EXTENT OF CONSERVATION AGRICULTURE PRACTICE

Introduction

Conservation Agriculture (CA) as defined in briefs 1 and 2 is premised on the three principles of: (a) reduced or no soil disturbance (b) provision of permanent soil cover through crop residues, cover crops or any other biomass and (c) the use of appropriate crop rotations including legumes and cereals.

For maximum benefits and sustainability, the three CA principles have to be applied simultaneously although use of any one of the three principles marks a step in the right direction! As highlighted in briefs 1 and 2, the three principles of CA can be implemented in many different ways dependent on crops to be grown, farming systems, farm power sources and agro-ecological conditions for the particular location.

Due to the huge benefits that can be derived from its use, CA has been dramatically adopted in many countries across the globe in the last 2 to 3 decades. At the same time, challenges associated with the simultaneous implementation of the three principles have also led to controversies over the quality of CA implemented in different parts of the world. What is important is that Africa is lagging behind and has to ensure it starts implementing CA significantly as a way to mitigate climate change, help farmers reduce production costs amidst the global food and input prices crisis while increasing yields without depleting the natural resource base.

Global CA Adoption

By 2007, it was estimated that CA in the form of no-tillage had been adopted on more than 105 million ha world wide. No-tillage involves at least 2 of the CA principles i.e. reduced or no soil disturbance and the retention of at least 30% residue cover soon after planting. It is worth noting that about 85% of this area is in North and South America and a mere 0.3% (368,000 ha) is in Africa (Table 1).

Continent	*Area (hectares)*	*% of total area*
South America	49,579,000	46.8
North America	40,074,000	37.8
Australia and New Zealand	12,162,000	11.5
Asia	2,530,000	2.3
Europe	1,150,000	1.1
Africa	368,000	0.3
World Total	**105,863,000**	**100**

Table 1: Area under no-tillage and % by continent by end of 2007
Source: Derpsch and Friedrich (2008)

The countries with the biggest area under no-tillage are the USA, followed by Brazil, Argentina, Canada, Australia and Paraguay (Derpsch & Friedrich, 2008). It took Brazil 20 years to adopt the first 1 million hectares under no-till (Figure 1). The adoption rate has grown exponentially to 25.5 million hectares in the last 16 years. While adoption rates are increasing much faster in South America, they continue to be very low in Europe, Africa and most parts of Asia.

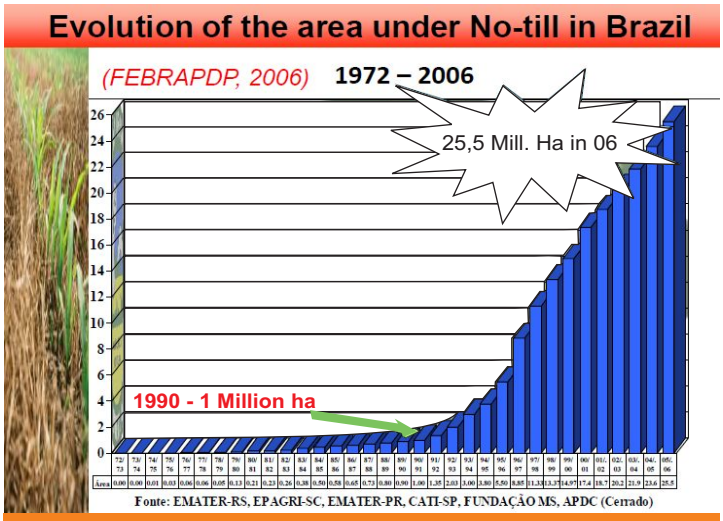

Figure 1. Evolution of area under no-till in Brazil

What type of CA has been adopted?

Conservation agriculture is being practised successfully in many contrasting environments. They range from sea level to 3000 m in e.g. Bolivia and Colombia; 90% sandy to 85% clay soils in Australia and Brazil; 250 to 3000 mm of rainfall in Australia and Brazil; and from equator to 50°S and 65° North.

Figure 2. No -till planting of rice in North Korea

World wide, conservation agriculture has been gainfully employed for all crops including tubers and horticulture. While cereals have benefited greatly from mechanization, evidence is emerging that even smaller grains like finger millet can be profitably established under CA. Figures 2-5 illustrate no till planting of various crops under CA.

Figure 3. Ox weeding of wheat in ripper rows in Njombe Tanzania

Figure 4. Onions cultivation under CA

Figure 5. Cassava under CA in Paraguay

Africa's Level of CA Practice

Various factors have generally affected the adoption of CA in Africa resulting in much lower hectarages. Nevertheless some progress has been made in the last decade particularly in the last 5 years. Preliminary and crude estimates of CA made in 2009 based on expert opinion from various sources suggest South Africa has The largest hectarage while countries such as Kenya, Ghana and Zambia have shown dramatic increases in the recent past (Table 2). It clear therefore that Africa has still a lot to do with regards to scaling out CA among the continent's farmers.

Country	*Area (hectares)*	*% of total*	**Type of CA**
Ghana	30,000	5	
Kenya	15,000	3	No till
Malawi	5,000	1	
Morocco	5,000	1	
Mozambique	10,000	2	
South Africa	377,000	64	No till, cover crops
Sudan	10,000	2	No till
Tanzania	10,000	2	No till
Zambia	120,000	20	Basins
Zimbabwe	10,000	2	Basins, No till
Total	592,000	100	

Table 2: Preliminary estimates of CA hectarages in Africa in 2009
Source: Anonymous sources (2009)

Typical Farm Operations under CA

Field preconditioning.
Conventional erosion control practices such as diversion systems, terraces, contour bunds and barriers are important supporting practices for CA systems.

Soil preparation
Planting basins are more concerned with concentration of soil fertility and soil moisture in specific planting locations, rather than aiming at reducing soil disturbance to a minimum. A similar approach is the use of the draught animal pulled chisel-tined ripper.

Planting
Generally the preferred method of planting the crop in CA is with a direct planter of some kind. This can be a sharpened stick (dibble stick) or a direct planter.

Cover crops
Meant to provide soil cover and to add organic matter and nutrients for the main crop, cover crops are sown as separate crops in a rotation, or in association with the main crop and generally relay planted to minimize the risk of competition fro nutrients, light and water. Lablab bean (Dolichos lablab) has been the preferred specie by many farmers followed by Mucuna pruriens and Pigeon peas.

Management of residues and cover crops
Prior to sowing the main crop, soil protecting residues and cover crops generally need to be flattened to provide a blanket of vegetative mulch that is as uniform as possible. This can be achieved manually with the use of a machete or with an animal-drawn knife roller designed to break and flatten the plant stalks to provide the appropriate cover. Perhaps the most important crop residue management aspect is not burning prior to planting.



Weed control
Conventional weeding with hoes and machetes or shallow surface scraping, will always expose a further weed seed bank to soil surface, is the most preferred compared to herbicides.

CA system packages in use

Planting basins. The Zambian system incorporates five components:

- Not burning retained (at least 30%) crop residues.
- Tillage (by hoe) of no more than 15% of the soil surface.
- Breaking plough pans.
- Permanent planting stations.
- Rotation of main crops to include legumes.

Manual CA. The manual CA package, which has been used at the FAO TCP and CA SARD sites, comprises the jab planter and manual herbicide applicators which can be knapsack sprayers or the Zamwipe. In manual systems weed control can be mechanical (with hoe or machete) or chemical with the use of either of these pieces of equipment.

DAP CA. Draught animal powered equipment has also been provided by FAO at the CA SARD pilot sites. The equipment package comprises no-till planters, usually pulled by at least one pair of oxen; knife rollers for controlling residues, weeds and cover crops prior to planting; and animal-drawn sprayers for herbicide application.

Tractor-powered CA. The use of tractor powered equipment in the CA SARD sites is restricted to a few mounted three-row planters. Unless some form of acceptable multi-farm use can be designed, then this technology will generally be beyond the financial reach of the vast majority of smallholder farmers in SSA.

How far has CA been accomplished?

CA is still in its infancy in SSA. The concept of continuous protective surface cover has been difficult to assimilate for farmers accustomed to striving towards clean seed beds. That the clean seed beds are the cause of soil degradation and yield reduction has not acted as brakes on the system as there have hitherto been few viable alternatives.
Basin planting cannot really be called CA, but it does reduce tillage over the field surface as the soil disturbance is confined to well defined pits. Ripping has proved to be one of the most popular forms of reduced tillage and has been adopted on a wide scale. Again ripping is a reduced tillage technology, but perhaps because of its similarity to mouldboard ploughing kit has taken less of a cultural leap to adopt the practice.

Ripping does cause considerable amount of soil disturbance which damages its structure and destroys the natural channel system. But it should be considered to be a step on the route to full CA and therefore encouraged at this stage of the adoption process.

The jab planter technology has been generally accepted by smallholder farmers who can appreciate the benefits of direct planting and fertilizing in one pass. As a response to the demand for the implement there has already been some small scale batch production of jab planters in several countries, which needs to be nurtured.

Draught animal powered equipment (planter, knife roller and sprayer) has been greeted enthusiastically, but there is always the problem of the cost of obtaining the technology. Knife rollers are being manufactured in Uganda and Tanzania, and no-till planters in Tanzania but, to date, these technologies has not been widely adopted.

Tractor powered CA technology is currently only suitable for larger scale, commercial farmers due, principally, to the high level of investment required. Opportunities are emerging to switch utilisation of the clusters of two wheeled tractors (power tillers) to CA and acquiring No Till seeders for existing tractors.

Key Challenges to CA Adoption

A number of challenges affect the adoption of CA by farmers and these have to be addressed by Africa's policy makers and technocrats.
Change of mindset: For many farmers and culturally, the term 'growing a crop' is also the same as 'tilling the soil' in sub-Saharan Africa's vernacular languages. Through traditional practices cropping has thus become synonymous with tillage and it is difficult for farmers to imagine growing a crop without ploughing the soil. There is therefore need for awareness creation among farmers to expose them to working CA technologies so as to change from this mindset.

Maintaining soil cover: Retention of crop residues in the field, to ensure there is at least 30% soil cover at planting, is another serious challenge for many farmers keeping livestock and practising communal grazing systems as well as other competing uses for crop residues such as fodder, fencing, hand crafts, roofing and fuel. Traditions of uncontrolled grazing of livestock on stubble as well as the lack of appropriate winter tolerant cover crops for the drier areas are key issues.

Nutrient depleted and degraded soils need to be rehabilitated before the fruits of CA can be reaped. Such deterioration may be on sodic or acidic soils due to

improper use of chemicals or fertilizers, compacted soils due to trafficking and "plough pans" or nutrient depleted soils due to soil erosion or nutrient mining. Attempts to copy the "green revolution" (improved hybrid seeds, inorganic fertilizers and pesticides/herbicides) are bound to fail.

Land tenure systems: Farmers may be reluctant to invest in improvement of the status of the soils they cultivate if they do not have clear rights to the land.

Weed control is a problem for most farmers particularly during the first year. Elimination of ploughing, which is also practiced by farmers to control weeds, increases weed infestation initially. However, the use of winter weeding techniques and prevention of weeds from seeding helps to reduce the seed bank reservoir in the soil and thus subsequently reduces weed pressure in CA.

Lack of appropriate CA Equipment: The more sophisticated forms of CA require specialised planting equipment and other inputs as herbicides. Affordability and accessibility of these inputs to farmers' can greatly hinder adoption. CA equipment is however being manufactured in Tanzania, Kenya, South Africa, Zambia and Zimbabwe to name a few. Vigorous attempts are therefore being made to ensure farmers access suitable equipment that they can afford. However the lack of such equipment should not be an excuse for not implementing as there are many other options of achieving CA as detailed in Brief 1.

Opportunities for Scaling out CA in Africa

- National governments and development partners alarmed by the soaring food prices, hikes in input (fertilizer prices) and climate change mitigation are looking at options to cushion negative impacts on smallholder farmers. Conservation agriculture provides an opportunity to address many of these key constraints.
- Conservation agriculture has the potential to increase African grain yields (refer to brief No. 2). Household food security and poverty alleviation, as advocated in the Millennium Development Goal of halving the number of malnourished and hungry people by 2015, is a selling point for CA. National and international funds may be mobilized when tangible and documented evidence is properly synthesized and presented.
- Emergence of a range of new market based opportunities such as payments for environmental services, Eco-tourism, bio-energy / agro-fuels, Green/Organic labels and certification that could be harnessed for promoting and funding CA.
- Improvement of the policy environment to stimulate CA uptake e.g. village land use planning, arable farming expansion versus maintenance of rangeland, agricultural mechanisation and review of environmental policies /synergies. institutionalization of ca training in education (schools, agric college and universities), extension and research so that consistent and complementary messages are transmitted to clients could be some of the appropriate strategies for scaling out ca in africa.

What can policy makers do to scale out CA

Policy makers have an important role to play in the adoption of CA by the region's farmers. There are many possible options for policy makers:

Being CA champions themselves: policy makers could lead by example through adopting CA
CA Policy Advocacy: Many countries do not have a CA policy. Policy makers can advocate for the necessary CA enabling environment through lobbying for policy changes in parliament, cabinet meetings and other policy making fora within their own governments. A CA policy could help to ensure CA is institutionalized in schools, tertiary colleges and universities. It could also ensure there is adequate funding allocated to research and extension of CA by NAREs. Policy incentives could include for example subsidies on CA equipment, CA chemicals e.g. herbicides. Farmers producing using CA could also get special concessions e.g. tax exemptions on certain purchases, special prizes for their commodities etc.
There are therefore many ways in which policy makers can contribute to CA adoption in Africa and thereby contribute to climate change mitigation and subsequently sustained agricultural production and the dream for food security in Africa!

References

Rolf Derpsch and Theodor Friedrich, 2008. The extent of Conservation Agriculture adoption worldwide: Implications and impact. Paper presented at the IV World congress on Conservation Agriculture, New Delhi, India.

Acknowledgement:

This Technical Briefing Note was produced with financial support from USAID.

African Conservation Tillage Network
P.O BOX 10375 - 00100
KARI - NARL, Waiyaki Way
Nairobi, Kenya
www.act-africa.org
info@act-africa.org