are required for anyone to confidently and effectively use herbicides. The demonstration was done.
- Herbicides have reduced the amount of human effort, misery and drudgery associated with hand weeding. Farmers routinely spent more than 75 % of their time hoe weeding battling to control weeds in the peak weeding period from December to February.

Calibration of the knapsack sprayer was done at Sussundenga. As for Manica and Baruè there were no practical Demos done since we failed to secure the herbicide nozzles.

4. MAJOR ISSUES

4.1 Training Focus Areas

Plate 21: Motto "Murimi aripo, munda uripo, rima ipapo, mari iripo"

ACT was delighted to work with UCAMA in the training of 48 Lead farmers from Manica, Sussundenga and Baruè districts of Manica province, Mozambique. The Training team had 4 basic thrusts: (i) to **concretise CA concepts** onto the participants; (ii) to **provide basic skills** in terms of dealing with the three principles, weed management, agro forestry and supportive CA agronomic practices; (iii) a **practical orientation** of participants to CA farming; and (iv) **an action plan** of what/how to do hereafter.

ACT would be willing to build this partnership beyond this training, in terms of monitoring/evaluation, networking, and continued capacity building in entrepreneurship technically and business-wise. We suggest a Memorandum of Understanding towards building a strong broad-based CA development.

4.2 Results

A total of 13 (6 Female, 7 Males) Lead farmers were trained in Manica together with 2 district extension officers and 5 UCAMA officers; 19 (7 Females, 12 Males) in Sussundenga and 1 district extension officer; and 16 (5 Females, 11 Males) in Baruè and 1 district extension officer were trained in the topics mentioned above. The training was also attended by the UCAMA President, the Project Coordinator and 1 Government extension officer each for the three districts. An extra officer for Manica district attended as well. Lead Farmer attendance was 96%.

The participants were tasked to establish learning demo plots of 60 m x 40 m each to be sub-divided into 4 equi-size sub-plots (15 m x 40 m each) on which to practise current farmer practice (plot 1), maize under CA (plot 2), a legume under CA (plot 3) and a CA maize/legume intercrop (plot 4).

Each association was tasked to develop an action plan to guide implementation of their activities. The plan for Manica needs to be sharpened, while for the other districts they required 'fine-tuning'. Management was encouraged to develop a support action plan of backstopping and follow ups.

Each Lead Farmer will receive a copy of the presentations made in Shona including additional notes.

4.3 Issues of Immediate Concern (Develop Action plan)

(i) Immediate tasks:

1) Good selection of demo plots, and proper management – follow and support Lead farmers' action plans.

2) Immediate soil sampling and analysis of each Lead Farmers demo plot soils. Find out and follow up what is possible.

3) Purchase of farm inputs – such as seed, fertilizer, herbicides, pesticides, protective wear, etc.

4) Purchase of recommended 'Jacto' knapsack sprayers with appropriate weed control nozzles, and with appropriate herbicides.

5) Need for rainfall records! The team observed a need for procurement of some rain gauges, at least one per association, among the trained Lead farmers.

6) A need to capacitate extension staff in selected technical skills especially calibration of equipment and herbicide weed control.

(ii) Tasks to be followed:

7) Development of a Backstopping/follow ups plan by management, especially the Technical Coordination office on Lead Farmer activities that can be shared with ACT.

8) Allow farmers to develop Coordinator's working plan periodically.

9) Build an experienced CA-proactive extension facilitation that can initially collaborate and be supported by extension system.

10) Monitoring and backstopping by the Training Team.

(iii) Other Supportive Tasks:

11) Need for re-training of animals for ADP.

12) Emphasis on record keeping.

13) The Coordinator this season must spend at least 60% of his time in the field among Lead farmers 'facilitating,' and not giving commands!

14) A need to capacitate extension staff first and the Lead farmers in facilitation skills, and entrepreneurship.

5. WAY FORWARD

The team proposes assigning of 1 person/district to monitor implementation of some of activities.

Stage of Monitoring	Activity	Who	How
1	Land preparation	Local Extension, Coordinator	Follow ups, may have to pay to entice them to be pro-active, emphasising on reporting/incentive
2	Planting/mulching	Team member, 1 per district; Coordinator	Backstopping
3	Weeding & scouting pests/diseases/fertilization (After crop emergence)	Team member, 1 per district; Coordinator	Backstopping
4	Weeding & scouting (After 2-3 weeks of 3 above)	Local Extension; Coordinator	Follow ups, see 1 above
5	Holding Field day	All Team members, All Local Extension' All LFs; Coordinator	
6	Harvesting	Team member, 1 per district; Coordinator	Backstopping
7	Monitoring/Follow ups – Local team	Local Extension; Coordinator	Follow ups
8	Evaluation of Results (i) Team (ii) With Lead Farmers + Local Extension (iii) Management	Team members Representative Coordinator	
9	Lead Facilitator – Monitoring all stages	ACT, UCAMA Coordinator	Monitoring

6. COURSE EVALUATION

This section highlights on what transpired during the onset of the training up to the completion of the training. It tries to highlight the course logistics that is the planning and the measures taken to do the training, course facilities which included all the equipment used for the training with the inclusion of venues used.

6.1 Course Logistics

It all started in Harare when ACT engaged 6 participants to go and conduct training on Conservation Agriculture in Mozambique. A planning meeting was done and each participant was given some topics to present depending on areas of specialisation. During the planning meeting, the requirements for the training were listed and some of the equipment to be purchased by one of the implementers in Mozambique (UCAMA). Planning was a success. Time for starting and finishing some presentations was properly allocated although in future more time should be allocated to practical especially when dealing with farmers.

- Transportation of participants to Mozambique was also done well but emphasis of an on vehicle was given to avoid hiring of a vehicle.
- Transportation of participants in Mozambique from one point to another was badly done, they were delays which resulted in demonstrations being conducted late and this problem occurred in Manica and Baruè districts.
- Stationery for farmers was availed in time in all districts that is books and pens
- Some of the equipment for Demonstrations were not available example correct sprayers and Jab planters; this resulted in the team failing to conduct some demonstrations.
- All of the sites for demonstrations were badly selected so it took time to prepare them.
- There were problems of electricity in Sussundenga so the use of a power point on presentation was difficult.
- Accommodation in all areas was fairly ok.
- Arrangements which enabled farmers to be at the training venue in time were properly conducted.
- Presents of technical personnel during training was limited.

6.2 Course Facilities

- The training venue in Manica was nicely selected.
- They were problems of toilets at a training venue in Sussundenga
- The training venue in Baruè was not all that badly selected.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

(i) Weed Management

1. Appropriate durable sprayers and protective clothing should be bought for the demonstrations and availed to the farmers.
2. Technical and Government Agriculture officers to be grilled on calibration of knapsack sprayers and the calculations to be emphasised.
3. Farmers need regular visits.

(ii) Agronomic Practices

4. The training process was a success but generally the time allocation for the training was a little bit compacted, farmers were given more work in a short space of time. In addition, the literacy level of all the farmers was low and some frequent visits are needed to check whether the farmers are performing well.
5. The training was a success and the objectives were achieved in the agreed stipulated time.

(iii) Crop Rotations/Associations

6. Overally the farmers understood the importance of rotating crops, inclusion of legumes as sole crop or a second crop in intercropping.

7.2 Recommendations

Topic	Recommendations
Conservation agriculture with trees/Agro forestry	• Capacity building of lead farmers in Agro forestry tree nursery establishment and management. • Sourcing of agro forestry tree seeds for sustainable soil fertility replenishment, soil cover, live fence and fodder for livestock. • Establishment of at least three agro forestry tree nurseries at each district site. • Follow-up (M&E) on tree planting and utilization in CA based farming systems.
Crop Rotation and Crop Sequencing	• Farmers to include a legume crop in their rotations/farming system. • Farmers must be encouraged to have a cereal- legume intercrop. • Farmers encouraged not growing same type of crops season by season by season like what they used to do.

Minimum Tillage	• Use of animal drawn equipment in Manica and Sussundenga is highly recommended as most farmers there have access to animal draught power. • Technical back up in form of follow ups required in all areas as aspects of calibration need constant check up. • Technical staff to calibrate and set planter equipment before farmers use them in their demo plots. • Training of animals for draught purposes required to produce straight furrows by all farmers • Farmers to make the recommended yokes sizes to suit the required inter row spacing • Manually operated equipment recommended to be used in Baruè district as there is limited animal draught power access. • Capacity building of government extension personnel necessary as they will be always in contact with the farmers. • UCAMA to make necessary arrangements for farmers to access various types of equipment (from reputable manufacturers) to be used in conservation agriculture.
Permanent Soil cover	• Use of cover crops should be used as mulch for example cowpea. • Mulch should be harvested and stored in Krebs. • Where possible farmers need to avoid use of fire • Trees should be used as mulch on rotational purposes. • Alley cropping practice should be used as soil cover. • Tree seeds and seedlings should be provided. • Cutting of trees is discouraged.
Agronomic Practices	• Farmers should use certified seed for planting with a total of 6kg per farmer on their demonstration plots. (300kg for all the lead farmers) • Farmers should be given a total of 2kg cowpea per lead farmer. (100kg cowpea for all demonstration plots) • Basal fertilizer, a total of 2500kg of compound D fertilizer should be given to 50 farmers with one 50kg bag per lead farmer. • Top dressing, a total of 1750kg of Urea should be purchased and given to lead farmers (25kg per lead farmer) • 50 litres of herbicide with each lead farmer having an allocation of 1 litre. • Carbaryl with a total quantity of 50kg, each lead farmer having an allocation of 1kg. Lambda 25 litres each lead farmer having an allocation of 500ml. • Farmers should prepare their plots early by October. • Chosen implements on CA plots should be used.
Weed management	• The sites need a pre-plant non-selective herbicide to control weeds before planting. Glyphosate to be used low rates in sands and high rates on clays and also depending on the height of weeds.

	• Pre-emergence herbicides to be used on sites that have high clay content.(Manica may not use the pre-emergence herbicides because of the soil type; sands) • Intercropped plots to be hand weeded. • Technical people need to be trained on the calibration of the sprayer so as to assist the farmers in calibration as a matter of urgency. • Soils to be analysed as soon as possible to correct the pH of the soil. • All sites need to be visited so as to make a physical check on the soil type so as to make recommendation on use of pre-emergence herbicides on different soil types. • Regular visits to the site for advice to the farmers. • Technical staff to be there during the spraying and do the calculations for the farmers.
Required CA Implements	i. Manual-based Implements: a. 7 Chaka hoes b. 4 Jab planters c. 4 Lee Seeders d. 4 Jacto knapsack sprayers ii. ADP-based Implements: a. 4 Magoye rippers, complete with housing; 4 Zim plow subsoilers, 4 Zimplow BSPs b. 4 Zim plow Direct Seeders or 4 Fitalleri Direct Seeders c. 4 Three-nozzle Jacto sprayers (manual-based) iii. Other Equipment: a. 4 measuring cylinders (1000 mls) b. 4 plastic buckets (8-10 litres) c. 4 tape measures (50 or 100 m) d. 4 balance scales e. 4 tie strings f. 4 planting chains
General Recommendations	• The training of trainers in CA and emphasis on calibration of CA equipment (Direct seeder, Jab planter, Ripper, Knapsack sprayer) • There is need to have close monitoring CA demo plots in all three districts by the technical staff and the trainers. • In future selection of farmers should not be biased for example avoiding two members from one family, farmers who are able to perform, energetic and influential in their communities. • Soils from demonstration sites should be sampled, analysed and come up with proper recommendations. • Purchasing of inputs and equipment should be only from reputable companies. • Fertilizers and seed should be distributed to farmers in time.

	• Land preparation and weeding should commence in time. • Farmers to harvest mulch sooner. • Burning should be discouraged. • Each farmer should produce a compost in the coming season. • Intercropping measures should be done on CA plots. • Ploughing to be done on a check plot. • Farmers should change the way they have been farming and concentrate on CA methods. • Records keeping should be a priority for all farmers. • We encourage a farmer field exposure during the season to Zimbabwe.

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ANNEX 1: ACTION PLANS FOR FARMERS IN THREE DISTRICT OF MANICA PROVINCE, MOZAMBIQUE

(1) Manica District

(i) Mabasa Pamberi Association

ACTIVITY	WHO	WHEN
To meet every Friday for all operations	Group	2013-2014 Summer season
Use of Ripper	Group	Oct 2013-Jan 2014
Herbicide	Group	2013-2014 Summer season
Technical assistance & provision of seed, fertiliser & herbicide	UCAMA & Government extension	2013-2014 Summer season
Planting maize, pigeon pea, soyabeans, beans, cowpeas & other agro forestry trees	Group	Oct 2013-Jan 2014

(ii) Tariro Association

Establishing 0.25ha demonstration plots	Individual	Oct 2013-Jan 2014
Use of ripper	Individual	Oct 2013-Jan 2014
Technical assistance & provision of seed, fertiliser , herbicide & knapsack sprayer	UCAMA & Government extension	2013-2014 Summer season
Planting maize, soyabeans, beans & cowpeas	Individual	Oct 2013-Jan 2014

(2) Sussundenga District

(i) Nyambamba Association

ACTIVITY	WHO	WHEN
Mulch gathering	Albertina Bhasketi	22 Oct 2013
Ripping		Nov 2013
Planting maize & legumes		11 Nov-Dec 2013
Mulch gathering	Aderio	21 Nov 2013
Direct seeder		Nov-Dec 2013
Planting maize & legumes		11 Nov-Dec 2013
Planting cowpeas		01 Dec 2013
Measuring & marking demo plot	Isabelo	21 Oct 2013
Mulch gathering		22 Oct 2013
Maize planting		28 Oct 2013
Planting pigeon peas		11 Nov

Planting cowpea		1 Jan 2014
Measuring & marking demo plot	Chenjerai Rangsi	21 Oct 2013
Ripping		25 Oct 2014
Mulch gathering		22 Oct 2013
Maize planting		28 Oct 2013
Planting pigeon peas		11 Nov 2013
Planting cowpea		01 Jan 2014
Land clearing	Paradzai	20 Oct 2013
Measuring & marking		21 Oct 2013
Mulch gathering		22 Oct 2013
Maize planting		28 Oct 2013
Planting pigeon peas		11 Nov 2013
Planting cowpeas		01 Jan 2013
Land clearing	Simon	20 Oct 2013
Measuring & marking demo plot		21 Oct 2013
Mulch gathering		22 Oct
Ripping		25 Oct 2013
Planting maize		28 Oct 2013
Planting pigeon peas		11 Nov 2013
Planting cowpeas		1 Jan 2014

(ii) February Association

Making pegs	Individual	15 Oct 2013
Measuring & marking	Group	16-19 Oct 2013
Conventional ploughing	Group	21 Oct 2013

NB: Crops to be grown include-maize, cowpea

Implements to be used by group members include: 3 Ripper, 3 Li seeder & 1 Direct seeder

(iii) Matimati Association

ACTIVITY	WHO	WHEN
Land clearing	Group	17 Oct 2013
Measuring & marking	Group	16 Oct 2013
Mulching	Group	23 Oct 2013
Planting & herbicide application	Group & Technical	15 Nov 2013

NB: Crops to be grown, maize, maize-cowpea intercrop, sole cowpea

Implements to be used: 3 Ripper, 3 Direct seeder

(3) BARUÈ DISTRICT

(i) Kufuma Ishungu Association

ACTIVITY	WHO	WHEN
Land preparation	Group	25 Oct 2013
Weeding	Individual	25 Oct 2013-June 2014
Planting	Group	15 Nov 2013
Work coordination	Group leader	Oct 2013-June 2014

NB: Implements to be used:
3 Li seeder, 1 Jab planter & 1 Direct seeder

(ii) Chichiri Kubata Chako Association

Marking & pegging	**Moffat**	21 Oct 2013
Ripping	Group work	-
Ploughing	Group work	-
Coordination of activities	Union Leader	-
Marking & pegging	**Peter**	21 Oct 2013
Direct seeder	Group work	
Ploughing	Group work	
Coordination of activities	Union Leader	
Marking & pegging	**Elizabeth**	21 Oct 2013
Direct seeder	Group	-
Ploughing	Group	-
Coordination of activities	Union Leader	-
		-
Marking & pegging	**Zhorise Vortada**	2-2 Oct 2013
Ripping	Group	-
Ploughing	Group	-
Coordination of activities	Union Leader	-
Li seeder	**Josphat**	22 Oct 2013
Marking & pegging	Group	-
Ploughing	Group	-
Coordination of activities	Union Leader	-

NB: Crops to be grown include maize, soya, pigeon peas, maize-soya/cowpea intercrop

(iii) Kurima Kwakanaka Association (Tito Zhuwawo-Group Leader)

Land preparation	Individual	18-28 Oct 2013
& pegging	Individual	-
Technical assistance	UCAMA	-

NB: implements to be used 3 Direct seeders, 2 Rippers & 1 Li seeder

Crops to be grown include maize, soyabeans, pigeon peas & beans

(4) UCAMA Group

Coordinate activities	UCAMA	2013-2014 Summer season
Training of supervisors & extension staff	UCAMA	2013-2014 Summer season
Providing protocols for demonstrations to each farmer	Coordinator	Nov-Dec 2013
Purchase of inputs & implements	UCAMA	Oct-Dec 2013
Organising at least one meeting per week	UCAMA technical	2013-2014 Summer season
Organising field days, exchange visits & shows	UCAMA, Farmers & Backstopping team	Dec 2013-June 2014

ANNEX 2: LIST OF PARTICIPANTS

1) Manica District

	Name	Gender	Contact	Institution
1	Maria Alves Queche	F	862559195	Machipanda
2	Alice Zacarias	F	866815724	Manhene
3	Filipa Joao	F	821662009	Chinhamacungo
4	Beauty Karumbidza	F	862582716	Machipanda
5	Emilia Francisco Jo	F	825218964	Chinhamacungo
6	Zeca Vasco Tomo	F?	821727253	Chinhamacungo
7	Razaro Muquete	M		Chinhamacungo
8	Daniel Raimundo	M	863333461	Manhene
9	Bento Tauro	M	824280364	UDAC
10	Marcos Jolamo	M	861589210	Chinhamacungo
11	Pita Pacanate	M	825221492	UDAC
12	David Arissome	M	828492160	Chinhamacungo
13	Roberto Jeremia	M	867772296	Sahwira
	Others:			
14	Manyewu Mutamba	M		SACAU
15	Jose Basquete	M	822955460	UCAMA
16	Norberto Simbe	M	826124137	UCAMA Project Coordinator
17	Vasco Fazenda	M	822429600	UCAMA
18	David Rafael	M	820940751	UCAMA
19	Zacarios Vasco	M	825180244	UCAMA
20	Isac M. Candreiso	M	823847122	SDAE - Manica
21	Antion Miguel Fejo	M	825436450	SDAE - Manica

2) Sussundenga District

	Name	Gender	Contact	Institution
1	Domingos Michone	M	863728657	Matimati
2	Rita Comboni	F		Matimati
3	Arminda Bassiquete	F	821365008	3 de Fevereiro
4	Sebastiao M. Quirambo	M	866593859	3 de Fevereiro
5	Febi Massimo	F		3 de Fevereiro
6	Betina Bassiquete	F		Nhambamba
7	Roseta Campira	F	821360326	3 de Fevereiro
8	Pedro Franque Mucondo	M	865727693	3 de Fevereiro
9	Paulina Augusto Vurande	F	827516226	UDC- Sussundenga
10	Lazaro Domingos	M	827378441	3 de Fevereiro
11	Armando Feniasse	M	866544760	Matimati
12	Filipe Castom	M	862777629	Matimati
13	Saimone Chissano	M	826541885	Nhambamba
14	Luis Paradzai Juga	M		Nhambamba
15	Chenjerai Munguma	M	821633640	Nhambamba
16	Lucos Matas	M	863363271	Matimati
17	Antonio Basquete	M	828110328	Nhambamba
18	Mario J. Filote Soquisso	M	861264764	UDAC
19	Aderia Andicemve	F		Nhambamba
	Extension Department:			
20	Rosario Casungaidze Filipe	M	827492433	SDAE - Sussundenga

3) Baruè District

	Name	Gender	Contact	Location
1	Antonio Fernando	M	823860711	VDAC 13, Baruè
2	Mofate Diquissoni Madziwa	M	827433935	Phanze, Baruè
3	Jorge Vontade	M	868182287	Uriri, Phanzi
4	Jeraldo Felipe	M		Honde criz
5	Encio Tiqui Timane	M	863699376	Honde criz
6	Antonio Carlos	M		Catandica
7	Eliza Cossi	F	868171483	Katio, Baruè
8	Esitefane Taimo	M?	829559739	Honde
9	Sessiria Timoti	F	863683237	Malomwe
10	Enesta Bacacheza	F?	863703957	Malomwe
11	Nelia Francisco	F		Membro
12	Tito Joao Crosse	M	862316680	Honde
13	Ana Nherezerani	F		Honde
14	Edmore Pita Dupwa	M	868167398	Phanzi, Honde
15	Jossefate Ofice Sagoro	M		Phanze, Honde
16	Alberto Namipunzi Sande	M	862490502	Malomwe
	Extension Department:			
17	Felizardo C. Chicoche	M	825442340	SDAE - Baruè

ANNEX 3: TRAINING PROGRAMME

Day 1

Time	Topic No	Topic	Emphasis	Responsible
0800-0900	I	Introductions/Ground Rules/Expectations		EMag/MM
0900-1030	II	Situational Analysis Group Work (2)		EMag/MM
1030-1100		Health Break		
1100-1230	III	Situational Analysis Presentations		MM/EMag
1230-1330		Lunch		
1330-1500	V	What is CA, its principles		HM
1500-1530		Health Break		
1530-1700	VII	Tillage	1) Minimal/Zero 2) Hardpans 3) Soils; 4) Soil Analysis	KM

Day 2

Time	Topic No	Topic	Emphasis	Responsible
0800-0930	VIII	Soil Cover	1) 'Permanent' 2) Dry cover (crop residue management, mulching) 3) Green cover (intercropping, alley cropping, relay cropping) 3) Crop/Livestock conflicts 4) Termites/burning	EMag, HM
0930-1030	IX	Crop Rotations/ Associations	1) Tree/Crop/ Livestock Integration 2) Rotations 3) Associations	MM
1030-1100		Health Break		
1130-1315	X	CA-Related Agro forestry practices (CAWT)	1) Nursery establishment 2) Tree estalishment & management 3) Utilisation of by-products from AF trees	MM
1315-1400		Lunch		
1400-1600	XI	Weed Management		EM
1600-1630		Health Break		
1630-1730	XII	Agronomic Practices	1) Change of mindset 2) Pests & Diseases 3) Compost making	EMag

Day 3: Demonstrations and Practicals

Time	Topic No	Topic	Emphasis	Responsible
0800-1130	XII	Appropriate CA Equipment	1) Land preparation 2) Weeding	KM, EMag, EM
1130-1300	XIII	Demos/Layouts/ Record Keeping		EMag, HM, EM
1400-1630		Action Planning & Evaluation		HM

ANNEX 4: LIST OF TRAINERS/MANAGEMENT

Left to Right: UCAMA President (José Basquete); SACAU Coordinator (Dr. Manyewu Matamba) and ACT Coordinator (Herbert M. Mwanza).

Seated on chairs - back row (left to right):

Herbert M. Mwanza Land Management Specialist/Team Leader

Eunice Mangosho Weed Specialist

Kefasi Murira Agricultural Engineer

José Basquete President, UCAMA

Seated on ground (left to right):

Misheck Musokwa Agro forestry Specialist

Nolberto Simbe Project Coordinator, UCAMA

Evans Magamha Field Technician