

# Conservation Agriculture in Development: The Case of Africa

*Martin Bwalya (ACT) and Theodor Friedrich (FAO)*

## Introduction

The rising world population is increasing the pressure on agriculture to produce more food (Fig. 1 and 2). This is more so for the African continent, where it is not just about food supply, but also a critical factor in economic development, poverty alleviation and improving living standards especially in rural areas. On the other side agricultural production is one of the factors contributing to the degradation of natural resources in Africa. Qualitative assessments of available data suggest that about 20% of Africa's agriculture lands are severely degraded as a result of direct agriculture activity (McNeely et al. 2001). Environmental problems are considered an inevitable trade off of productive agriculture. On the contrary, Conservation Agriculture proven agricultural production options, which combine production with sustainability.

## The Concept of Conservation Agriculture

*A concept, not a practice*

Conservation Agriculture conserves, improves and makes more efficient use of natural resources through integrated management of available soil, water and biological resources. It does not exclude the use of external inputs. It leads to environmental conservation as well as enhanced and sustained agricultural production. It is resource-efficient/resource effective agriculture. As such it is a concept of agriculture, which embraces a set of practices, but it is not a practice or technology itself. Conservation Agriculture also cannot be implemented by recipes, because it depends on the specific conditions of each farm. With this the farmer becomes the main player in the technology development under Conservation Agriculture. However, the concept as such is universally applicable.

*Three principles: permanent soil cover - direct planting/no till - crop rotation*

Conservation Agriculture can be characterized superficially by three main principles:

- Permanent maintenance of soil cover of live or dead vegetal material on the soil surface. No burning of residues is allowed.
- Permanent no-tillage and direct seeding or planting of crops through the cover using special equipment.
- Planning of crop rotations over several seasons to minimise the build-up of pests or diseases and to optimise plant nutrient use by synergy between different crop types and by alternating crops with different rooting characteristics.

These three principles allow to experience the full benefits of Conservation Agriculture while minimizing the need for farm inputs particularly chemical inputs. Not observance of one of these principles, as for example crop rotation, makes Conservation Agriculture more difficult to manage, less sustainable and increases the need of chemical inputs. The principles would even apply in those types of agriculture, which are not field crops, such as perennial crops, agro-forest systems, livestock-pasture systems and which can also be managed following the Conservation Agriculture concept.

## The experiences with Conservation Agriculture - case Brazil

In the context of Conservation Agriculture the case of Brazil is often referred to as example. The reason for this is not that it was the first country to work on no-till based cropping systems. But in Brazil, as well as in some other parts of southern South America, there is a long history of farmers who practice no-till farming and who have managed to create a mass movement; more than that they have developed out of the no-till farming a farming concept which can be considered a real revolution in agriculture. There are farms which for 30 years have never tilled their land, there is an exponential growth rate of no-till farming in the region and in many parts of the region the vast majority of farmers is not tilling any more. Farmers and communities have developed methods of promoting the concept as they started to see the benefits, the research sector has moved in and developed Conservation Agriculture in a holistic form and the commercial input supply sector such as the machinery manufacturers has responded with completely new concepts for agricultural machines and equipment. In parts of that region Conservation Agriculture has become the norm, conventional tillage based agriculture is the odd exception and bound to disappear.

The original impulse for the first innovators to change the way of farming was serious soil erosion and increased economic pressure due to globalized markets. Many farmers were left with no choice but to change or to perish. Those farmers who did not adopt no-till farming often sold their land to the adopters. No-till farming made farming more profitable, but many lessons had to be learnt. Sharing experiences with other farmers helped and a very active movement of farmers groups, clubs, associations was created which culminated in a regional Association for the entire American Continent. The dynamic of this community organization and participatory technology development is a very interesting experience.

It led to a development of no-till farming into what is called Conservation Agriculture, a concept of farming characterized by a permanently increased number of practices and new features which were developed by farmers, scientists and commercial manufactures in close collaboration with each other. With now probably 17 Million ha land under Conservation Agriculture in Brazil, a lot of which for more than a decade, impacts are visible in the environment also outside the direct farmland.

Conservation Agriculture first of all makes farming more profitable. It allowed the pioneers to survive on their farms. It is a way to cut costs and, more than anything else, to cut time and labour invested in farming. This time saving allows to improve the living conditions of rural families, makes the life more attractive in rural areas, provides opportunities to invest the time in more profitable occupation, such as value adding operations in integrated livestock production or on-farm processing activities. As a result in Brazil there were cases where the migration towards the urban centres could be reverted. Risk of farming is reduced as yields stabilize and the impacts of wet or dry years, even of real natural disasters like floods and draughts, can be measurably reduced. In addition farmers realize with the time that the necessity for synthetic inputs such as fertilizers and pesticides is reduced while yields increase. The environmental awareness of the farmers generally grows as Conservation Agriculture depends even more than conventional agriculture on the natural processes in the environment.

These benefits are not only obvious to the farmers but to rural communities in general. Water tables of ground water and wells raise, river flows stabilize throughout the year, and danger of floods and mud eroding from agricultural land is reduced. The water quality improves and the costs of communities for road maintenance and purification of drinking water drop

dramatically (Bassi 2000). Rural municipalities started to support Conservation Agriculture for that reason in Southern Brazil. Another important supporter is the electricity company running the Itaipu Hydroelectric Project. Conservation Agriculture in their watershed reduces the maintenance costs and increases the lifetime of the dam, which justifies a support to farmers to adopt that concept of farming.

In this way Conservation Agriculture can be considered a win-win concept, in which there is really no trade off for any of the parties. In the case of Brazil there is already sufficient evidence that this is not only theory but also that it can be achieved in reality.

## How would Conservation Agriculture address problems of African Agriculture

Obviously Africa is not Brazil; agro-ecological conditions, although not in all cases, are different. The socio-cultural framework is different. However, Conservation Agriculture in Brazil has proven to solve many problems, which are also very common in Africa. Conservation Agriculture as a concept should be able to solve the same problems here, but the practical solutions, means the actual field practices, have to be developed by African farmers and researchers, as was the case in Brazil.

### *Soil degradation*

Soil degradation is a serious problem in many parts of Africa. Large areas are already seriously degraded physically, biologically and chemically. (Fig. 3) (FAO 2000a). On more fertile deep soils, erosion does not seem to concern the farmers too much, but the farming practices employed on these fields could also be described as “mining”. The erosion effects, though not felt here, is at least creating a cost downstream with increased pollution and sedimentation. Many African Farmers report declining yields and even fertilizer does not seem to be the answer to stop this. Zambia has reported a decline in maize yield from about 2.4 tonnes per hectare in 1991 to less than 1.4 tonnes per hectare in 1999. Most of these national and international statistics fail to present the seriousness of the decline and impact it is having on households at community level. Farmers “cry” today that from the same fields where 15 – 20 years ago they got enough harvest to feed the household and sell some for cash income, they are unable to get even a quarter of that harvest today even with increased use of fertilizers and higher yielding seed. This has put increasing threat on food security with relief food aid becoming a norm than an exception. One of the major factors causing soil degradation in tropical climates is soil tillage, which is responsible for soil compaction, exposing the soil to rain, wind and temperature extremes and causing mineralization of organic matter. Therefore the soil loses structure and capacity to hold water and nutrients and erodes. Soil nutrients are lost in this way. No-till based agriculture seems to be the only way to stop the degradation process in tropical climate and Conservation Agriculture offers a concept to integrate no-till agriculture into sustainable farming systems.

### *Lack of water, drought, and unreliable rainfall*

Drought and lack of water is a very common and increasingly serious problem, in Sub Saharan Africa (Ragab & Prudhomme 2002). In many cases, with exception of the real arid climates, the lack of water is relative; while crops suffer and die from lack of water stress, the same areas suffer serious erosion problems with gullies a common sight. Siavonga District is in what is defined as Zambia’s driest areas. The District receives an average annual rainfall of 300 – 400 mm. A problem analysis workshop (Bwalya, 2002), in the District singled out “insufficient water stress” and “soil erosion” as the two major causes for low/declining crop yields in the District. This means that the actual land use systems are not making best use of the water. In addition to this tillage operation for the seedbed preparation leads to heavy loss

of soil moisture through evaporation as the loose-bare soil dries up. As a result the crop suffer stress through insufficient water even in the event of a few days dry spell. With increasingly unreliable rainfall patterns this delays often the planting, decreases the yield and increases the risk of farming. Evidence of water erosion in many semi arid areas of Africa suggests that a significant percentage of rainwater is lost unproductively in surface runoff. Not only that this water does not contribute to growing a crop but also it is also lost for the recharge of the aquifer. The result is drying wells.

Increased soil compaction causes decrease in water infiltration leading even serious water availability and erosion problems. Conservation Agriculture provides the options to reverse these processes. It is building up soil structure, improving water infiltration, and reducing surface runoff and loss of rainwater. No tilled and covered soils maintain surface moisture better and can even allow early planting taking advantage of the residual soil moisture. Drought periods are better tolerated by the crops as the water holding capacity of the soil is increased by the increased organic matter, while the mulch cover reduces unproductive evaporation.

#### *Labour shortage, AIDS pandemic*

The availability of farm labour is declining also in Africa. The rural population is steadily reduced due to migration to urban centres (Fig. 4). Particularly the younger and male population, which means those who have the potential for heavy physical work, are moving to the cities (Fig. 5) (Mrema 1996). Consequently labour for agricultural work, particularly for tillage operations, is increasingly lacking. With limited or no access to other forms of farm power, many households have no alternative but to reduce or even abandon agricultural land. The situation is aggravated by the HIV/AIDS pandemic affecting most parts of the African continent. HIV/AIDS is not only reducing even further the available human labour force, but also take away many hours of work from the health ones as their care for the sick and attend funeral of those passing. AIDS is now one of the leading causes of death in Sub-Saharan Africa (SSA). Since the pandemic began, the Joint United Nations Programme on HIV/AIDS estimates that **17.2 million** Africans have died from AIDS. In 2000, **25.3 million** Africans were estimated to be living with the disease, **3.8 million** of who were infected with HIV during that year.

Migration, including the temporal migrant labourers (mostly men leaving households in the rural areas to work in urban centres and only come back at month-ends) which is still common in some countries (South Africa, Zimbabwe, Namibia), and HIV/AIDS have left many African households with women as head of the household. This further increases pressure on these women to care for household and family and manage farming work at the same time. The workload and particularly the hard work of land preparation and weeding are for these female headed households very difficult to cope with.

All these factors only go to emphasize why farming methods that reduce the requirements for human labour and the drudgery of heavy farm work are mandatory. Conservation Agriculture could be an answer to this problem.

#### *Lack of farm power and appropriate implements*

Coupled to the labour shortage is the problem of unavailability of farm power in Africa. Kenya, Tanzania and Zambia primary land (seedbed) preparation is done manually on over 80% of cultivated land (Kaumbutho & Simalenga, 1999). The situation is the same in many other countries. Even in countries which had attained a higher extent of tractor use (e.g. Zimbabwe - 55% of cultivated land prepared with tractor power) the situation is either stagnant or declining as farmers including commercial farmers, suffer increasing financial

inability to maintain, let alone, replace the tractors. In some African countries there are still land reserves, which could be used for agricultural production. However, the farm power to cultivate these areas is not available. Available draft animals are also either stagnant or on decline. Zambia's Southern Province, once the country's bread basket and accounted for over 80% of the country's traditional cattle herds, has in the period 1989 to 1999 lost about 50% of trained work oxen due to disease and drought. On the other hand, the available draft animals are often weak or in bad condition at the time land preparation has to be done; provision of quality fodder is difficult. Desired access to tractors is increasingly difficult; if available it is often financially beyond reach for many farmers. Even in countries still running government managed (subsidised) tractor hire schemes, e.g. Zimbabwe, their capacity in any year is very limited. An investment in tractors and their maintenance also is often prohibitive from the financial point of view.

Conservation Agriculture could reduce substantially the need for new investments in farm power and allow farmers to do more with the available power. On the other side it can also provide a new chance for animal traction whose use have almost 100% been restricted to primary land (seedbed) preparation, using the mouldboard plough. Farmers using animal traction but facing power bottlenecks for certain operations such as land preparation, for which they would hire a tractor, could now carry out all their farm operations with animals using fairly sophisticated technologies for direct planting. More than that, they could even start themselves to provide services to neighbouring farmers not having animals or the equipment, as the work capacity of direct planting equipment allows for much higher outputs than usually experienced under conventional agriculture. Along one of the main themes of this workshop, animal traction in Conservation Agriculture (used with appropriate implements) could become a real long term source of farm power without always having the connotation of second class or transitory towards tractor mechanization. From that point of view the introduction of a kind of agriculture, which requires less farm power, probably would not solve the farm power problem completely but it would help to overcome the bottleneck.

Available implements are limited both in numbers and types. One of the most pronounced implement CA/CT development thrust in the region has been the one in Southern Africa involving ripper-tine implements being developed/used in minimum tillage and ripper-planting operations. These efforts have brought on the scene animal drawn rippers, ripper-planter and sub-soiler. Despite getting popular, there are still very few (no more than 5000 pieces in Zambia, and possibly the highest in any one country) such implements acquired by farmers. Manufacturers are reluctant to mass-produce without demand guarantees and on the other side extension promotion is not extensive, at least yet.

### *Rural livelihood*

A central problem remains the unattractiveness of rural life in African countries. Urban centres in parts of Africa are growing by 7% yearly and by the year 2025 the rural population in Africa is expected to have dropped below 50% of the total population. As explained above, it is mostly the economically active part of the population migrating from rural areas, leaving behind old people and children. This process can only be controlled by improving rural livelihoods, an important part of it being the way, agriculture as the core rural business is done. Conventional agriculture is viewed essentially as a lot of hard work and drudgery with low and uncertain returns. Reducing the drudgery of agriculture, leaving more time for other either more pleasant or more profitable occupations, might reduce the pressure on the young generations to migrate to the cities. It would not only make it easier for children to go to school but also for the working population to get involved in business outside farming, such

as rural crafts or processing. Again here, the introduction of Conservation Agriculture has helped to provide the right incentives in Brazil and there is a good chance that this could also apply for Africa.

The low/declining performance of agriculture also leads to increasing poverty and lack of development in rural areas. With little or no access to external inputs, most rural farmers, depend on the inherent productivity of their natural resource base – soil and water. Therefore, degradation of these resources directly affects the very livelihood of these communities. It should also be noted that such degradation in natural resources not only leads to further poverty, but also results from it. With increased difficulty to get food because of degraded soils, the rural farmers become even dependent on gleaning the products of natural biodiversity. Such (survival) strategies may provide immediate relief, but are not sustainable – is only postponing the adverse consequences to the future.

### Initiatives on Conservation Agriculture in Africa

The terms Conservation Agriculture or conservation tillage are not entirely new to African agriculture. In Africa’s agricultural development, the 1960s and 1970s could be described as the mechanisation era, i.e. when most African countries, just after political independence, embarked on extensive agricultural mechanisation, particularly increasing agricultural output from increased area under cultivation. In the 1980s as limitations to sustain the mechanisation interventions become more apparent, with development organisations and NGOs more coming on the scene, efforts to promote increased performance in the agricultural sectors moved to embrace other strategies and technologies. Among these are various technologies and practices, which relate to Conservation Agriculture.

In the last two to three decades, there have been numerous efforts at some sort of conservation farming or sustainable farming practices. These range from practices directed and enforced by government legislation to agronomic recommendations developed and promoted by and through government and NGO agricultural extension services. Table 1 gives some of the typical practices that relate to soil conservation and have been promoted in African agriculture for many years now.

**Table 1:** Typical Conservation Practices promoted in Africa

<b>Options</b>	<b>Problem/issue being addressed</b>	<b>Examples</b>
Rotations	- soil fertility (including legume in the rotation) - pest and disease control - crop diversification	
Contours ridges	- control surface water run-off and, hence, limit soil erosion	
Terraces	- control surface water run-off and, hence, limit soil erosion	
Storm drains and water ways	- control surface water run-off and, hence, limit soil erosion	
Strip cropping		
Agroforestry	- soil fertility and organic matter replenishment	
Stone bunds	- control surface water run-off and, hence, limit soil erosion	
Ridges and tied-ridges	- control surface water run-off and, hence, limit soil erosion - collecting/harvesting rain water in the field to allow infiltration	
Winter ploughing	- water infiltration and runoff control	
Green manuring	- soil fertility	
Farrowing	- soil fertility	

However, with the current rising demand for food in particular and agricultural productivity in general, on one side and poorer and less predictable rain, it is increasingly being realised that much more needs to be done than the options previously promoted, sometimes in isolation, under the banner of conservation farming.

Adoption at farm level for most of these technical conventional conservation-farming techniques is very low, especially when viewed against the efforts and resources put in developing and promoting such technologies.

One element of Conservation Agriculture that conspicuously missed in previous efforts was “the extent of soil disturbance” done. In fact, past options were promoted in the context of very high levels of disturbance to the soil – conventional tillage. Acknowledging the critical role tillage would play in a system for sustainable soil-water use and the need for a holistic approach, it is noted that even though some past and current initiatives might not reflect the full concept of Conservation Agriculture, they present some valid approaches, as long as they are understood as steps to move through the transitional phase. It is important that the concept of Conservation Agriculture is well understood and avoid converting it into a “quick fix” for all problems as it appears to be happening already.

There are currently a number of national, regional and international initiatives supporting and/or facilitating promotion of the new concept (described earlier in this paper) of Conservation Agriculture in Africa. These include development efforts supporting direct technology development/adaptation and adoption to Networks, Projects and NGOs facilitating exchange of experiences and information among stakeholders and players within and between countries/regions. Table 2 gives a list of some Networks working in Conservation Agriculture in SADC countries.

**Table 2:** Table Networks on addressing Conservation Agriculture in SADC countries

Name of Network	Year established	HQ
Soil Fertility Network for Maize-based cropping system in Southern Africa	1994	Harare
Tropical Soil Biology and Fertility Programme (TSBF)	1988	Nairobi
Alley Farming Network for Tropical Africa	1989	ICRAF
Network for Management of Vertisols	1987	
Soil and Plant Analytical Laboratories in Africa	1991	IITI
Agroforestry Research Network for East and Central Africa	1987	
Sustainable Agriculture Networking and Extension	1993	
African Conservation Tillage Network	1998	Harare
Nutrient Network for Improving Soil Fertility in Africa	1998	
Association of Participatory Ecological Land-Use Management (PELUM)	1995	Harare
Soil Science Society of East Africa	1974	
Management of Degraded Soils in Southern and East Africa	1998	Rome (FAO)
Global Network on Integrated Soil Management for Sustainable Use of Salt-affected Soils	1990	Rome (FAO)
World Overview of Conservation Approaches and Technologies	1994	Berne

### Adoption of the new concept of Conservation Agriculture in Africa

In most countries in Africa, conservation farming, in general, and specifically conservation tillage is more adopted in large scale commercial farming systems, while the smallholder traditional farmers are just becoming aware of it. Adoption in the commercial farm sector has been driven by various factors, including purely economic factors. In South Africa, commercial farmers in KwaZulu-Natal, driven by increasing cost of maintaining soil

fertility/productivity as a result of many factors including the rising fuel cost and the 1995 deregulation of the maize market, mobilised and organised themselves into one of the continent's successful farmer-driven no-till club. The club has moved on to embrace and provide support to its member on the principles of Conservation Agriculture – including rotations, no-till, soil cover and cover crops, fertilization and liming. The club has currently over 100 members (commercial farmers) commanding among them about 5,000 hectares of fields under no-till. In Zambia, it is estimated that about 20 to 30 commercial farmers working an average of 400 hectares are using direct-planters.

Extent of adoption among smallholder communal farmers is varied and clear figures are hard to come by. This is further complicated by the differences in definitions and interpretations of the practical CA options. However, indication in all cases is that adoption of some form of conservation farming is on the increase. In some cases, farmers have taken and adopted basic measures, which lay the desired foundation for the application of conservation farming. This has been necessary in fields that have been degraded and would require some restoration before full application of Conservation Agriculture.

In Kenya's Machakos District, a RELMA-ACT supported programme implemented by the Kenya Conservation Tillage Initiative, has successfully introduced sub-soiling with over 150 farm households already sub-soiling their fields (major limitation being availability of animal drawn sub-soilers). Sub-soiling has been essential as the soils were seriously compacted with a plough pan just about 15 cm in the soil. This is being done in combination with minimum tillage, i.e. after sub-soiling, then a ripper is used to make planting furrows where seed and then placed manually. A few farmers have also already started to incorporate the element of soil cover in the practice – *Dolichos lablab* is being used as a cover crop. *Dolichos* bean is also eaten in the areas.

In Zambia, six to seven year of intensive promotion of Conservation Agriculture is said to have resulted in about 20, 000 -30, 000 hectares (CFU, 2002) under minimum tillage, mostly represented by hand-hoe made pot-holing and animal drawn ripper-planting. Data of the Land Management and Conservation Farming Unit and the Ministry of Agriculture indicate about 80,000 hectares. This is all in smallholder communal farming sector. About 800,000 ha are cropped under some form of reduced tillage. However, the figures of 20,000 to 30,000 ha include only those which fully conform to the CFU package including no-till (potholing), rotation, timely application of inputs and soil cover. These figures have to be understood within the context of what is defined as no-till or Conservation Agriculture. This package is rapidly getting popular among farmers. In the 2001-02 season when 70 % of maize fields in Southern Province and 50% in areas west of Lusaka have zero yield due to the drought that affected the most of the country in December-January period, farmers in these areas who had used the CFU techniques have all recorded some yield.

In Zimbabwe, emphasis have since the 1970s been placed on developing conservation agricultural practices described by various terms such as conservation tillage, minimum tillage, residue farming, mixed cropping, and crop rotations. Benefits to this approach have been realised in Chivi district Ward 25 where resource poor farmers dramatically increased adoption of conservation technologies such as *fanya juus*, vetiver strips, infiltration pits mulching and tied ridges through subsequent activities by the Indigenous Soil and Water Conservation Project (Nyagumbo, 2002). Communal grazing has generally tended to limit the adoption of mulch-tillage-systems in the smallholder sector.

In Namibia, where commercial farmers have extensively adopted conservation tillage application (Mwenya et al, 2000), among smallholder communal farmers, the trend has been more towards conventional tillage practices. Until recently Namibia had a government

managed tractor hire scheme, which provided tractor-ploughing services to farmers at up to 80% subsidy. This service was discontinued in 1998, moving it to the private sector. Most farmers now use the animal drawn mouldboard plough to work their land. Deliberate Conservation Agriculture efforts in Namibia's communal farming systems are very recent and coming in through the animal draft power programmes. Conservation tillage equipment available in the country is still essentially the demonstration rippers imported from Zambia in 1999 and a few sets of direct planters (animal and hand) acquired through a visit of Brazilian CA specialists in 1998.

## Factors influencing adoption of CA in Africa

Whiles experience through a number of initiatives (Garcia-Torres et al, 2000; Benites et al, 1998; Biamah, et al 2000) has shown that the principles of Conservation Agriculture are feasible in the African environment, it is important to be mindful of the fact that success in application and adoption will have to conform to the specific African (local) socio-economic and cultural factors in addition to technical parameters. One critical benchmark in the development and promotion of Conservation Agriculture is that the concept and principles have to be "internalised" into the African situation. The concept and principles have to be defined and understood within the context of the socio-economic and cultural factors unique to Africa. A number of factors in the development/promotion strategies and dissemination approaches and those that relate directly to the technical options need to be addressed. A few are discussed below.

### *Awareness and appreciation of the problem*

It is critical that the process is based on a solid and genuine awareness and appreciation of the "problem/s" and related causes among a critical mass of stakeholders. Central to this are the farmers and farming communities. Particularly when the possible solution/s would require radical changes in, for instance, traditional behaviour and practices, the perceived problem much be serious enough to justify the change.

### *Awareness on possible options and technologies to address the problem*

It is important that farmers and indeed related stakeholders are aware of other possible ways to, in this case, farm with little or no damage to the environment. Many of the smallholder farmers in Africa look at ploughing (complete soil disturbance done for seedbed preparation) as a necessary evil as there are not aware of any alternatives. Therefore, relevant and appropriate information support and exposure would greatly induce and motivate farmers to "venture" into alternative systems.

### *Compatibility or conflicts with existing cultural habits and traditions*

This is a critical factor, especially in address adoption of Conservation Agriculture in Africa's smallholder communal farming systems. Conservation Agriculture includes a long-term commitment to the land – a factors sometimes not possible due to local traditions and/or land tenure systems. Conservation Agriculture would also require more deliberate and conscious efforts in managing arable-livestock interactions – away from conflicting to more mutually rewarding enterprises. The common unguided and little controlled communal grazing does not support Conservation Agriculture.

### *Farmers' accessibility to necessary inputs*

Availability and farmers financial and physical ability to access and use required inputs is critical to the adoption of Conservation Agriculture. Whiles seed, fertilizers and herbicides

have been important, adoption of Conservation Agriculture in particularly Africa's smallholder-communal farming systems has been influenced by farmers' accessibility to appropriate equipment. Unlike seed and fertilizers (generally and widely available from the many years of past and current agronomic research), Conservation Agriculture equipment is a relatively newer issue and less available. This is compounded by the fact that most development agencies and farmers support NGOs would rather deal in seed, fertilizers and chemical which are cheaper and can be sub-divided than dealing in equipment which is expensive.

#### *Public good and public sector commitment*

As could be seen also from the above factor, adoption of Conservation Agriculture would, on one end represent substantial investment from the farmer and on the other calling for taking of significant risks. For farmers, in smallholder communal farming systems, risking agriculture production has immediate and direct impact on food security and livelihood. For instance, adoption of Conservation Agriculture would require a farmer making costly investment in relevant equipment. It is, however, also a risk and costly step for the manufacturer to develop and offer such equipment when there is no clear and significant demand, let alone deliberate promotion of the equipment. It is, here, in view of the national and possibly global benefits from adoption of Conservation Agriculture, that governments, and especially African governments should translate the political will into practical programmes that would, for instance, mitigate such risks.

#### *Current state of the soils*

It has to be appreciated that significant amount of the lands (soils) in question have been used in arable farming for up to twenty years and more and often without much break. These are soils that have been consistently subjected to complete soil disturbance (ploughing) and harrowing for seedbed preparation, weeded mechanically and actually all the weeds (plant materials) removed from the field, usually monocropped. Those degraded soils, presenting hardpans and erosion often require some restoration before they can be taken under Conservation Agriculture.

#### *Weeds*

Weeds and weeding have been an issue even in conservation farming systems. This is mostly weed control/management technologies available to smallholder farmers are very limited. The problem is even further complex in CA systems. Farmers adopting no-till are immediately confronted with the weed problem. Experiences show that weeds decline after a few years under no till especially as factors such as soil cover take effect. However, what is critical in most cases among the smallholder farmers is weed control in the first, second year. After that they will have abandoned the practice if there was no solution. It should in this context be remembered that most farmers' argument for ploughing is weed control and that these farmers have no capacity to risk crop failure even just for one year. In Kenya, research undertaken by KARI (Wanjala, 1987) indicated that higher yields in reduced tillage systems (compared to conventionally tilled fields) were observed mainly in cases where the use of herbicides had achieved nearly the same level of weed control as in conventional system.

#### **Current status and trends in the application of CA in Africa**

Although interpretations and definitions vary, and probably rightly so, the term "Conservation Agriculture" is now a household name across the continent. Additional to numerous localised initiatives on Conservation Agriculture, there are some national, regional and international

programmes addressing issues of Conservation Agriculture in Africa. These include the World Bank supported Soil Fertility Initiative Programme RELMA's soil conservation and sustainable agriculture support, FAO's support on various aspects of Conservation Agriculture including equipment and other international NGOs such as Sasakawa Global 2000.

As indicated earlier in this paper, whereas adoption of no-till based conservation farming practices is significant among commercial farmers in most countries (75% in Zimbabwe - 1995), extent of sustained adoption among smallholder communal farmers is minimum. Even with increasing focus on Conservation Agriculture in programmes addressing smallholder agriculture, it is still not uncommon to find heavily supported programmes focusing on conventional farming practices. For instance, the land reform programme in Zimbabwe includes a heavily subsidised tractor-ploughing scheme. During the 2001-02 season, thousands of hectares of land were ploughed through this programme.

## References

- Alexandratos, Nikos (1995): World Agriculture: Towards 2010; FAO, Rome
- Bassi, L. (2000): Impactos sociais, econômicos e ambientais na Microbacia Hidrográfica do Lajeado São José, Chapecó, SC; EPAGRI, Documentos No 203, 50pp
- FAO (2000): Agriculture: Towards 2015/2030; technical interim report
- FAO (2000a): Global Assessment of Soil Degradation GLASOD
- FAOSTAT (2001). <http://apps.fao.org/default.htm>.
- Mrema, G. C. (1996): Agricultural Development and the Environment in Sub-Saharan Africa: An Engineer's Perspective; Key note paper presented at the First International Conference of SEASAE, Oct. 2-4, 1996, Arusha, Tanzania
- Ragab R. and Ch. Prudhomme (2002): Climate Change and Water Resources Management in Arid and Semi Arid Regions: Prospective and Challenges for the 21<sup>st</sup> Century; Biosystems Engineering (2002) **81**(1), 3-34
- Biamah E. K., Rockstrom, J. & Okwach, G.E. – Editors. (2000): Conservation Tillage for Dryland Farming; Technological options and experiences in Eastern and Southern Africa. RELMA.
- Benites et al (1998): Conservation Tillage for Sustainable Agriculture, Workshop Proceedings. Part II (Annexes). 22<sup>nd</sup> – 27<sup>th</sup> June 1998, Harare, Zimbabwe.
- McNeely J. A. & Scherr S.J. (2001) (draft): Common ground; Common future: Ecoagriculture Strategies to help feed the world and save wild biodiversity. IUCN, Future Harvest.
- Garcia-Torres, L., Benites, J., & Martinez-vilela, A. - Editors (2001): Conservation Agriculture, A worldwide Challenge. 1st World Congress on Conservation Agriculture. Volume I & II. EU, FAO, ECAF.
- No-Till Club – KwaZulu-Natal (2002): A guide to No-till crop production in KwaZulu-Natal.
- Ministry of Agriculture, Water and Rural Development (2000): Soil Fertility Management and Conservation Tillage for Sustainable Land Use in Namibia. National Workshop Proceedings, 16<sup>th</sup> – 18<sup>th</sup> May 2000, Otjiwarango, Namibia.
- Kaumbutho P.G. & Simalenga T.E. (Editors), (1999): conservation Tillage with Animal Traction. A resource book of Animal Traction Network for Eastern and Southern Africa (ATNESA). Harare, Zimbabwe.

Figures:

Fig. 1: Agricultural Area per Caput Source: FAO Statistics (FAOSTAT), 2001

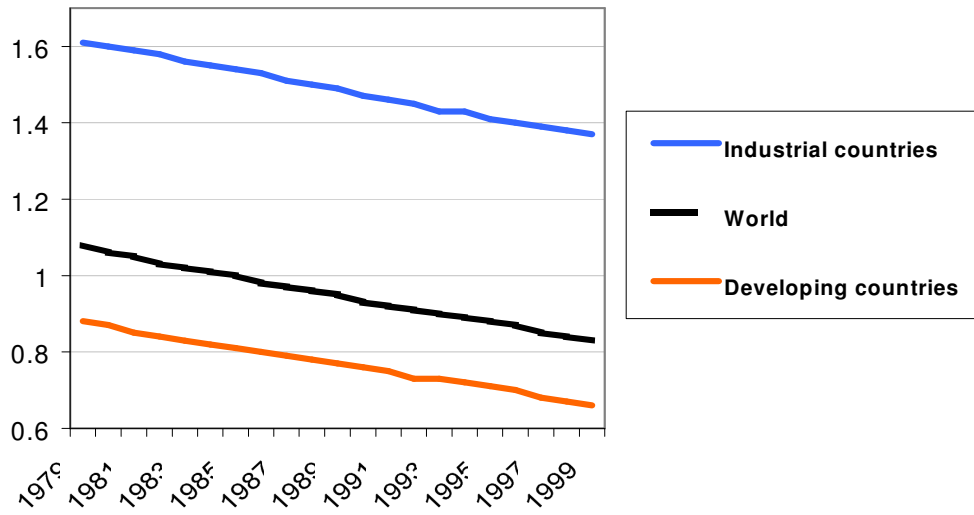


Fig. 2: Per Caput Food Consumption Source: FAO 2000, Agric. Towards 2015/2030; interim report

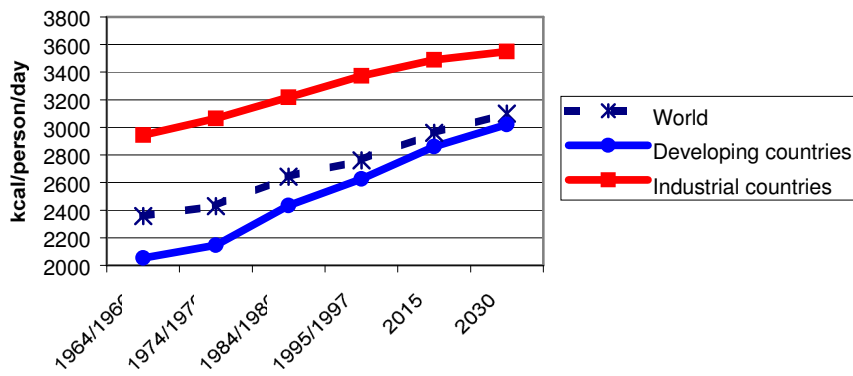


Fig. 3 Land degradation world wide according to GLASOD

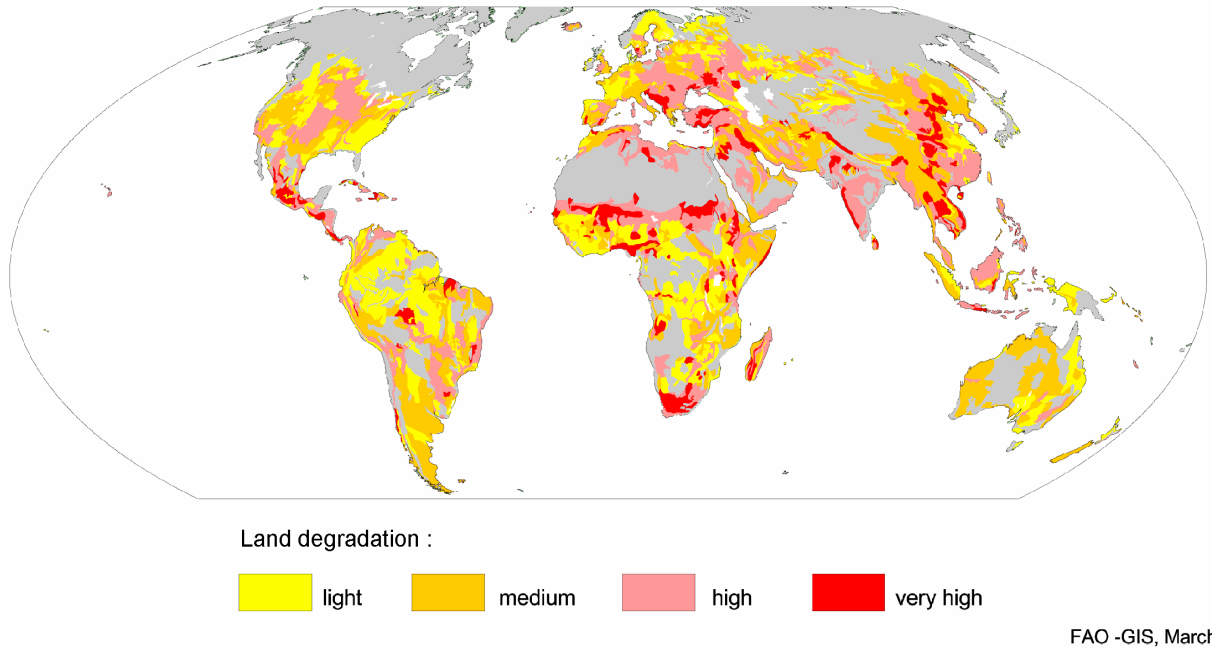


Fig. 4 Demographic development and percentage of population active in agriculture Source: FAO World Agriculture Towards 2010

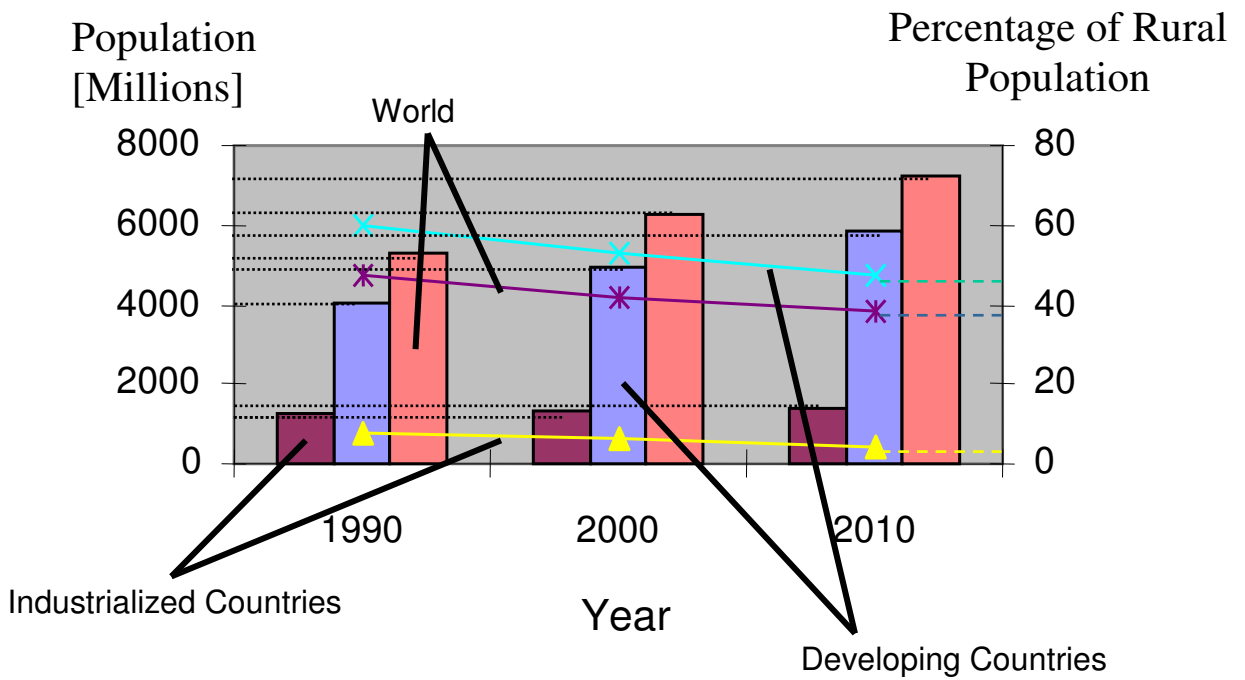


Fig. 5 Age of heads of rural household in Botswana and Tanzania (from Mrema 1996)

