AGWATER SOLUTIONS
Improved livelihoods for smallholder farmers

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This briefing note summarizes the preliminary case study findings for discussion and comment

CONSERVATION AGRICULTURE IN TANZANIA

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Conservation Agriculture (CA) covers many techniques for capturing and storing water as well as improving soil quality and ultimately agricultural output. Forming farmer groups and training farmers has shown positive results both in spreading the use of CA and increasing yields.

The Opportunity

Conservation agriculture (CA) is a method of farming that can optimize yields and profits by improving soil structure, conserving water, and reducing inputs. There are several techniques involved:

Terracing - sections of a hill are leveled or grassed to reduce run-off and conserve water nutrients.

Conservation tillage - crop rotation and minimal tilling help maintain the quality of the soil cover.

***Chololo* pits** - large pits are dug in a row. Organic matter is deposited and covered with soil for planting two or three single plants. The pits retain water and provide vital nutrients for crops.

Trenches - furrows are dug along slopes and crop residues are deposited in them to increase the fertility and water holding capacity. The trenches are covered with soil and crops are planted along them.

Cover cropping - crops such as *lablab* are planted in between the main crop to help reduce evaporation in dry spells.

Ridges - earth is banked up in rows and crops are planted in between to help conserve water.

The Research

The study was designed to provide information on the adoption of CA techniques, cost of implementation, benefits, and possible investment pathways for out-scaling in Tanzania. It was undertaken in Arumeru District, Arusha Region; and Chamwino and Dodoma Urban districts, Dodoma Region. Interviews were conducted with 200 farmers in eight villages, all of whom had adopted some sort of CA technique. In addition, village, ward and district officials, and two NGOs were interviewed.

Ridges of earth help to conserve moisture around the plants.

Main Findings

The CA techniques used in the study areas include minimum tillage, cover cropping, *chololo* pits and ridges (Figure 1), with some farmers adopting more than one technique. There are regional differences in the choice of CA technique and in the rates of adoption. In Arusha, most farmers adopt two or three CA techniques across their farms, but in the poorer households only 30% manage to adopt even one.

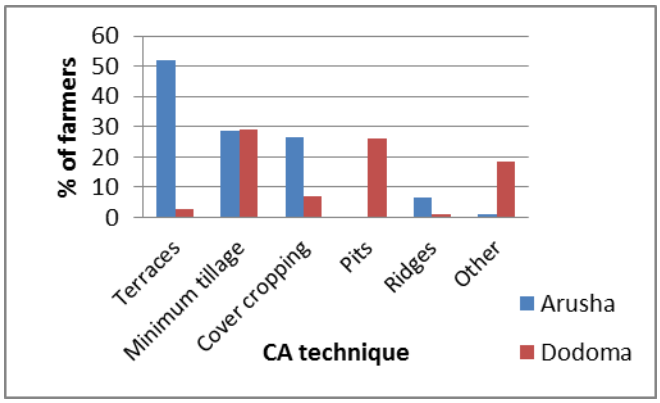

Figure 1: Percentage of farmers currently using CA techniques in the research sample (n=200)

In Dodoma wealth seems to be less relevant as over 50% of farmers invest in three techniques regardless of their wealth status. This may reflect the drier conditions in Dodoma.

Choice of CA technique is also influenced by gender. In Arusha, men prefer ridges and terraces, while women tend to focus on minimum tillage and cover cropping more. In Dodoma men prefer *chololo* pits and minimum tillage. Joint decisions are made by about 30% of respondents for all techniques except ridges.

Conservation agriculture techniques are usually introduced by an agency to a group of farmers. Anecdotal evidence from this study suggests that they then spread to other farmers: *"Our group started with 19 members and this is the third year that we are practicing CA, … it has reached more than 50 households in the village."* Interviews with NGOs and extension agents revealed that CA technologies have spread to 11 of the 21 wards in Arumeru District.

Early efforts in CA are credited to various projects implemented by NGOs in collaboration with the Selian Agricultural Research Institute. Input and equipment suppliers have also supported adoption.

In terms of adoption dynamics, farmers are interested to adopt technologies proven to increase yields, conserve soil moisture and reduce soil erosion. However, several factors hinder broader adoption of CA. These include labor intensiveness of certain CA techniques; insufficient capital and training to support investments in new technologies; knowledge of and access to input and output markets; and issues of land tenure. The time lag, generally more than 2 years, to realize returns from investment in CA technologies also deterred many farmers.

Impact of CA techniques

Of the CA techniques practised, maize yields were highest on terraces (1.3 t/ha), beans on ridges (1.5 t/ha), and cassava with terraces and minimum tillage (0.5 t/ha). Large pits and ridges produced yields of 1 t/ha which is twice that of typical maize yield in the study areas. However, the yield levels of sorghum, groundnuts, and *lablab* were low across the CA technologies. In 2007/08, a year with below average rainfall (630 mm), one study found a significant difference in yield between conventional and conservation tillage (1.7 t/ha against 3.8 t/ha) (Mkoga et al., 2010).

Other related studies further support the positive yield impacts of CA techniques in semi-arid regions, such as Tanzania (Rockström et al., 2009). For example, on-farm trials in eight East African locations, including Arusha, Tanzania, found that conservation farming (CF) practices, particularly when combined with fertilizer application, produced higher average crop yields compared with conventional practices, with and without fertilization (Con+F, Con).

Finally, in addition to yield benefits, other potential environmental impacts from the adoption of CA techniques include reduced sedimentation and carbon sequestration (see, e.g., Enfors, et al., 2011), the further study and quantification of which could open opportunities for offsetting the costs of adopting conservation agriculture techniques in the future.

E. Enfors, J. Barron, H. Makurira, J. Rockstrom, S.D. Tumbo. Yield and soil system changes from conservation tillage in dryland farming: a case study from North Eastern Tanzania. Agricultural Water Management vol 98, Issue 11, Sept 2011, pp1687-1695.

Mkoga Z.J., S.D. Tumbo, N. Kihupi, J. Semoka. Extrapolating effects of conservation tillage on yield, soil moisture and dry spell mitigation using simulation modelling. Physics and Chemistry of the Earth 35 (2010) 686–698.

J. Rockström, P. Kaumbutho, J. Mwalley, A.W. Nzabi, M. Temesgen, L. Mawenya, J, Barron, J. Mutua, S. Damgaard-Larsen. Conservation farming strategies in East and Southern Africa: Yields and rain water productivity from on-farm action research. Soil and Tillage Research 103 (2009) 23-22.

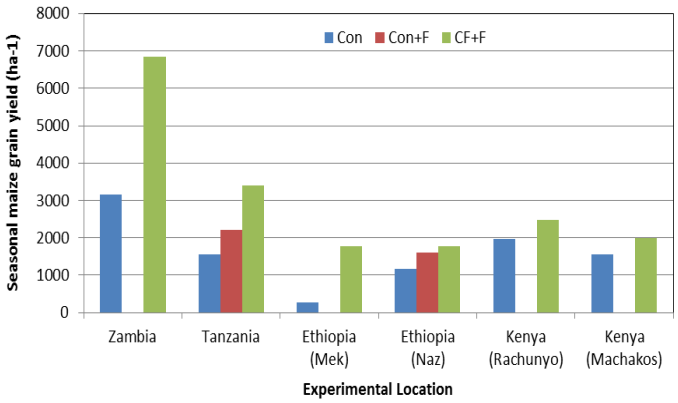

Figure 2: Summary of crop yields in six locations

Source: Rockström et al., 2009

Solutions

To stimulate adoption the following strategies were proposed by stakeholders:

- Train trainers (e.g. NGOs, suppliers, extension agents) on CA techniques and their benefits.
- Provide good materials and training packs.
- Train farmers, clearly stipulating the advantages and disadvantages of each technology. Include demonstration plots and exchange visits.
- Register these farmers to become trainers.
- Form farmer groups to enhance up-scaling.
- Link farmers with dealers and financial institutions to address supply chain constraints.

Topics which should be covered in the training are:

- Management of strategic watersheds.
- Rainwater harvesting and storage.
- Management of nutrients through cover crops.
- Maximising soil water infiltration and storage through tillage and crop choice.
- Opportunities for financial support.

Questions for discussion

Which organizations are best placed to undertake training? Where will the funding come from?

What form should farmers' groups take and how should they be formed.

What should be the different pathways for cost-effective investment programmes CA?

What are the priority areas in CA that could yield quick returns?