

**CONSERVATION AGRICULTURE TRAINING OF TRAINERS
(KAPSLM TAITA TAVETA CATCHMENT AREA SERVICE
PROVIDERS) AT THE SCRIPTURES CENTER VOI, TAITA
TAVETA ON 26TH – 30TH AUGUST, 2014**



Training participants Taken through field practical & CA equipment demonstration session by Mutai W. (ACT)

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LIST OF ABBREVIATIONS

CA	Conservation Agriculture
ACT	African Conservation Tillage Network
KAPP	Kenya Agricultural Productivity Programme
KAPSLMP	Kenya Agricultural Productivity and Sustainable Land Management Programme
PAD	Project Appraisal Document
MDGs	Millennium Development Goals
GDP	Gross Domestic Product
CAC	Catchment Area Coordinator
C	Carbon
N	Nitrogen
NH ₃	Ammonia
VISION 2030	Government of Kenya Economic Blueprint (dubbed)

1.0 INTRODUCTION

The Kenya Agricultural Productivity and Sustainable Land Management (**KAPSLM**) Project is a Kenya Government Project supported by the World Bank through a Global Environment Facility (GEF) grant and implemented in 9 Counties under Kinale-Kikuyu, Taita-Taveta and Cherangany hills catchments areas (127 Micro-catchments). It is responsive to the limited success in the country's efforts to address land degradation. The project is promoting sustainable use of natural resources for higher productivity and increased incomes for small scale farmers. It is also focusing on the maintenance of critical ecosystem functions in degraded and fragile environments.

The development objective of KASLMP is to facilitate agricultural producers in the three catchments areas to adopt environmentally sound land management practices without reducing their incomes. Its global environment objective is to reduce and mitigate land degradation in the three catchments to contribute to maintenance of critical ecosystem functions and structures. The three catchments are important water towers but are facing challenges of high erosion and land degradation; factors that are closely linked to poor and unsustainable farming practices as well as high poverty levels.

The project works with rural communities in three catchment areas and it involves service providers drawn from the private sector and various relevant government departments at catchment level to implement its planned activities collectively with the targeted project's beneficiaries on the ground. Among the technologies KAPSLMP has earmarked to be introduced in the catchment area is conservation agriculture with the intention of having farmers produce food in an environmental friendly way whilst taking care of the fragile ecosystems and sustaining production for economic development.

It is under this background that Africa Conservation Tillage Network (ACT) was engaged to facilitate and train services providers (TOT) on Conservation agriculture for the three catchments areas (project sites). Based on the reconnaissance prior to the trainings, CA has great potential in regions as it can minimum excessive soil erosion, enhance biodiversity regeneration, produce stable yields and reduce labour requirements. It also increases farmers' resilience to adapt and mitigate effects of climate change. The objective of the training was to enhance understanding of the principles of resource-saving and sustainable agricultural technology (Conservation Agriculture) as the new way to farm; to provide practical knowledge and skills in the application of sustainable agriculture practices for different socioeconomic and agro-ecological environments in Kenya's water towers and enable Service Providers to respond competently to sustainability and productivity needs of farmers as well as strengthen the competency of the service providers to facilitate learning of conservation Agriculture technology to potential support staff (extension) and farmers. The training was done for Taita - Taveta Catchment area's service providers in Voi at the Scripture Centre on 26-30th August, 2014.

Notably, at the beginning of each day, previous day's committee members could give a recap of what transpired previously and checked the minds of the participants to comprehend the course discourse.

2.0 DAY 1: TRAINING PROCEEDINGS:

2.1. Setting the stage for the training.

The training started with the introduction of the participants with Mr. Haro being the moderator at the session. The participants were then engaged by Mrs. Jane Ngugi to express their anticipations and expectations from the course; each trainee wrote his or her expectations. These were later consolidated to produce the final summary of trainee's expectations. In a nutshell, trainees expected to:

- ✓ Know what is conservation agriculture (its agronomic principles), and its implications.
- ✓ Sources of equipment to enable one practice conservation agriculture
- ✓ Application of CA in Taita Taveta catchment
- ✓ Incorporation of CA in KAPSLMP
- ✓ Animal drawn CA equipment and Draught animal harnessing
- ✓ Relations between environment conservation and conservation agriculture
- ✓ Get hands-on experience in handling the equipment and doing CA practices during the practicals
- ✓ Certification after the course (Certificates)
- ✓ Know more on soil improvement strategies
- ✓ How CA relation to MDGs and VISION 3020
- ✓ Sharing experience on practices of CA.

Other than stating the expectations, through the moderation of Mr. Peter Kuria, the trainees set ground rules and stipulate the possible penalties. In addition, four Committees were formed and each tasked to coordinate and supervise different days' activities. All these were purposed to ensure smooth training sessions and improve the participation of the trainees.

Later, in brief, Mr. Kuria went ahead to outline the course objectives, content and outputs as well as brief review of the programme.

The main objectives of the course included:

- ✓ To understand the principles of conservation agriculture as a new way of farming.
- ✓ To provide practical knowledge and skills in the application of conservation agriculture principles.
- ✓ To strengthen the competence of the participants to facilitate learning.

At the end of the training, participants were expected to have basic understanding of CA and to give input to the development of individual consortium action plans aimed at facilitating effective introduction and implementation micro-catchments levels demonstration trials geared

towards introducing CA technology and other climate change adaptive technology in the region of catchment areas they are operating in.

In particular, at the end of the course the participants were expected to be able:

- ✓ Explain and demonstrate to other the concept of conservation agriculture
- ✓ Guide farmers and other stakeholders in practicing CA
- ✓ Plan and facilitate farmers

Meanings and differences of different terms that refer to conservation agriculture were also highlighted and the participants were made to understand it in the various schools of thought.

2.2. Official opening of the training

The training event was officially opened by Eng. James Njuki, who begun by expressing his gratitude to ACT team for the organization of the training, the County Service Unit for the logistical preparation towards the training and the participants for the usual and excellent turn up. He expresses his hope that the huge enthusiasm was driven by the need to learn CA and improve the livelihoods of the people under our whims in service.

Outlining the prime intention of the workshop, Eng. Njuki reiterated that it is purposed to capacity build trainers who are supposed to cascade this knowledge and skills to the grass-root partners and the communities in the micro-catchments. It is also for the members of the County Technical Teams to enhance their capacities on CA to be able to provide technical backstopping to extension staff. We are not here to create awareness that has been done by the media and others. This is serious business. This is part of the series of training of trainers courses that are being done to address the capacities of service providers to address issues of sustainable land management. It adds to the other courses that were carried out including sustainable land management, Gender etc. we regard it as an incremental training to what you have been training.



Plate 1: Eng. J Njuki presenting his brief opening remark at the official opening of the training

Notably, the workshop is a bit different in that we are getting the support of the African Conservation Tillage Network (ACT) to carry out the capacity building. ACT is a Pan African organization that is experienced in conservation agriculture and has carried similar training for other organizations within the country. We want to thank them for that, he explained.

The need for this workshop comes from the content of the draft Training Need Assessment report in which the service providers have expressed CA as a priority in terms of training

required. Conservation Farming was also stated in the Aide memoir as priority training if issues of climate change have to be addressed. The training also has a bearing in meeting the Global Development Objective in the Project Appraisal Document

Conservation agriculture, as a conservation farming system has great potential in Africa as it can control erosion, enhance biodiversity regeneration, produce stable yields, and reduce labour requirements. It is also associated with adaptation and mitigation of climate change. The most critical thing is the ability of the farming system to reduce land degradation. Land degradation has a great impact on Countries National Economies. Studies in other countries indicate that land degradation cause reduction of GDP to the tune of 5%. The greatest challenge to mitigation of land degradation remains on how to persuade people to adopt mitigation methods. It is important that service providers focus on addressing and changing the behavioral patterns that lead to land degradation.

- *Land users must receive direct benefits from preventing or mitigating land degradation.* Empirical evidence shows that land users are more likely to prevent or mitigate land degradation when they benefit directly from the necessary investments and when those benefits outweigh the benefits of continuing current practices that degrade the land.
- *Access to rural services is key to increasing benefits from investment in land management.* Access to rural roads, extension services, communication infrastructure, markets, and other rural services helps increase returns on land investments since these rural services link land users to markets and reduce transaction costs.
- *Integrated local, national, and international institutions and policies increase land investments*

One opportunity that the area has is the water resource which is abundant in this area. As we discuss other opportunities available through CA, let us engage with these professional to come up with local prescription for our farmers.

2.3. Presentation on what is and why conservation agriculture; the principles of conservation Agriculture (Minimum soil disturbance & Soil cover)

This presentation was facilitated by Mr. Peter Kuria, who took the participants through the history of conservation agriculture, how it started and how it has evolved over time. He cited the kind of farming system in early days considered primitive was surely what is called CA currently. In America, the concept was adopted in 1930s after the dust blown by wind increased and people started mechanizing agriculture. The country has moved steadily with use of this environment friendly way of farming to become the world's largest food producer it is today.

On the issues of Why Africa has failed to feed its people: Peter illustrated that Africa remains the only continent where per capita food production has declined over the last four decades. Environmental degradation coupled with HIV/AIDS and malaria pandemics compromise productivity of the African smallholder farming systems. More often than not, small scale

farmers face recurrent droughts and crop failures in the abnormal weather patterns that are as a result of climate change. Unusual heavy downpours are followed by prolonged droughts and inconsistent rainfall patterns usually with low moisture supply. Moreover, Conventional tillage systems often leave behind a heavily pulverized soil of low organic matter and poor structure. The said soils are easily carried off by the erosive rains and increasing wind velocities due to low tree vegetation in agricultural areas. Poor water infiltration rate as a result of soil compaction pave way for increased surface volumes of runoff that are not easily tamed and result to massive soil loss through erosion. In farmlands, 1mm layer of soil lost would translate to several tonnes per acre/hectare. Soil inversion has led to loss of sequestered carbon and nitrogen to the atmosphere and adding to the greenhouse effect.

Having set the background, Peter went on to introduce **Conservation agriculture technology**, as a farming concept that promotes efficient input use and increases long term productivity of land and water resources. These objectives are achieved through the application, in combination with other good agronomic practices, of the following three principles; *the principle of Minimum soil disturbance* which involves reducing the number of till operations in our farmlands, it helps the buildup of soil organic matter which in turn increases carbon sequestration and maintenance of improves soil structure and soil health including biodiversity. It also improves water infiltration and reduces exposure of soil to erosion and runoff; *the principle of Permanent soil cover* which involves establishing either live or dead organic cover to protects soil from erosion, extreme temperatures and fluctuations. This also improves soil moisture retention by reduced evaporation. Source of organic matter and suppresses weeds by blocking sunlight; *and finally the principle of crop rotation and associations* which emphasizes crop diversification to avoid build up pest and diseases, total crop failure and improves soil fertility through nitrogen fixation by legumes and microbes as well as extraction of nutrients from different soil depths by achieving biological tillage by roots and enhances water infiltration and percolation.

Among the beneficial practices that CA favors in improving productivity and conserving the environment are agro-forestry, use of improved seed, proper management of fertilizers and pesticides. Agro forestry trees such as *Faidherbia albida*, *Leucaena leucocephala*, and *Calliandra sp.* are beneficial to the soil as well as livestock. Use of leguminous cover crops such as *Dolichos lablab* and pigeon peas is key to soil regeneration and in achieving the CA agronomic principle of permanent soil cover especially during the dry periods when temperatures are high.

Finally Peter highlighted some of the challenges experienced in promotion and adoption of CA with the intention to prepare learners to the reality. These challenges included: *fixed mindset; Other competing use of crop residues; Weed control; existing land tenure systems; poor adaptation of CA within local conditions and Poor government policy support*

2.4. Presentation on soil health

This presentation was handled in two parts; the first presentation from Mr. Weldone Mutai and the second presentation from Mr. Paul Wamae.

Mr. Mutai started by introducing why soil healthy, discuss the aspects of basic soil science; soil components; soil properties and how practice of CA influence the three types of soil properties constituents. He illustrated the aspects of soil structure, soil pH, and the flora and fauna that are contained in the soil as the components that determine the state of soil as healthy or degraded.

He emphasized that for the soil to be in a healthy state: It must be able to support healthy plants



Plate 2: Mr. Mutai presenting the topic on soil health and effects of CA on soil properties & fertility

and animals; the soil must be able to sustain production and it must be able to retain and release nutrients to the plants when needed. According to him, soil health can be addressed through; reduction in soil erosion; increase fertility; improve structure and minimize soil crust in. Soil health is linked to crop performance through improved properties. This presentation went on to illustrate various effects of CA on physical, chemical and biological properties of soil and how are these effects related to functional status of the soil in maintaining plant materials that results in improved crop yields.

On his part, Mr. Wamae further talked about the common sources of soil cover with a more emphasis on leguminous cover crops for nitrogen fixation in the N depleted soils. The various microbes that are involved in the processes on nitrogen transformation from organic to inorganic states or otherwise are described. It emphasizes importance of maintaining leguminous soil cover for the purpose of protection from erosion, high temperatures and to inhibit growth of unnecessary plants. Soil cover using organic material is the most viable option in small-scale farming systems. Crop residues are allowed to rot in the crop field and enrich the soil with C, N and other nutrients. This is achieved through the process of ammonification or mineralization that is carried out by microbes.

He cited the tremendous benefit to the farmer with the use of leguminous soil cover because out of their symbiotic relationship with nitrogen fixing bacteria



Plate 3: Mr. Wamae presenting additional content on effects of CA on soil fertility- Nitrogen fixation

are beneficial to the farmer in enriching their soils. Beneficial leguminous include *Dolichos lablab*, *Cajanus cajan*, *Mucuna pruriens*, *Crotalaria* sp., *Vicia benghalensis* and are just few examples among the many researched legumes for soil enrichment as well as food and fodder for animals.

He rounded up his presentation talking about Nitrogen fixation, Nitrogen assimilation, ammonification/ mineralization and denitrification processes and importance of each process in contributing to soil fertility improvements as well as the various bacteria involved

Finally he emphasized that the key interventions to achieve the soil cover agronomic principle are to plant and incorporate leguminous cover crops in the crop fields and in fallow land that is waiting to regenerate for future cropping. Crop residues such as maize, sorghum, pigeon peas, *Dolichos lablab* and common beans should be left to rot in the field to enrich the soil.

At this point, there was a brief discussion on weed control due to anxiety of the Participants, this various weed types and control based on the local situation. It emerged that weed issue was a major reason for conventional practices and participants were enthused by the approaches to which one can employ in different weed situations.

2.5. Soil erosion and water infiltration demonstration and exhibition of some cover crops species

The participants were divided into two groups based on the two demonstrations, each group started with one demonstration and later alternate. This was purpose to ensure every participants could have a feel of what was being illustrated.

▪ Effects of soil cover on water infiltration and soil erosion

A short demonstration on the effects of the soil cover on soil erosion and water infiltration into the soil was established. The set-up included two soil trays inclined at same angle with one covered with dry grasses. At the same depth rainfall was simulated and the effects of the induced runoff were observed. The demonstration really illustrated the anticipated effects as participants were able to appreciate the heavy water erosion in the uncovered trays and the different depth of infiltration levels, the concept was internalized



Plate 4: Practical demonstration of effects of soil cover on erosion and water infiltration and display of various cover crops

▪ Display of Cover crop seeds

A variety of cover crop seeds were demonstrated and various agronomic characteristics discussed with the participants. Based on the understanding participants concluded that cover crops like *Mucuna*, *Dolichos lablab*, *Canavalia*

ensiformis, purple vetch, vetiver grass and pigeon peas viable crops in the region since they confess some are already planted by farmers and they are doing well.

2.6. Emerging issues and concerns

Earlier, the participants were given an open discussion presentation to highlight on the needs to determine plant population during planting and how to seed effectively in the planting structures like the **zai**-pits.

Pesticides and fertilizer and the amounts and methods of use were discussed in the plenary prior to the practical demonstration.

Participants were concerned on the sources of rare cover crop seeds and its use as food or fodder. They were also concerned with the use of sorghum as animal feed when it is green and were enlightened on the effects of prussic acid when the crop is actively photosynthesizing during the day.

Sorghum seed as forage fed was touché on and Stanley Muriuki gave an account of how he has been able to feed his draught oxen using germinated sorghum and supplemented with other feeds to improve the health of his draught animals during the feed scarcity period which is also the peak season of his CA services.

Forage from cover crops was highlighted to address cropland livestock related issues and the purpose for retaining crop residues on the farm as opposed to the current system where farmers carry away the residues to store and feed the animals with.

The general issues mentioned here was the low nutrient value of stovers as opposed to the forage from cover crops which is nitrogenous.

3.0 DAY TWO: TRAINING PROCEEDINGS

3.1. Presentation on Conservation Agriculture equipment Demonstration and use: *Equipment Manufacturing and hire-service provision*

▪ Conservation Agriculture equipment Demonstration and use

This topic was facilitated by Mr. Peter Kuria. The presentation begun with revisiting conventional tillage equipment utilized at different level of crop production, their effects on production agents and effects of this system mechanization. Besides, it focused on the various CA equipment used for different operations in CA. He touched on the tools for land preparation, planting, weed management and other operations. He also elaborated on the hand/manual, animal

drawn and tractor drawn equipment used in CA system. The topic was later concluded by practical on the use, handling and calibration of the manual CA tools in the practical session.

Various equipment were illustrated through photo slides which included: tractor rippers, tractor planters and sprayers, power tiller planters and weeders, animal drawn direct planter, ripper and sprayer, hand jab planter, pedestal sprayer and hand ripper. Other innovations from farmers in terms of use and the various transformations that farmers have gone through to maximize the use of such equipments were shown and discussed.

He later shown a lists of manufactures and suppliers of CA equipment; who include: Femo works Ltd – Kiambu; Ekima engineering works- Machakos; Benmah- Nairobi; Nandra engineering works Ltd- Tanzania; Elmi farm implement manufactures- Tanzania; Intermech and Ndume engineering, Kenya.

▪ **Conservation agriculture service provision:**

With the presence of the ACT facilitated CA service provider from laikipia, Mr. Peter after his presentation invited him to share with the trainees the service provision model, its success and experiences in promotion of commercialized conservation agriculture. Mr. Stanley Muriuki as a farmer cum CA service provider in the Eastern side of Laikipia County, he begun by giving his brief history of how he started his business and how he has evolved. According to him, he adopted CA in the early years of the 2000 millennium and says that CA is energy saving especially using his draught animals. Time is saved in the farm operations and thus he is able to serve more farmers. He generates income from his service provision career and distributes his earnings as follows: *10% is used for tithing in church; 20% is spent for family needs; 20% is saved for the project maintenance and sustenance; 40% is saved as profit and used for other projects that would be supportive to the family when the seasons are not very good; and 10% is saved for miscellaneous situations.*

He illustrated that he can spray 10 acres of land and he has been able to acquire a two wheel tractor to meet his power requirement. Generally he charges his services as follows: *Kshs. 1500 direct maize planting per acre and can do 4 acres per day; Kshs. 2000 planting legumes because of line spacing and can do 2 acres per day; Kshs. 1250 to plant wheat; Kshs. 500 for spraying per acre; and Kshs. 100 for shelling 1 bag of maize*

He said he has be able to move to others areas when the season in his area has been exhausted and when he has serviced all his consumers. He says he is aiming at maximizing the service provision opportunity in his career.



Plate 5: Mr. Kuria taking trainees through various CA equipment use and their importance

3.2. Field practicals : practical use of CA equipment and water harnessing structures

The participants were divided into 3 groups to familiarize, study, practice and know how to assemble including the various adjustments that are involved in handling and usage of CA equipments.

The participants were mainly enthused by the pedestal sprayer as it was something new to them. Major questions that arose in the sprayer and pests/weeds control using chemicals was rates and methods and some specific details about mode of action of chemicals. They had a chance to assemble and practically use.

Participants were given a chance to determine how much of the chemical applied goes to what area of land to enable them assist farmers once they embark on disseminating CA in the area. Explanations and practical spraying was done and the determination of rate of application, chemicals was classified according to the groups and purpose of use and their mode of action. Each of the three groups was allowed equal chance to practically use the spray equipment and put on the appropriate spray gear.



Plate 6: Participants learning the use of different CA equipment during the field practicals

4.0 DAY THREE: TRAINING PROCEEDINGS

4.1. Weed Management and control in Conservation Agriculture systems

This session was facilitated by Mr. Peter Kuria. Under this topic several issues pertaining weed control and management. Definition and characteristics of weeds, importance of weed control and traditional methods employed were discussed. It also touched on approaches to weed control, integrated weed control methods in CA system and



Plate 7: Kuria facilitating the elusive topic on weed control mechanisms and methods.

how CA reduces invasion of weeds in the crop land. Several equipment used at different scales for weed control under CA systems were touched including their operation and importance.

In this session, participants were taken to understand issues relating to various weed control methods that are applicable to CA. Caution was put across to members no to confuse or attached chemical weeds control to CA as it has been in some quarters. Safety and the adherence to chemical use instruction were over emphasis, this is intended to ensure effectiveness and efficient use of the chemicals. The session answered most of the questions and imaginations of participants have been citing of issues to do with weeds form the start in CA farms without traditional tillage methods.

4.2. Field visit

The visit was paid to Elpina Ngui farm which is situated at Kirumbi village in Kizumanzi sub location of Voi sub-county. Participants were able to learn about the plough beam, frog, lateral adjustment hake, depth adjustment pin, chain, chain pin, mould board, share, land side, handles, and the depth wheel as well as the yoke and the various lengths depending on the work. There was also a pair of Sekaye oxen.



Plate 8: Equipment assembling and practical use by participants; Zai-pits construction was also

The pair of young oxen was under training and is currently being used for conventional ploughing. The farmer uses her family labour for the farm work in her 2½ acre piece of land where she grows crops.

The participants were able to dismantle the plough and attach the ripper onto the plough beam as well as fix various parts of the animal drawn direct planter before operating them practically using the available pair of oxen.

The participants got a chance to practice using a 180cm yoke and understood the purpose of the length as

- To be able to make straight passes even when the animals are not fully trained.
- For easier equipment control.

The trainees actively assembled the planter whose parts include; wheel, coulter, ripper, seed/fertilizer hoppers, seed plates, sprockets, handles and gears.

Attached it the yoke on the animals neck calibrated the seed/fertilizer application drove the animals as they planted the seed.

4.3. Planting stations: Zai Pits method

The farmer had constructed zai-pits in her farm with the help of food for assets programme that is promoting water harvesting structures for food production in the area. The stations had

1. Spacing of 60 cm x 60 cm along the contour
2. Holes done at 60 x 60 x 30 cm top soil separated from the sub soil
3. Top soil mixed with farm yard manures
4. Refill the hole with the mixture after dry material.

Observations from the farm visited

- Poorly managed farm yard manure
- The attitude change towards the use of farm yard manure by farmers
- Availability of the CA implements in the local markets
- Train artisan to enable fabrication of equipments locally
- A farmer can start CA on a small portion of his farm to begin with.

4.4. 14.availability of CA implements in the markets and prices

Various prices for the available conservation agriculture equipment were shown to the participants and created the debate for the need to maintain the acquired tools in good shape by proper handling and storage as well as proper usage in the right purpose as had been discussed the previous day during the field visit.

4.5. Presentation on Project implementation strategies and Rwanda Benchmarks (Experiences from Rwanda) By Thomas Haro

Mr. Thomas Haro briefly run through the KAPSLM project implementation strategies and plan. He took the participants through various levels of implementation and actors responsible for every activity at every level. In his pictorial presentations, Mr. Haro showed a



Plate 8: Mr. Haro briefly re-presenting the project implementation plan and Rwanda bench mark exposure tour in pictorial

similar topography with Taita-Taveta catchment that composed of hill masses and flat land.

According to the experiences from Rwanda the government works with communities to install necessary soil conservation structures on farmlands. Communities are moved to urban or peri-urban places where they are provided with improved living amenities such as water and electricity and good schools. The land is left for agricultural purposes and not for settlement where demarcation is done later after conservation structures have been installed.

Farmers of the same catchment are only allowed to grow a similar type of crop to be able to fetch market and sell together. This method has enabled them to form cooperatives and fetch good prices as well as grow socio-economically.

In the same agro ecosystems, participants were able to see well structured fish farming infrastructure that incorporates rabbitry where the droppings from the latter fall into the fishpond water and become feed for fish. This was an ecological system just like agro forestry.

The terrain in the shown photos appeared very similar to the hill mass terrain of Taita Taveta and although the terracing concept has been borrowed from Kenya, the land management and tenure is something to learn from.

A lot that was learnt from Thomas' presentation is the benefit of good policies and laws that govern agricultural land management practices in the country. As a recovery from the adverse effects of the genocide, the country has instituted serious laws in many sectors particularly environment and agriculture which everyone seems to follow.

4.6. Tips for Extension Officers and Farmer Trainers: Adoption of Conservation Agriculture

- To facilitate change in production system towards CA, it is important to understand why farmers think that soil tillage is such an important part of their system.
- Soil is being tilled in order to break-up the soil after harvest of the previous crop, to eliminate weeds and to prepare the seedbed for the next crop.
- Farmers perceive it as being important and besides that they feel comfortable with the technology, they know how to manage the technology and they know that tillage activities render good crop yields.

4.6.1. What is required to start CA?

- a change in crop management system
- 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

- improve the capacity to tackle new challenges and find a solution

4.6.2. How does a farmer start conservation agriculture?

- start with composure and concentrate on achievable objectives in order to gain experience,
- start on a small part of the farm
- Start in an area where there is enough cover and use a tool or implement that can easily do the job.
- in the case of using herbicides, take time to learn to identify and use herbicides in a correct way and the right equipment
- learn to identify and manage different problems
- talk to other farmers who are practicing conservation agriculture and learn from their experiences and mistakes

4.6.3. Important aspects of CA!

- Plan a good crop rotation.
- Conduct Soil analysis- Practices such as removing compaction, liming, use of green manure and synthetic fertilizer to correct extreme nutrient deficiencies may be necessary.
- Soils under CA are usually improving, which means that even degraded soils will recover and might become productive under this system e.g. the Brazilian Cerrados, which were considered degraded land unsuitable for farming and which have been converted by CA into a highly productive area.
- The focus of conservation agriculture will shift, especially in the first years towards weed control and (cover) crop residue management, and monitoring pest and disease incidence.
- A farmer should be prepared for new habits and timetables.
- Conservation agriculture is based on restoring natural occurring processes and therefore needs a conversion period before the new system is established and the natural balances are restored.
- Information sharing and exchange of experiences is necessary for farmers who are starting with conservation agriculture. New CA farmers need a period in order to gain experience with conservation agriculture.
- Especially in the beginning a lot of information is needed on the use and adjustment of tools and implements.
- The specialized so-called "planter clinics" are very useful for farmers to learn not only about the tools and implements, but also on the time needed for conversion to the new system, crop yields during and after the conversion period, labour and time requirements in agricultural activities before and after the change.

- The experiences of farmers who have been implementing conservation agriculture for a longer time might give indications to new ones which key practices generate success and what mistakes to avoid.
- One of the problems in promoting CA is the fear of changing "good" practices into new practices and the fact that these "good" or actual practices are culturally linked to the communities.
- The change will generate opposition within the community, which is completely normal, but it is useful to identify reasons and strategies for changing beforehand.
- Soil tillage is a traditional practice and thus presents some cultural barriers. Tillage is perceived as:
 - ✓ necessary
 - ✓ soil improvement facilitating crop management giving higher yields
- Tillage is considered a tradition by farmers and changing the practice is difficult because:
 - they are satisfied with the actual practices
 - they know better than anyone else to manage their production
 - they don't feel an economic pressure to change
 - the attitude towards tillage defines a good farmer and this results in self confidence
- Extension officers and pioneer farmers as change agent should assume a facilitating role that will encourage the confidence of starting farmers that the technology is working by demonstrating the technology and its economic benefits in other farmers' fields, with facts and numbers and train people in the region to help others.
- As tillage is considered traditional, some cultural barriers that might aggravate the change process can exist in a region. For extension personnel it is always important to recognize these barriers. They include:
 - not understanding the technology
 - being afraid of the economic risk
 - not being able to buy equipment
 - soils or crops are not adequate and need to be adjusted
- Change usually does not appear "overnight" and will take time. Extension personnel therefore need to be patient and accept that agricultural technologies are adopted step-by-step, because farmers:
 - need to feel at ease with the new technology
 - do not have the capital to invest
 - cannot run a big risk, especially not when the technology is not locally known
 - need a learning-by-doing environment

5.0 DAY FOUR PROCEEDINGS

5.1. Presentation on Crop Tree – Livestock Integration in Conservation Agriculture Practice

The following issues were discussed

- Climate change has contributed to global food fluctuation.
- Farmers should embrace CA as an opportunity to generate income.
- Agro forestry will improve the environment and microclimate as well as enrich soil.
- Combining CA and agro forestry will help farmers realize prolonged benefits.

Advantage of CA and agro forestry is that the system is more tolerant to climate fluctuations.

Dairy goats rearing for milk and income: It was viewed as a cheaper way of producing milk and income with the animal since they are; Low feed consumers, adaptive and can rely on diverse wild feeds such as shrubs

Evergreen agriculture: It is a method of preserving the natural herbs, shrubs and trees so that they can be of help to the farming ecosystems, provide feed for animals, break wind and provide fuel.

5.2. Presentation on Action plans development: Consortium planning- Action plans

This session was facilitated by Mr. Weldone Mutai. This session was meant to illustrate how to develop and decide on the way forward in implementing the dissemination of the knowledge acquired and setting up demonstration plots in the different micro-catchments by the consortia. It concentrated on guidelines on how to devise an action plan to implement the trials and generally promotion of the technology illustrating step by step methodology towards developing action plan sheet and implementing strategy.



Plate 9: The three consortia members developing potential action plans for implementation of CA on-farm demonstrations in their micro-catchments in groups and later present them to the plenary

This was then followed by the participants breaking away to their respective Consortiums to discuss and develop an illustrative action plans on how to implement introduction of CA

technology practices in their areas of jurisdiction. They later present to the plenary what each has developed. These consortia included: NAREMA; VEGFRUN and MILMET

6.0 Closure and Diplomas' ceremony

The closure of training was graced by Taita-Taveta County Director of Agriculture, who applauded the organizers of the event, the facilitators and the participants for their fruitful and active participation in the training. She encouraged the participants to deliver the message to their jurisdictions and implement what they have learned expectedly. She recognizes the role being played by KAPASLM project in the county. Finally she presented the course certificates, CA manuals, and other materials to the participants ceremoniously. Participants were really impressed with this issuance of the materials and expressed their appreciation to the ACT & KAPASLM.



Plate 9: Closing remarks from Peter Kuria (ACT); Jane Ngugi (KAPASLM Secretariat) and County Director of Agriculture and final issuance of Certificates and materials to ToTs

7.0 CONCLUSION: RECAP

The training went on as planned and all the planned topics and activities were achieved and adequately covered, the target number of participants made to the training with quorum being 100% and participants were very enthusiastic about the subject and noted that more sensitization and follow-up trainings and support needs to be done to ensure successful implementation of the demonstration as most of the noted in their action plans.

However, there were **emerging issues and concerns** which arose during the training which needs further attention are summarized below;

- There was concern whether exotic tree species should be left out and indigenous ones taken up for agro forestry.
- Farmers need livestock more to produce alternative energy like biogas which in turn mitigates cutting down of trees in the catchment. Livestock were felt to be a cross cutting issue in the adoption of ca when it comes to feeding.
- Participants wanted to understand the issue of cover crops well. They wanted to know whether the cover crops should lie parallel to the ground surface or at some point be standing as in the case of say pigeon peas as a cover crop.
- Participants were concerned with the termite menace in the event that one wants to meet the permanent soil cover agronomic principle using organic plant residues. Fear was that the principle is hard to achieve.
- They pose a question on whether there was a consideration of the depth of seeds and behavior of roots if the land is to be ripped and a machine used to plant or inject seeds into the ground.
- They were concerned with the manner in which road runoff can be tame and utilized by farmers.
- They posed a question on the impact of using inorganic /synthetic fertilizers and pesticides in farming.
- Participants wanted to know about the period and time when a farmer starts realizing the benefits of CA after starting the practice in his/her farm from a background of conventional farming.

8.0 APPENDICES:

APPENDIX A: COURSE EVALUATION RESULTS: CA WORKSHOP AT SCRIPTURES MISSION, VOI, TAITA

Kindly place a \surd against the ranking - 1 representing the lowest and 5 the highest

Ranking 1 2 3 4 5

A. Course logistics	(Average values calculated)				
○ Transport from your station to the meeting venue			3.95		
○ Accommodation arrangements in SCRIPTURES MISSION			3		
○ Entertainment during the training period			3.33		
B. Course Facilities					
○ Training Venue				4.28	
○ Food services during the training (meals and snacks)			3.95		
C. Course content					
○ Did the course content cover your expectations?				4.52	
○ Rate the presentation methodology				4.28	
○ Quality of session facilitations				4.28	
○ Facilitators				4.38	
○ Handouts				4.04	
○ Technical content				4	
○ Were your questions answered satisfactorily?				4.23	
○ Timeliness & overall logistics of course sessions				4.05	

- What is your major satisfaction(s)/Lesson about this training?

The three principles of CA were well covered

- What is your major frustration(s) / disappointment(s) about this course, if any?

Time was too short for such a good training

- Please provide specific recommendations for the organizers of the next course
More practicals in the field with added time

- Free comments & suggestions (use back of this form for more comments)
There should be regular contacts between TOTs and facilitators or CA trainers.
A tour for TOTs should be arranged to expand their knowledge in CA

APPENDIX B: LIST OF PARTICIPANTS

KAPSLMP TRAINING ON CONSERVATION AGRICULTURE (TOT)

CONSERVATION AGRICULTURE WORKSHOP AT SCRIPTURE MISSION – VOI ON 25TH – 28TH AUGUST 2014

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APPENDIX C: PHOTO STORY



Plate 10: Clockwise: Eng. Njuki opening the training; Soil erosion demonstration; Safe spaying using pedestrian pull sprayer; Committee recap; Muriuki brief the participants on the field practicals and everything end.