Conservation Agriculture for sustainable crop production, Tanzania

GENERAL INFORMATION	
Sources of information of the practice	FAO Tanzania IFAD/FAO (2004) Conservation Agriculture as a Labour Saving Practice for Vulnerable Households Kaihura, F.B.S.; Kullaya, I.K.; Aune, J.B. Singh, B.R. and Lal, R. (1998) Impact of soil erosion on soil productivity and crop yields in Tanzania Ministry of Tourism, Natural Resources and Environment, MTNRE (1994) Tanzania National Environment Plan
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Useful links	FAO Conservation Agriculture website http://www.fao.org/ag/ca Africa Conservation Tillage Network http://www.act.org.zw/
INFORMATION ABOUT THE PROGRAMME OR PROJECT PROMOTING THE PRACTICE (IF APPLICABLE)	
Programme or project	Conservation Agriculture and Appropriate Mechanization for Sustainable Crop and Livestock Production
Time frame	The pilot project, Conservation Agriculture for Sustainable Agriculture and Rural Development (CA SARD) was implemented by FAO and lasted for two years from 2004 - 2006. After the end of the pilot phase, the Government of Tanzania has been supporting the project activities using a similar approach and has made initiatives to introduce CA to 10 new districts in the country.
Donor	The pilot project was financed by FAO, the second phase is supported by the Ministry of Agriculture, Food Security and Cooperatives
Implementer of the programme or project	Government Institution: Ministry of Agriculture, Food Security and Cooperatives in collaboration with district authorities
LOCATION OF THE PRACTICE	
Region	Africa
Country	Tanzania
Province, Districts, Villages	Districts of Morogoro, Kilosa and Mbeya
Climatic zone	Sub-humid
Other descriptive information	-
INFORMATION ABOUT THE PRACTICE	
Practice category	Managing natural resources sustainably
Practice type	Technology for natural resource management Technology for improving farm productivity sustainably
Sector	Crop production system management
Institutions fostering the practice	As Implementer of the project
Beneficiaries of the practice	Smallholder farm families and their communities Equipment manufacturers, distributors and suppliers who benefit from the market opportunity generated by the project
Users of the practice	Ten groups of 25 farmers in each of the 3 districts for a total of 750 farmers
Natural resource used or accessed (if applicable)	Land, vegetative soil cover crops and rainfall/water

BRIEF DESCRIPTION OF THE PRACTICE	
Background/problem statement	Land degradation is a growing problem in Tanzania because of increased human activity and land demand as a result of the growing population. Deforestation, over-grazing and inappropriate tillage practices are contributing heavily to land degradation. It has been observed that the rate of soil losses in some parts of the country have increased from 1.4 tons/ha/year in 1960 to 224 tons/ha/year in 1980 (MTNRE, 1994). With the increased population pressure, the fallow periods, which were commonly practiced, have become shorter for the soils to recover, perpetuating the "soil mining" of nutrients. The replenishment of nutrients is low because of inadequate application of manure and inorganic fertilizers. This leads to a further decline in soil fertility, which is manifested in declined crop yields. Conventional tillage, which is most commonly practiced in the country, involves the use of hand hoes, ox drawn mouldboard ploughs, tractor drawn disc ploughs and harrows combined with straw collection and burning during land preparation. During the operation the soils are cut, inverted and pulverized burying most of the residues underneath. The practice frequently causes soil compaction, affects soil physical properties, provokes biological degradation and results in declined crop yields. With fine dust on the surface and compaction below, a lot of soil is washed away with the first rains. Soil losses of up to 30 tons/ha have been reported in Kilimanjaro region in conventional flat cultivated fields at a slope of 5% (Kaihura *et al*., 1998). The costs for land preparation are increasing every year due to the rising costs of fuel and tractors spare parts while the labour supply is diminishing due to the spread of the HIV/AIDS and increasing urbanization in the region. Conservation tillage, zero or minimum tillage, is one of the practices that has proved to combat soil degradation efficiently. While millions of hectares of farm land are already under zero tillage in Latin America, in Africa conservation tillage is restricted mainly to larger estates. There are, however, enough examples demonstrating that conservation tillage can be practiced successfully by small holder farmers too. Yet much work is needed to demonstrate that the technology works in order to change the mindset of farmers who for many years were taught or learned from their parents that it is necessary to plough and maintain a weed free field for better crop production.
Approach followed	The idea of introducing Conservation Agriculture (CA) in the sub-region was initiated by FAO in 1998, when an international workshop on Conservation Tillage for Sustainable Agriculture was held in Harare Zimbabwe from 22 - 27th 1998. Conservation agriculture is a concept aimed at enhancing agricultural production on a sustainable and environmentally friendly basis and involves some land and farm management practices that allow for the restoration of soil nutrients, regeneration and maintenance of a good surface of vegetative cover and rooting depth. The practices are as follows: • **No soil inversion** and reduction or total elimination of mechanical soil disturbance, except to inject seeds or plants into the soil by direct drilling techniques; • Maintenance of a complete **soil cover** consisting of crops and/or crop residues; • **Crop rotations**, judiciously selected to enhance the crop environment and to avoid build-up of pests and diseases. The project started with sensitization of district authorities and farmers to create awareness on the CA initiative. Inception workshops were also conducted for all participating districts authorities, technicians, manufacturers, researchers and other stakeholders. A total of 30 Participatory Farmer Groups (PFG) of 25 individuals, ten in each district, were organized on the basis of common interests and similar constraints and were encouraged to work together.

	Each participating farmer was asked to set aside an area equivalent to 0.4 ha as a management training plot. The area was divided into two equal parts (of 0.2 ha each). One part was to be used for conservation agriculture practices, where the farmer uses inputs provided by the project. These include high yielding varieties of maize crop as recommended by the District Agriculture Office for that particular area, basal and top dressing fertilizer as a soil fertility improvement measure prior to establishment of cover crops and cover crop seeds. In the other part the farmers are allowed to use the type of seeds and inputs that they normally use in their farms. Farmers were also asked to plant the two plots at the same time. Farmers were trained on the use of the hand jab planters and direct seeders to reduce labour requirements for various agricultural operations. Training of farmers was conducted by trained Village Extension Officers. Under their guidance farmers also kept records of timing of activities, costs involved and outputs to facilitate the analysis of cost/benefit derived from the adoption or adaptation of CA practices. In this way the farmers were able to see the differences between their practices and the proposed CA interventions. Another advantage of the approach is that farmers learned-by-doing and they became the resource persons to sensitize other farmers during the expansion phase of the project. The products from the CA plot belong to the farmers but it is anticipated that part of the produce will be kept as savings in their Savings and Credit Cooperative (SACCO). This allows them to become credit worthy to access loans by being guaranteed by their SACCO. These saving mobilization cooperatives were formed by the PFG and subsequently legalized.
Innovative elements	The advantages of reduced and minimum tillage against conventional mechanical tillage practices are: • Saving farm power and labour requirements due to the elimination of ploughing and the reduction of weeding efforts; • Increased infiltration of rain and surface water, enhanced retention of soil moisture and resilience to the effects of drought. Stream flows show better regularity and improved quality; • Increased crop yields but lower production costs, mainly due to reduced labour inputs. This time saving often allows diversification into other agricultural production or rural income-generating activities; • Downstream benefits to the rural community such as reduced municipal water treatment costs and reduced damage to infrastructure due to run-off (for example roads, bridges).
Impacts on natural resource base	-
Impacts on livelihood of the practice users	Actual: The weather in the 2006 season was not good for crop production and most PFG plots suffered moisture stress. This was also reflected on the amount of harvest from the CA plots for the main crop (maize) and cover crop seed production. In Mvomero District, maize harvests for all groups from the CA plot were 58,444 kg, compared to 38,588 kg realised from the farmer practice plots. In villages where the rains were better the harvest from the CA plots was also higher. In Kilosa District, maize harvests for all groups from the CA plot were 21,691 kg, compared to 18,110 kg realised from the farmer practice plots. Cover crops harvested include also hyacinth bean (*Dolichos lablab*) 4,608 kg and pigeon peas (*Cajanus cajan*) 615 kg.
Other impacts	-
General success factors	• Successful introduction of the CA concept to the selected villages. These include understanding the concept, associated implements and possible crop rotations for pests and disease control • Interests of local manufacturers to produce direct seeding equipment and sell them to the farmers

	• Willingness of district/local government authorities to introduce CA as an important approach to reverse land degradation. This requires a change in mindset on the part of the farmers, who have used conventional tillage as the *correct* approach in crop production for many years • Links have been strengthened with local research institutions on suitable cover crops and proper crop rotation recommendations for adoption by the farmers
Technology success factors	Increase farm production and/or stabilizes it No adverse environment effects, preventing erosion and improving soil fertility
Institutional success factors	Farmer's capacity for adoption of the technology Institutional support and outreach
Problems remaining to be resolved	The following problems have not been resolved yet: • Lack of adequate funding to reach more farmers • Direct seeding implements are not readily available locally • Inadequate awareness-creation campaigns among all stakeholders • Poor integration of crop and livestock whereby some conflicts between pastoralists and farmers have been experienced
Keywords	Agriculture, Capacity building, Cropping systems, Crop production, Crops, Empowerment, Environmental management, Extension activities, Natural resources management, Soil fertility, Soil conservation, Subsistence farming, Water conservation, Zero tillage