Scaling Up
Conservation Agriculture
in Africa:Strategy and Approaches

Scaling-up Conservation Agriculture in Africa: Strategy and Approaches

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Acronyms and Abbreviations

AAAID	Arab Authority for Agriculture and Development
ACT	Africa Conservation Tillage Network
ADB	Africa Development Bank
ASSS	African Soil Science Society
CA	Conservation Agriculture
FAO	Food and Agriculture Organization of the United Nations
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IFAD	International Fund for Agricultural Development
JIRCAS	Japan International Research Center for Agricultural Sciences
KARI	Kenya Agricultural Research Institute
KENDAT	Kenya Network for Dissemination of Agricultural Technologies
NEPAD	New Partnership for Africa's Development
AADP	African Agricultural Development Programme
NGOs	Non-governmental organizations
SLM	Sustainable Land Management

Preface

Most specialists agree that Africa has an extremely wide range of soils and climatic conditions, and that most of the continent's soils are of poor quality compared to other parts of the world. In addition to their low inherent fertility, African soils nutrient balances are often negative indicating that farmers mine their soils. In many parts of the continent, inappropriate land use, poor management and lack of inputs have led to a decline in productivity, soil erosion, salinization and loss of vegetation. African soils are at risk, as they are commonly undergoing degradation since traditional methods used by farmers (shifting cultivation, nomadic grazing) cannot cope with the increasing needs of the ever-expanding human and livestock populations.

Thus, conservation actions to halt and reverse degradation as well as boost agricultural productivity have gained increasing interest in Africa and the world at large. Conservation approaches, particularly through Conservation Agriculture (CA), could contribute significantly to reducing land degradation and increasing food security. Based on past and on-going experiences, there is a need to determine the specific bio-physical and socio-economic circumstances that could encourage the adoption of Conservation Agriculture by small, medium and large scale farmers in Africa.

This publication is an outcome of a Joint Workshop organized by the Food and Agriculture Organization of the United Nations (FAO), the African Soil Science Society (ASSS), Japan International Research Center for Agricultural Sciences (JIRCAS), Kenya Agricultural Research Institute (KARI) and the Africa Conservation Tillage Network (ACT) in Nanyuki, Kenya from 22 - 25 June 2008. A total of 22 participants from Burkina Faso, Cameroon, Ethiopia, Kenya, Lesotho, Malawi, Nigeria, South Africa, Sudan, Zambia, ASSS, ACT, JIRCAS and KENDAT attended the meeting.

During the Workshop, thirteen papers covering challenges for promoting Conservation Agriculture for Sustainable Land Management (SLM) in Africa, country experiences, CA development in large scale mechanized farms and support to surrounding small scale farmers, extension services to farmers, and farmer field schools were presented. Conservation Agriculture was endorsed as one of the best options to meet future food demands, prevent ecological degradation and ensure sustainable agriculture and rural development. If implemented well, CA methods can improve the efficiency of input, increase farm income, improve or sustain crop yields, and protect and revitalize soil, biodiversity and the natural resource base.

The Sub-regional Office for Eastern Africa does not promote a single approach to farming but offers this information on CA as one position to consider in seeking a prosperous and productive agricultural sector.

It responds to the need for the promotion of CA in Africa, gives guidelines and principles to various users and promoters of Conservation Agriculture. It provides a step based approach in promoting CA, having in mind the high diversity of African “agro ecological contexts”, and the need to apply the “One size doesn’t fit All” principle.

FAO is thankful to the participants of the June Workshop for their contributions during and after the meeting.

Table of Contents

1
Introduction

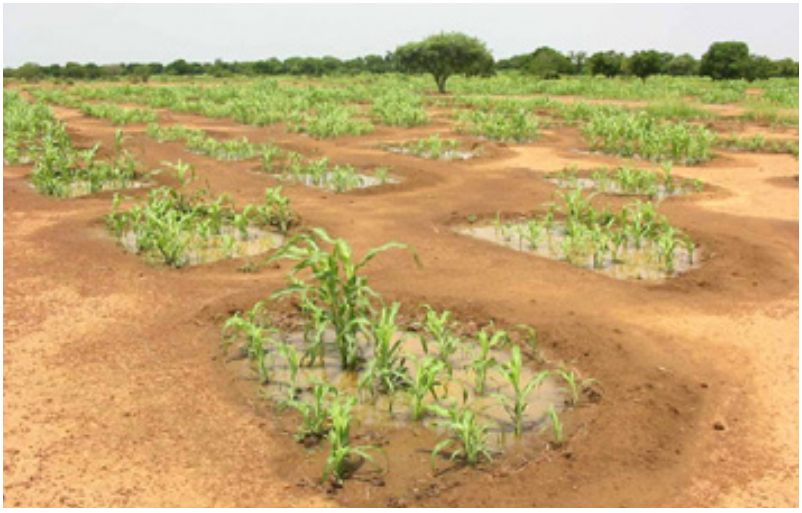
Conservation Agriculture (CA) is a combination of tested scientific technologies and/or principles in agricultural production. The practice of CA in Africa is now maturing with increasing demand for more sustainable agricultural practices and better natural resources management and conservation. Conservation Agriculture, as a concept for natural resource-saving, strives to achieve acceptable profits with high and sustained production levels while concurrently conserving the environment. It appears to be a promising way of attaining sustainable agricultural production. In practice, CA relies on simultaneous application of three basic principles: 1) Minimum soil disturbance or if possible, no tillage; 2) Permanent soil cover; and 3) Crop rotations or/and associations.

© S.Mareke: An examplary farmer engaged in crop production using Conservation Agriculture

CA is a toolkit of agricultural practices that combines, in a locally adapted sequence, the simultaneous principles of reduced tillage or no-till; soil surface cover and crop rotations and/or associations, where farmers choose what is best for them. In essence, CA is an approach that advocates the concept of sustainable intensification of production by picking the best possible options that farmers can apply at their own conditions.

Conservation Agriculture fits within other resource management approaches such as sustainable land management; organic farming and agroforestry that do not necessarily

include all the three principles of Conservation Agriculture (do not turn the soil, keep the soil covered, and rotate or associate crops). Conservation Agriculture is part of 'Sustainable Land Management' and it is also possible to do Conservation Agriculture in an organic way (without using fertilizers, herbicides or pesticides). Moreover, agroforestry or any other practice that promotes soil cover and crop rotation greatly promotes CA.



© R. Zougmore: Half moon soil & water conservation reduced tillage in dry lands

Conservation Agriculture is being practiced in a number of countries as traditional soil and water conservation practices by specific communities or at pilot project scale throughout the continent. Despite the difficulties faced in the first years of implementation, benefits from this practice have shown great potential in boosting agricultural production and diversifying livelihood incomes. But its level of adoption is still very low and the total area of coverage could be estimated to be less than 1 percent of the continent's land. Therefore, there is need to move from project based and site based approaches to programme large scale approaches through upscaling of this technology.

This booklet aims at providing the basis for upscaling CA by addressing the strategy and approaches to engage policy makers and other stakeholders (farmers, agro pastoralists and pastoralists, donors, researchers, extensions and the private sector) in the challenge to move beyond pilot and demonstration plots.

2
Background

2.1 Conservation Agriculture in the World

Moving from conventional agriculture and environmental management practices to non-conventional ones represents one of the great, global challenges in terms of changing habits and mind sets. Table 1 gives a comparison between conventional and non-conventional practices.

Table 1: Comparison of Conventional Farming Verses Conservation Agriculture

	Conventional Farming	Conservation Agriculture	Rationale
Tillage	Farmers plough and hoe to improve soil structure and control weed	Direct planting without prior inversion of the soil; Planting on the rip line or making holes for planting with a hoe	Ploughing in the long term destroys soil structure and contributes to declining fertility and organic matter levels.
Crop Residue	Farmers remove or burn residue or mix them into the soil with plough or hoe	Crop residue left on the field Planting of cover crops	Crop residue improves soil structure Cover crops protect soil from erosion and limit weed growth.
Mix and rotate crops	Monocultures or crop rotations in a tillage framework where the soil is inverted with a mouldboard, plough or similar implements	Crop rotation or intercropping is a permanent feature of the cropping system	Helps maintain soil fertility Breaks disease cycles

Conservation Agriculture spreading worldwide:

- In China for instance, the region of Beijing has planned to develop CA on 80 percent of their agricultural land by the end of 2009. This is based on clear facts of the impacts of CA on: (i) reduction of wind erosion by 50 to 60 percent; (ii) runoff by 80 percent; (iii) and yield increasing from 0.6 to 32 percent.

- In USA, 60 percent of farmers from Tennessee practice CA for cotton, wheat, maize and soybean production. The National Agricultural Bill of 2005 included erosion control and therefore encouraged CA development. A “No-Till” day is organized each year and attracted 1 000 participants in 1995 and 4 000 in 2005. The trend in the US is now to move from erosion control, to soil quality conservation. USA is leading with over 25 million hectares.

- In Latin America, particularly in Brazil, 23 million hectares at commercial farm levels are under Conservation Agriculture; Paraguay is now the leading country in the world in terms of percentage of no-tillage adoption

- In India, through integrated watershed management programmes, CA is becoming better known.

3

Conservation Agriculture vs. Current Global Challenges

Growing concerns in regards to global warming and rising food prices could drive an increasing adoption of CA.

- With agriculture consuming 70 percent of the blue water, to meet the Millennium Development Goals (MDGs), water consumption should increase from 1700 km^3/year to 2200 km^3/year. Consequently, reduction on water use is an important challenge for the forthcoming decades; and CA could play a key role by decreasing the level of water consumption and maintaining more moisture in the soils. Conservation Agriculture could help save up to 2500 km^3 of water consumption by 2050.
- The simultaneous application of the three CA principles stand to boost yields, which would contribute towards meeting notably, MDG1 of eradicating extreme poverty and hunger, MDG7 of ensuring environmental sustainability and MDG8 of developing global partnership for development.
- In regards to climate change, CA advocates building and storage of soil organic matter, which is important for storage (carbon credit in soils) and/or sequestration of carbon. Carbon is derived from the atmospheric CO_2 taken up by the plant and added to the organic matter when the plant dies. In a world concerned with the buildup of atmospheric greenhouse gases, CA presents an opportunity for reversing the green house gas build up. Carbon sequestration is a recognized method in the removal of CO_2 from the atmosphere under international treaties, such as the Kyoto Protocol.

3.1 Context of Conservation Agriculture in Africa

Conservation Agriculture and no-till systems are not new agricultural production methods in Africa. While many people perceive no-till and minimum till production systems to be products of the late 1900s, the evolution of such systems can be traced far into the past of African agricultural practices when food was produced using pointed sticks to punch holes into the ground to prepare land for planting. Agricultural production changed drastically due to colonial powers and missionaries who introduced mechanization and tillage implements with extensionists and learning institutions *promoting* the hoe and plough. However, not all of Africa's farmland was put to mechanization, or to the deep-till hoe, and pockets of Conservation Agriculture-friendly farming still exist.

© F.Theodor: Soil under Conservation Agriculture

In Africa, the simultaneous application of the three principles known as CA started recently and has emerged in several places, most notably in South Africa, Zimbabwe, Zambia, Kenya and Tanzania. Conservation Agriculture has spread rapidly in Ghana from a handful of farmers in 1996 to 350 000 by 2002 through the Monsanto and GTZ support. Malawi is beginning to have renewed interest and has currently 47 000 hectares under "some form" of Conservation Agriculture involving 5 407 groups of farmers. Out of the 47 000 hectares at least 1 000 hectares can truly be said to be under CA.

Table 2: Area under Conservation Agriculture in some Africa Countries

Country	Number of small scale farmers involved	Area Under Conservation Agriculture (ha)
South Africa		377 000
Ghana	400 000	300 000
Zambia	100 000	110 000
Malawi	5 407	47 000
Kenya	5 000	18 000

4

Prospects For Scaling Up Conservation Agriculture In Africa

Experiences of CA take-up in Africa have so far been diverse. It has mainly been driven by donor and non-governmental organizations and the need to reduce crop establishment costs. Consequently, there is a huge challenge to upscale in order CA to tackle the following issues (among others):

© M. Mareke: A successful CA field

i. *Improve African Yields:* The African population continues to increase while crop yields and consequently food production in many areas are actually falling. In many parts of the continent, grain yields are at no more than 1 ton/ha which is much less than what is needed to achieve the MDG 1. The major cause is attributed to soil infertility often caused by extractive and exploitative farming methods. The intensive annual tilling of the soil destroys soil structure, produces a hard pan in the soil, restricting root growth and stunting plant growth. Moreover, the impact of raindrops on bare soil causes sheet and rill erosion. The resulting soil erosion and land degradation are quiet severe in Africa and lead to an annual decrease of 3 percent agricultural production. Conservation Agriculture where it has been implemented has shown a high potential to reverse this trend.

ii. Reduce production costs: Conventional agricultural practices such as tilling are expensive especially within the context of rising fuel and labor costs.Experiences in Ghana and Kenya have shown a decrease of labor costs by 40 percent input by using no tillage methods.

iii. Shortage of labour and farm power: A number of factors including rural-urban migration, HIV/AIDS and cash constraints among others are contributing to shortage of labor and farm power.Conservation Agriculture takes less work, thus enabling efforts to be channeled to other development activities.

iv. Environmental degradation: Sustainable Land Management (SLM) is now an emerging top agenda in Africa in the context of *TerrAfrica* Initiative . Conservation Agriculture protects the land and feeds the soil. It has the potential to halt and reverse land degradation and could be a major part of the package for SLM.

A comparative analysis of the return on investment between conventional and non-conventional agriculture in Kenya has shown a potential of doubling benefits by using Conservation Agriculture (Table 2)

Table 2: Cost comparison in Muriuki's Farm in Nyanyuki Kenya

Conventional farming inputs	Costs KSh.	Conservation Agriculture inputs	Cost Ksh.
Land rent/acre/ year Ploughing Tractor Ridging by Oxen (Men) Seed 10 Kg	2 300 2 000 1 000 1 250	Land rent/acre/ year Herbicide (glyphosphate) Seed 8Kg	2 300 1 200 1 000
Fertilizer 50Kg	4 000	Fertilizer 25Kg	2 000
Planting 5 women @150	750	Planting with animal planter	1 000
1st Weeding 10x10 @50	2 500	1st Weeding	1 200
2nd Weeding 10x10 @50	2 500	2nd Weeding	1 200
Chemical application labor	300	Chmical application labor	300
Harvest+ transport(home)	2 500	Harvest+ transport(home)	2 500
Total input Total Harvest 8 bags@1500	21 600 12 000	Total input Total Harvest 16 bags @1500	14 000 24 000

1 USD= Ksh 74, July 2008

4.1 Addressing Barriers to Adoption and Scaling-up of Conservation Agriculture in Africa

Conservation Agriculture technologies and principles have diffused, but questions linger over factors that have hindered upscaling despite sound technical, agronomic and environmentally-friendly merits. The following are some critical factors that have hindered the scaling-up of CA in Africa:

i. Insufficient enabling policy environment to boost sustainable land management and scale up success stories of projects and community's efforts

- Essential national policies and regulations as well as international commitments enabling CA practices exist but their implementation and enforcement in the field remains very weak;
- Land resources are usually taken for granted and therefore incentives (including subsidies for improved access to inputs) for better land care programmes and development do not constitute a priority in most African countries;
- The level of national budget investment in sustainable land management is very low and in some cases represents only 0.4 percent of the country's budget;
- Incentive policies for better access to land resources through appropriate land tenure systems provide the right to land, particularly to vulnerable people are lacking or insufficient

ii. Weak capacities at institutional, community and various stakeholders levels

- The level of awareness of policy and decision makers including private sector, on the potential of CA is insufficient;
- Database development and research activities for scaling up CA practices need to be undertaken;
- Extension services and actors (NGOs) capacities are insufficient in the area of scaling up the success of CA obtained at local levels;
- Insufficient integration of CA practices with farmers, herders, agro-pastoralists and traditional foresters indigenious land management systems (conflictual practices risks)

iii. Insufficient partnership and investments in CA

- The multi-dimensional scale and aspects of land management call for more coordination and cooperation in planning and decision making. Therefore, coordination and harmonization of CA and SLM objectives through better mainstreaming within national budgets, medium term expenditure frameworks, poverty reduction and rural development strategies and development plans is essential.

- At international levels, partnership among donors, UN agencies, governments, local communities and chiefs/rulers is insufficient to align, harmonize and create more synergy among the various stakeholders' interventions for coordinated investments in CA.

iv. Mindset, lack of awareness and improper knowledge

- Farmers traditionally believe in working their soils. It is believed that working the soil buries weeds as well as seeds, mineralizes nutrients, breaks soil compaction, aerates the soil and creates a loose bed, suitable for sowing crops. While some of these assertions may be individually true, collectively, they lead to an overall impoverishment of soil quality that is unsuitable in the medium to long term both from an economic and environmental point of view.

- It is also well accepted that a clean farm is synonymous with hard work and is the opposite of laziness.

- Lack of knowledge on how to undertake Conservation Agriculture and its benefits is the most common reason for its slow adoption in Africa. Farmers need to acquire the basic knowledge before attempting to try the practices on their own farms.

v. Capital constraints and the need for external drive

© M.Malo: Large scale Conservation Agriculture exercise

- Many farmers have restricted access to implements and inputs and are likely to delay planting because they have to sell labor to other fields to earn capital for the purchase of inputs. Although this situation should in essence stimulate adoption of cost saving Conservation Agriculture technologies such as reduced tillage systems and direct seeding many small scale farmers are not finding equipments and herbicides accessible or affordable. Often, implements are imported from Brazil and made available to farmers on an experimental basis. Africa has so far depended on external drive to get the initial momentum as communities are often outside the input/output markets and do not always see the immediate benefits.

- The lack of subsidies and efficient incentives in a context of high poverty rate in rural areas does not create favorable environment for Conservation Agriculture practices adoption.

vi. Inadequate cover crop - Livestock factor

- Permanent soil cover is a cornerstone of Conservation Agriculture, yet many farmers face difficulties in achieving it as crop residue have diverse uses including feeding of livestock, building huts and/or fence, and producing cooking fire .

- Producing enough biomass to cater for both soil cover and livestock demand is a challenge while replacing food legumes used traditionally in intercropping (such as beans) by a cover crop (such as *canavalia* or *mucuna*) is not yet attractive to farmers.

vii. Insecure land tenure

- The land tenure system where farmers or farmer groups hire land or have only user rights, makes it difficult for the consistent practice and full attainment of gains of Conservation Agriculture on such land as they do not have security of tenure while Conservation Agriculture require permanent practice and implies long term benefits.

viii. Degraded soils

- Conservation Agriculture promotes the management of the finite soil resource with great care to safeguard the organic matter and natural inherent fertility. Much of the smallholder land in Africa is highly degraded and need investment in rehabilitation. This implies a difficult start for Conservation Agriculture in Africa in comparison with other regions.

ix. Pests and weeds

- One of the main setbacks to Conservation Agriculture is the proliferation of weed species. It is frequently noted that the move from plowing to no-till or minimum till will increase dependence on herbicides in the first years.

x. Diversity of situations and contexts

- The continent is characterized by a high diversity of agro-ecological zones, cropping and farming systems. The difficulty in having three or four emerging crops within the region in contrast to the situation in Asia make it difficult to come up with a harmonized package related to Conservation Agriculture.

© S.Mkomwa: Animal drawn seedar

5

Strategy to Scaling-up Conservation Agriculture

Vision

To see African agriculture contribute to achieving food security in a sustainable fashion, increasing livelihoods' income and conserving the environment through Conservation Agriculture.

Goal

To attain at least 30 percent of African farm and rangelands under the simultaneous application of the three principles of CA (reduced soil manipulation, permanent soil cover and crop rotations/associations) by 2015.

There is an urgent need to move from project and pilot site levels towards a long term programme-based approach to CA.

Target

- Small scale resource farms
- Medium scale farms
- Large scale commercial farms
- Policy and decision makers
- Private sector stakeholders in agriculture
- Educational institutions

5.1 Key Factors for the Successful Upscale of Conservation Agriculture

i. Mainstreaming CA in the government agricultural development education and extension services

CA in Africa is not yet well integrated in government development agendas and policies of many countries. There are however examples of CA successes in Zambia, Kenya, Malawi and South Africa. The implementation of Conservation Agriculture within the mainstream agriculture development and extension services will have important positive consequences for up-scaling of conservation agricultural practices.

One of the cornerstones to put in place for the promotion and development of Conservation Agriculture is the mainstreaming of this concept in the agricultural, environmental and socio-economical strategies and policies of countries.

It is important to assist in the formulation and/or mainstreaming and implementation of proper policy for scaling-up Conservation Agriculture practices as part of Sustainable Land Management (SLM) through a programmeme-based approach.

ii. Initial advancement with CA Equipment and other inputs

Smallholder farmers will be propelled faster towards mainstreaming CA practice through a strategic and more inclusive CA programmeme that includes access to such implements as the jab-planters, animal drawn direct–seeders, cover crop seed and other inputs. Incentives and subsidy systems should be put in place to support initial investments in equipment and inputs particularly for smallscale/ poor farmers.

© M.Mareke: A successful CA field

Appropriate policies need to be put in place or strengthened toward encouraging private sector operators and importers of equipment in availing CA equipment and other inputs to farmers. The private sector services should be encouraged for the local manufacturing of CA equipment for sustainability.

iii. Access to cover crop seed

There is a need for adequate alternative packs of seeds availed to reach farmers on time for both long and short seasons. The type of cover crops should take into account the existing practices and indigenous species. Introducing only few exotic varieties of cover crops is not sustainable given the diverse socio-economic and environmental conditions in Africa. It is also critical that farmers are advised on the prons and cons of each pack of seed. Incentives and subsidies should be provided to farmers particularly to small-scale ones in order to support their access to good quality cover crops seeds.

iv. Flexibility and adaptability

Given the diversity of agricultural practices and cropping systems in Africa, adaptation and flexibility is vital in responding to the real needs of farmers and to challenges in the various agro-ecological zones. It is thus not just a question of

technology transfer, but of adaptation and experimentation, it is a set of principles that can be adapted to suit local conditions. Often aspects to adapt would entail tillage methods, crop combinations, maintaining soil cover and equipments.

v. Weed control

Farmers' efforts to achieve good crop yield may never be attained if weeds are not deterred from out competing the crop while manual weeding is labour intensive. Weed control is a key factor in CA and all appropriate means including mechanization should be used to reduce and eliminate weed pressure.

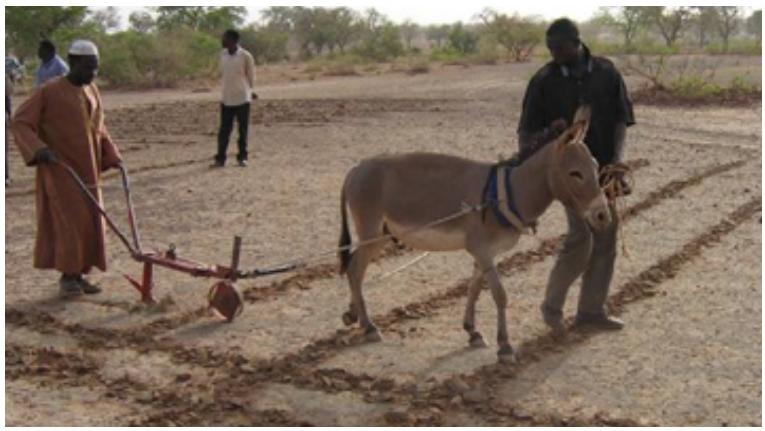
In the case of small scale farmers the following approaches could be used: planted short fallow practice, strip cropping legumes with cereals like maize and sorghum; and planned legume fodder production using appropriate dual purpose legumes could be used among others.

vi. Advocacy

The positive impacts of CA are not well known and there is a need for strong advocacy towards governments, extension services, development agencies and the private sector. It is only through advocacy that the mind shift (from clean and ploughed farms to crop residues covered and not tilled soils) can take place. Not only among farmers but also among extension personnel, government officials, researchers and others involved in agriculture.

vii. Emergence of a range of new market based opportunities

The emergence of great interest for payments for environmental services, Eco-tourism, bio-energy/agro-fuels, Green/Organic labels and certification as well as soaring food prices could be harnessed for promoting and funding CA and SLM. The interrelation between climate change and land degradation also provides opportunities for building a larger and stronger coalition to boost investments in CA practices to address the challenges of adaptation and mitigation to droughts and floods in terms of emergency issues.



© R.Zougmore: Animal drawn mechanized tilage in the Sahel

6
Technical Package

The objective of this chapter is to provide guidelines in CA implementation, keeping in mind that the concept should be applied according to specific contexts with adequate flexibility.

6.1 Scaling up CA in Different Agro-ecological Zones

Due to the wide range of agro-ecological conditions in Africa, it is important for the promotion and development of CA to identify entry points for implementation. It is vital during scaling up to focus on specific principles as entry points towards full application.

© B.Okoba: Hand held jab planter

- Conservation Agriculture in deserts

Desert areas outside oasis situations do not allow biomass production for agricultural purposes and CA is therefore also not an option. In the case of an oasis, rehabilitation methods for water collection and establishment of vegetation points would be the first entry points.

- Conservation Agriculture in Arid zones

Entry point for Conservation Agriculture in arid zones would be the reduction

of tillage and direct seeding. This would serve to reduce tillage induced water losses, and help timely planting to make use of most of the scarce rainfall. As biomass production increases, the amount of soil cover can increase, adding more organic matter to soils and thus improve the water holding capacity over time.

- *Conservation Agriculture in Sahelian zones*

  In the Sahelian zones, the strategy is to use or improve existing minimum tillage practices notably with the iler* that would be able to increase substantially the crop biomass production as entry point.

- *Conservation Agriculture in Semi-arid zones*

  Similar to the arid zones the easiest entry point into CA for semi arid zones seems to be the reduction of tillage and direct seeding. With increasing humidity levels options for cover crops and/or crop residues for soil cover as entry point into CA increase.

- *Conservation Agriculture in Sub-Humid zones*

  This area is favorable to important biomass production and the growing season is much longer. Cover crops could bring grain yields benefit. This could also reduce the weed pressure in sole or intercrop. With increasing humidity levels therefore the use of cover crops to establish good mulch before starting with no-tillage and direct seeding is becoming a more feasible entry option into CA.

6.2 Step Based Approach to Scaling up CA

i. Public awareness and knowledge:

The following means could be used to create more awareness for CA:

- Target key policy makers, advisors including those in regional economic commissions and the African Union in advocacy and awareness creation activities.
- Engage Cabinets/ governments/ decision makers' policy in events related to CA.
- Involve and integrate the private sector, academia and researchers in their respective domains of competency related to CA.
- Develop meetings, trainings and site visits for farmers, extension services and decision makers.
- Develop and promote Farmers Fields Schools (FFS) for CA.
- Use of media through development of documentaries, TV and newspaper adverts.

ii. Determination of priority areas (Low hanging fruits)

The priority areas and entry points for CA should be discussed and approved by farmers and producers in relation to existing farming systems. It should, for instance, be important to focus on "low hanging fruits" and entail three target groups:

a. Farmers practising no-till and crop rotations need to incorporate permanent soil cover for simultaneous application.
b. Farmers practising permanent cover and crop-rotation need to incorporate no-till for simultaneous application.
c. Farmers practising permanent cover and no-till and need to incorporate crop rotation for simultaneous application.

Key entry point which would guarantee a progressive and sustainable adoption of the three CA principles should be identified. Progressively, strategy should be to build the promotion and development of CA on the existing traditional knowledge and proven practices closest to the CA's three principles.

iii. Obtaining CA equipment while adapting within existing tools: Regarding CA tools and equipment it is recommended to:

- Modify and adapt existing tools or/and equipment to suit CA requirements
- Train local manufacturers in the production of CA equipment (jab planters, zamwipes etc.) in the case of small and medium scale farmers.
- Facilitate import of CA equipment and tools for small, medium and large scale farmers

iv. Monitoring progress made and impacts of practices

Progress and challenges should be documented and recorded. The quantity and quality of yields, their economical values, the environmental benefits, the impacts of income diversification and ecosystems diversity, the quality and quantity of water resources, the increasing of soil moisture and soil biodiversity should be measured by appropriate and participatory methods.

Monitoring and evaluation should help inform on the positive impacts of Conservation Agriculture on poverty reduction through development of appropriate database.

v. Engaging various partners at local and international levels

Conservation Agriculture promotion and development requires increased investments in agricultural sector. Therefore appropriate action through media coverage, field visits and reports on the economical and environmental benefits of CA should be made available to the Donors community (IFAD, ADB, Arab Authority for Agriculture and Development (AAAID), Arab Organization for Agricultural Development, Islamic Bank for Development, World Bank, etc.), technical Agencies (FAO, GTZ, JIRCAS) and Private Sector (Agrochemical Industry, Agricultural Machinery Industry etc.) in the countries.

vi. Linkage with regional and global initiatives and market opportunities

- Seize the opportunity of emerging new market based opportunities (payments for environmental services, eco-tourism, bio-energy /agro-fuels, Green/ Organic labels and, certification) including soaring food prices to harness the

promotion and funding of CA as important component of SLM.
- Strengthen CA promotion activities with ongoing regional or sub-regional initiatives and programmes such as NEPAD-AADP, TerrAfrica, Regional Economical Organizations Programmes.

6.3 Providing Technical Responses

- Conservation Agriculture is based upon soil life and health; therefore soils have to be brought up to a condition where healthy life can develop. Physical and chemical soil limitations like compactions; pH, phosphorus (P) and potassium (K) have to be corrected before changing to Conservation Agriculture. Especially in highly degraded or depleted soils, this means some investment is necessary to recover them, such as removing compactions, liming, use of green manure and synthetic fertilizer to control extreme nutrient deficiencies.

- Conservation Agriculture is a different production system and one of the biggest changes is in weed control. In conventional tillage, generally no special knowledge is needed about specific weeds because tillage implements bury and kill most of the weeds. In Conservation Agriculture often farmers must know the weeds and herbicides as well as other characteristics to control specific weed and avoid competition with crops.

- Most advantages of Conservation Agriculture in terms of building up of soil life, soil organic matter and weed management come from permanent cover of the soil. Not tilling the soil however provides the basis for the soil cover to be maintained, the soil organic matter not to be mineralized faster than it can be supplied and for the soil life, macro-pores and structure not to be disturbed, which reduces enormously erosion control and flood prevention under CA. No-tillage with low amount of crop residues does not give the full benefits of the system and often results in yield decrease in the first two to three years.

- Using leguminous cover crops such as *Mucuna pruriens, Pueraria phasheoloides, Centrosema pacuorum, Macrotyloma uniflorum*, dual purpose food legume Cowpeas (like IT93k-452-1), and *Glycin max* [Soybean] (like TGX1448-2E), and Groundnut like (SAMNUT 21) have proven to successfully control some of the obnoxious weeds. There is need however, to also build the soil cover process on indigenous farm and wild species.

6.4 Information Sharing

There is relatively good information on Conservation Agriculture, but the challenge is how to collate and share it appropriately. Knowledge management can thus be looked at in terms of (i) management issues and (ii) information sharing.

© P.Kaumbuto :Information exchange among CA experts and practioners

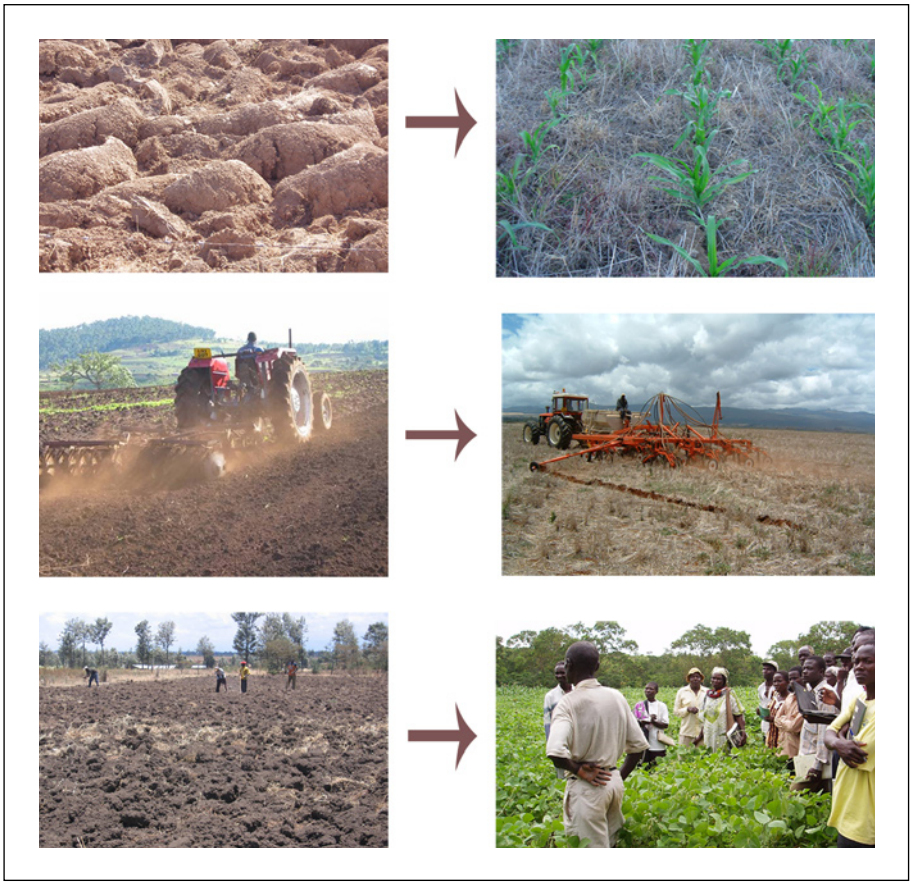
i. *Management issues:* FAO has a comparative advantage for undertaking data collection and documentation of CA practices, assisted by the existing networks (ACT, ASSS etc.), CA projects in Africa. The creation of a database, handling and management could also be facilitated through the same organizations in collaboration with other networks.

ii. *Information sharing:* There is a need to reinforce existing networks such as ACT by identifying local focal point in each African Country, African Soil Science Society, National Soil Science Societies and other environmental Associations through tools such as Pamphlet, books, research publications, web site (ACT, FAO, ASSS, etc), cabinet information memoranda, medias, education/ Curricula for CA education at various levels, extension education, farmers organization fora, workshops, trade fare, farmer field days, exchange visits and farmer field schools

7
Conclusion

The promotion and development of CA in Africa requires a step by step approach with enough flexibility at the outset so as to capture the needs, expectations and capabilities of resource-poor farmers.

Appropriate policy support including incentives and subsidies, particularly for small and medium scale farmers is essential. The involvement of the private sector (mainly local manufacturers of CA tools and equipment production) will be instrumental to sustain the successes of various on-going and past projects. Linking increased agricultural production to local and international markets including the emerging new market based opportunities such as carbon credits, eco-tourism, organic products among others could be key in the upscaling of CA practices with strong support from policy makers.



© F.Theodore, M. Malo, P.Kambutho: CA is about encouraging change as illustrated above

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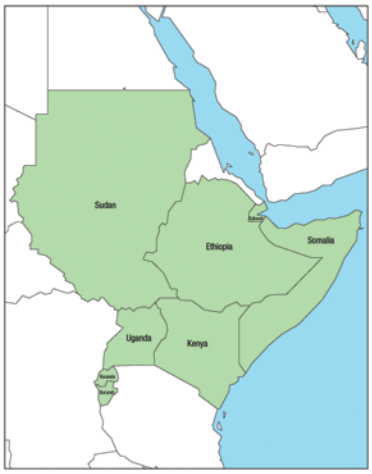

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