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Making it Happen: Conservation Agriculture in Africa

Conservation agriculture may hold the key to climate resilient food production, but implementation is challenged by complex social and economic factors. KPMG IDAS Africa manages several agribusiness focused development funds across Africa. In this paper, we examine the experiences of grantees engaged in conservation agriculture to see what works on the ground.

The Issue

Conservation agriculture (CA) is an umbrella term for various sustainable farming practices, driven by three principles: permanent soil cover, diversified crop rotation and minimal soil disturbance. Over the last decade, CA has been promoted by governments and development agencies seeking to improve crop yields, limit land degradation and build resilience to climate change in emerging markets. These issues are especially pertinent in sub-Saharan Africa, where average yields are less than half of those seen in Asia while food importation costs the continent US$40bn each year. A recent expert panel report[i] found that in Africa, 65% of arable land is damaged, with about a quarter of all land in sub-Saharan Africa suffering from serious degradation.

The purported benefits of CA are many, including:

- improved soil fertility, soil-based biodiversity and moister retention,
- better or more consistent crop yields,
- reduced soil erosion and less flooding,
- reduced contamination of surface and ground water in some cases,
- recharging of aquifers, and
- reduced carbon emissions.

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[1] This is one of a series of thought pieces from KPMG IDAS Advisors based on our extensive experience in overseeing and deploying development funds on behalf of our clients in Africa. The series is edited by Julio Garrido-Mirapeix, Head of IDAS Africa. This paper was written by Rachel Keeler, Impact and Innovation Manager at KPMG IDAS, and Corin Mitchell, Director at KPMG IDAS.

However, these gains can vary greatly by the type of crop as well as the environment in which it is grown. CA techniques practiced to great effect in one context have led to negative outcomes in another.[ii] Success therefore depends on carefully tailoring CA to each situation, backed by sound scientific research and appropriate technology.

Complex social and economic factors also play an important role. Adoption rates are a major challenge, especially amongst smallholder farmers. Many of the benefits of CA are long term and accrue at community, national, regional or global levels, while the bulk of the implementation costs are felt on the farm. This presents a collective action dilemma, with poor incentives for farmers. The transition to CA can be a lengthy and difficult process. Expensive chemical inputs may be needed to replace the pest and disease control provided by conventional tillage. No-till planting is also labour intensive without access to the right machinery. Dedicating crop residue to field cover presents opportunity costs and social stress for cattle herding communities. High up-front costs can be prohibitive for farmers, even if savings are promised over time. And while some crops show yield improvements in a single season, others can take years to set in.

In Practice

KPMG's International Development Advisory Services (IDAS) Africa manages several agribusiness focused development funds across Africa. In this paper, we examine the work of four grantees supported by the African Enterprise Challenge Fund (AECF). These companies are engaged in conservation agriculture in Zimbabwe and Tanzania. Their experiences reveal important lessons regarding the circumstances under which farmers and agribusinesses have the most success with CA.

AECF Grantees Engaged in Conservation Agriculture

IETC Zimbabwe built a processing plant that will produce tasty soya pieces made from soya beans supplied under contract by 1,400 smallholder farmers. In the first pilot season, farmers were required to practice conservation agriculture, with low adoption rates thereafter.

Quality Food Products provides crop planting, processing and marketing services to smallholder farmers in Tanzania. The company uses mechanized zero-till conservation agriculture technology and originates produce via purchase contracts with 1,000 farmers growing crops on 35,000 acres of farmland.

Northern Farming provides an affordable, total production and marketing package to 1,000 farmers in Zimbabwe to produce maize, soya, beans and wheat. The package covers finance, input supply and technical support, including guidance on conservation agriculture techniques.

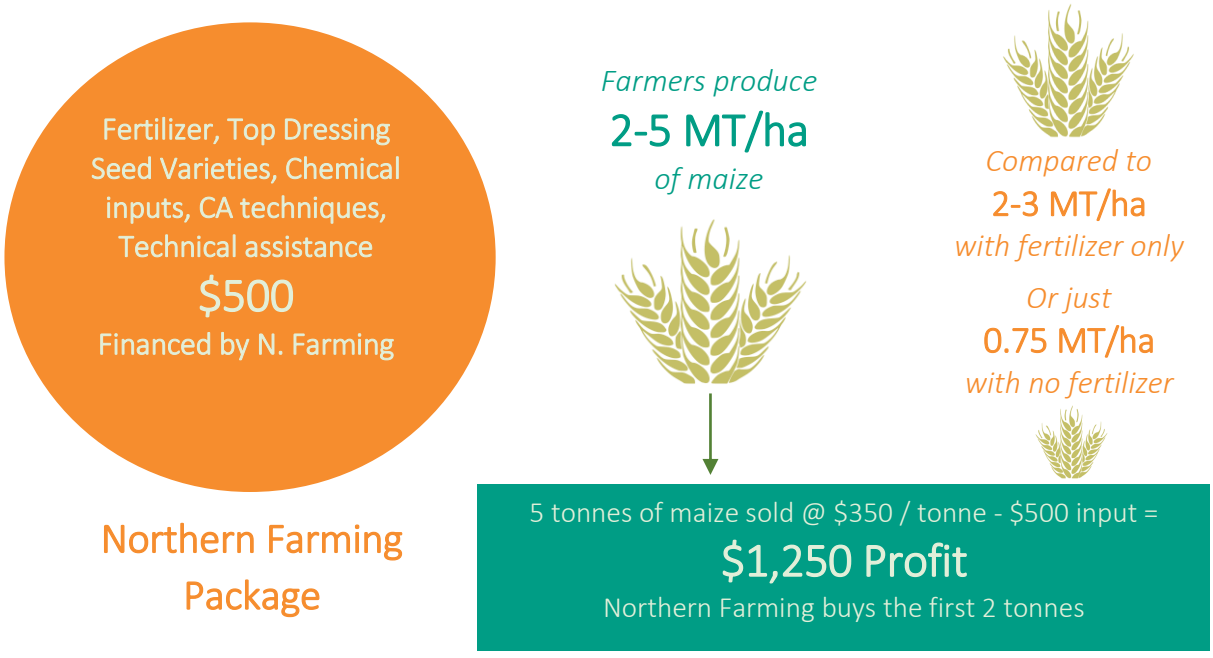
Field Masters provides crop planting services to farmers in Tanzania using zero-till tractors fitted with Bio-agtive™ exhaust emission kits. This new technology injects tractor exhaust into the soil, which acts as a microbial stimulant, replaces conventional fertilizer and reduces carbon emissions.

Zimbabwe: Conservation agriculture has been promoted in Zimbabwe since the 1970s, when commercial farmers linked declining yields to land degradation caused by deep plough practices. Various campaigns have resulted in roughly 300,000 smallholder farmers practicing CA in the country today, with that number on the rise.[iii] However, a 2006 review of NGO promotion efforts in Zimbabwe cited limited sustained adoption by famers, despite these efforts, due to constraints including lack of mechanization in the smallholder system, problems with weed control and access to credit.[iv] Studies in other African countries have shown similar results, with CA practices adopted during, and abandoned shortly after, non-profit support programs that come and go.

This effect points to a main challenge in implementing CA – benefits depend on significant dedication by the farmer to a comprehensive program of practices, including use of fertilizer, herbicides and mechanical equipment. Few farmers can afford these inputs without access to finance, even with a single season payback period. And short-term support from NGOs has thus far not been able to catalyse continued purchasing power or demand amongst farmers.

In Zimbabwe, **Northern Farming** has taken a private sector approach to solving this problem with grant support from AECF. The company partners with 1000 farmers who receive a full service input supply package financed by Northern Farming up front. Farmers working with Northern Farming have shown dramatic yield increases for maize crops in their first season, producing on average two to five metric tonnes per hectare (MT/ha) of maize, compared to the .75 MT/ha average for local smallholders who don't use fertilizer, or two to three MT/ha for those who do.

Northern Farming shares both financing and sell-side risk with their farmers, committing to buy the first two tonnes of maize produced at a fair market rate, from which the cost of the input package is deducted. At current commodity prices of roughly $350 per tonne of maize, farmers who produce five tonnes will walk away with a $1,250 profit. The demonstration of this substantial benefit has prompted other local farmers to take on CA techniques. And, essentially, operating as a profitable business will allow Northern Farming to sustain their engagement with farmers over the long term.



IETC Zimbabwe is part of the multinational commodity trading group, ETG. With AECF support, IETC has been working with farmers under contract to produce soya beans for a manufacturing plant using CA techniques. Similarly to Northern Farming, the IETC contract includes an input loan, extension support, business training and a floor price purchase guarantee. IETC invested considerable resources in teaching proper CA techniques via experienced field teams and monitoring progress in order to show farmers the benefits of CA. In the first season, the IETC contract with farmers made CA a requirement, with varying success.

Soya yields averaged 1,500 kg/ha and each farmer made $300 more that year after repayment from selling soya to a dedicated buyer. Most of these farmers had not grown soya before, so while their soya yields were three times the national average (500 kg/ha), they had no personal history by which to compare yield growth. Some farmers who had grown soya before argued that they had achieved higher yields and better profit margins using conventional methods. Hired farm labourers charged more to perform CA with no mechanical support and, because they had not attended the CA trainings, implemented it incorrectly. Farmers who owned traditional ploughs felt especially cheated because they were unable to use them and unable to afford no-till alternatives.

During the first season, farmers in the scheme also grew maize for food security using CA. Most of these farmers had grown maize before, and saw their individual yields increase significantly upon introducing CA with the IETC input package. On average, maize yields went up to 3 MT/ha – three times the national average of 1 MT/ha – but for many farmers the yields were 4-5 MT/ha and for some they went as high as 7-8 MT/ha. Unlike with the soya cash crop, maize is traditionally farmed by the family, so the farmers also saved on hired labour costs. While many farmers refused to continue with CA on their soya farming, many agreed to continue with maize in the following seasons.

Across Africa, maize farmers have had relatively consistent success under CA schemes. In contrast, soya planting under CA is more difficult (as a creeping plant), less tested, backed by less research, and has not shown consistent results. For maize, yields tend to increase quite quickly under CA, while for soya, yields may stay the same while long-term benefits accrue slowly through soil improvement and land preservation.

For both crops, IETC farmers faced social challenges with CA. Family labour struggled because children did not attend CA trainings. Some women who took CA training home to their husbands were rejected. Others complained that CA was only for the poorest farmers, a misperception promoted by many years of NGO campaigns targeting smallholders. It is interesting to see that social challenges, which presumably confront many farmers in Zimbabwe in similar ways, presented a greater barrier for IETC soya farmers, while under the Northern Farming scheme the benefits generated immediately by increased maize yields seem to outweigh social factors.

As a contract farming venture, the inconsistency associated with the soya scheme also posed problems for IETC's bottom line. Running a contract farming scheme is expensive for a trading company. It requires significant resources to support farmers, finance inputs and prevent side selling. Introducing CA to this mix incurs additional costs and risk: training on CA techniques is costly and if yields do not improve immediately, this may prevent farmers from repaying loans. This suggests that donor support is especially needed to test and prove the benefits of CA for each crop and community context before private companies can implement profitable CA schemes.

In **Tanzania**, **Field Masters** is trialling an innovative solution to the hard labour required to plant CA

crops by hand. With AECF support, the company has introduced a no-till tractor fitted with Bio-agtive™ exhaust emission kits. This technology injects tractor exhaust into the soil, which acts as a microbial stimulant, replaces conventional fertilizer, controls weeds and reduces carbon emissions. Results have been very promising: after three years, maize fields have shown a 1.5% increase in organic matter content of the soil and a significant increase in water holding capacity – up to 150,000 liters an acre. This results in drought resistant, fertile soil with yield increases of 50-100%.

Field Masters offers crop planting services to farmers in Tanzania at about $50 an acre – roughly on par with the cost of planting with a traditional till tractor and subsequent weed control. With yield improvements, a farmer with four acres could net about $300 after paying for the planting service. Economically, this makes sense. The service has sold well with Tanzania's few commercial farmers. Field Masters has been manufacturing specialised CA mechanical equipment for commercial farmers and other service providers (including AECF grantee, QFP – see below) since 2005 to good effect.

Demand from smallholder farmers remains low for several reasons:

1. Field Masters requires 50% payment up front with the balance paid at harvest, but few farmers can afford to pay anything up front.

2. Field Masters provides a service to farmers without further engagement or a contractual relationship, which does not provide the support or leverage that might be necessary to encourage farmers to embrace a transition to CA.

3. Rural Tanzania's strong pastoralist culture clashes with CA practices. Cattle traditionally graze on farmland, eating crop residues and compacting the soil. Farmers dedicated to practicing CA face community pressure to allow cattle on their land. Many smallholders are also both farmers and herders, whose cultural pride is linked to livestock ownership, while farming is seen more as a 'try-your-luck' pastime. Even if CA farming promises a higher income, it is difficult to convince these farmers to prioritize CA over care for their cattle.

4. Governance also plays a role – although farm land is protected from cattle grazing by Tanzanian law, with clear penalties in place, local authorities reportedly do not always enforce the law.

5. And finally, Tanzania has a very small number of commercial farmers in the country. In Zimbabwe and Zambia, promotion of CA has been driven in part by commercial farmers, who are able to take on up-front costs and embrace new ideas in order to take advantage of long-term benefits.

Field Masters is now working with Equity for Tanzania (EFTA) to develop financing solutions that will allow small and medium scale farmers to buy their equipment. The Tanzanian government is also working with Field Masters to secure their farming operation from livestock pressure and to retain their manufacturing plant in the country.

Another company working with AECF support in Tanzania, **Quality Food Products**, has had somewhat more success combining CA planting services with processing, marketing and an off-taker agreement. This packaged engagement provides important leverage that helps QFP convince farmers to take on CA practices.

QFP uses specialized equipment from Australia (manufactured by Field Masters in Tanzania) specific to no till planting in hot and dry soil that, combined with using crop residue for soil cover, has produced strong results. After three to four years, organic matter has returned up to 3% levels in previously degraded land. In Northern Tanzania, rains come in December and January, followed by a hot and dry spell with rain again in late March. Farmers not practicing CA in this area are often forced to delay planting until the second rains come in March. With the QFP package and CA techniques, farmers can plant quite early, survive the dry spell, and bring crops to their flowering point by April when the rains are best. This process greatly increases yields with immediate benefits. QFP farmers have produced up to 5 MT/ha of maize, compared to farmers producing 200 to 500 kg/ha just 500 meters away on bad land. Commercial farmers practicing CA in Iringa have reported 8-9 MT/ha of maize, compared to 1-2 tonnes produced by their neighbours.

Even with these impressive results, QFP also struggles with farmer uptake due to pastoralist pressures, and the demonstration effect has not been as strong as in Zimbabwe. To address this, the company is exploring ways to encourage cooperation with herders, in an effort to develop better relationships that can encourage respect for farm boundaries. One idea is to grow food for cattle that can be sold in exchange for cow manure.

Lessons for Donors and Businesses

Given the strong yield improvements arising from many CA projects and resulting increases in income for farmers and traders, understanding the drivers behind effective execution of CA is quite important for food security and resilience in Africa. Key lessons arising from our experience with CA include:

1. Donor grants should support research, field demonstrations, farmer education, and testing for new technologies. This is especially important for introduction of new crops, and may need to include grants for farmers and businesses during the transition period until yield increases take hold. The delivery mechanism for these is well served through sustainable private enterprise.

2. Successful CA schemes must also address cultural incentives for farmers. Where economic incentives are strong, cultural barriers will be easier to overcome, but pastoralism is the hardest of these. The most conducive markets will have limited livestock pressure, more commercial farmers, and good governance of agricultural land.

3. Financing for inputs and access to mechanical equipment are also key incentives for farmers. Inputs and mechanisation are essential for efficiency and scaling of CA practices. But these things will only be available to smallholders via a financing solution and may only be economical on >1 acre plots.

4. Establishing profitable business models for long-term support as a way of engaging with farmers is a good way to promote sustained uptake of CA. However, many of these business models rely on small margins that require volume sales to succeed, which means they may need a grant from a fund like AECF when starting out.

5. Companies will be most successful where they provide a holistic CA service package to farmers, either independently or through partnerships, and engage closely with farmers to promote CA uptake.

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[i] Mark Kinver (2014). "African soil crisis threatens food security, says study." BBC News: 4 December 2014. <http://www.bbc.com/news/science-environment-30277514>

[ii] Ken E. Giller, Ernst Witter, Marc Corbeels, Pablo Tittonell (2009). Conservation agriculture and smallholder farming in Africa: The heretics' view. *Field Crops Research* 114: 23–34.

[iii] Brighton Nhau. (2014). ZimCAN study - Commercial Aspects of Conservation Agriculture. *Market Linkage Association: Commercialisation of Conservation Agriculture.* Harare.

[iv] Ken E. Giller, Ernst Witter, Marc Corbeels, Pablo Tittonell (2009). Conservation agriculture and smallholder farming in Africa: The heretics' view. *Field Crops Research* 114: 23–34.