Conservation Agriculture Practices in Malawi: Opportunities and Challenges

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Abstract

Conservation agriculture (CA) benefits include increased organic matter, improved water retention, improved soil fertility, reduced soil erosion, reduced weed infestation, crop productivity and others. In this study, we reviewed the different CA practices to understand the experiences by stakeholders, the opportunities and challenges of CA development in Malawi. Through structured questionnaires, a formal survey was administered to 13 key institutions that are the most important CA players in the country. These institutions were located in different parts of the country and were selected from the National CA Task Force's (NCATF) database of CA stakeholders. The study showed that permanent planting basins (92%), maize stover (92%) and agroforestry (84%) are the most promoted methods by stakeholders for minimizing soil tillage, maximizing soil cover and supplementing CA practice, respectively. The inconsistent research and on-farm demonstrations, extension capacity, policy support from Agriculture Sector Wide Approach's (ASWAp) catalyse CA development in Malawi. Despite livestock and fire damage resulting in scarcity of crop residues and longer gestation period of the benefits, CA has the potential to rejuvenate soil health in the long run. It is recommended that CA should not be promoted in a one-size-fit-all style due to the diverse agro-ecological conditions in Malawi and harmonized extension materials should be devised to avoid confusions amongst farmers and stakeholders.

Keywords: conservation agriculture, conventional agriculture, extension, stakeholders, smallholder farmers

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1. Introduction

Both during the colonial era and post independence in Malawi, the agricultural extension system advocated ridging and burning of residues (Mloza-Banda, 2002). Therefore, smallholder farmers continue this practice of soil disturbance involving ridging and shifting ridges every year in Malawi. Research in CA in Malawi dates back to the 1980's when Bunda College of Agriculture and Department of Agricultural Research Services (DARS) conducted on-station and on farm trials on the effects on CA practices on maize performance and soil fertility enhancement (Mloza-Banda, 2002). The results of these studies have however been received with mixed reactions amongst scientists, extension workers, farmers and policy makers who raised questions regarding economical feasibility and appropriateness to smallholder farmers to change from conventional tillage to conservation agriculture . CA is promoted for the positive benefits of increased organic matter, improved water retention, water infiltration, improved soil fertility, improved soil structure, reduced soil erosion, reduced weed infestation and increased maize yield (CFU, 2007; Giller et al., 2009). Although CA is increasingly being tested by smallholder farmers and extension workers, there are misconceptions about it (Mloza-Banda and Nanthambwe, 2010). Stakeholders have different technical understanding of CA and consequently promote diverse and sometimes contradictory extension messages. Although there are extension guides on CA for specific agro-ecological zones in neighboring countries including Zimbabwe (ZCATF, 2009) and Zambia (CFU, 2007) such guidelines are nonexistent in Malawi (Mloza-Banda and Nanthabwe, 2010). Most stakeholders do not have systematic research protocols to obtain empirical evidence except in a few cases (Mloza-Banda and Nanthambwe 2010). This study supports the work of ICRAF's Evergreen Agriculture for Food Security project in Malawi which aims at improving food security through agroforestry based conservation agriculture which is termed "Evergreen Agriculture" (Garrity et al., 2010).

2. Methodology

This study involved (1) a stakeholder consultation workshop and (2) a survey. A stakeholder workshop was organized by the World Agroforestry Centre (ICRAF) with the following objectives: (a) sharing experience on CA in Malawi and Zambia and develop a common understanding among stakeholders and (b) identifying technical, institutional and policy challenges to the scaling up of CA in Malawi. Land Resources Conservation Department (LRCD) and Department of Agriculture and Research Services (DARS) both from the Ministry of Agriculture and Food Security, the Environmental Affairs Department (EAD) and the Forestry Department from the Ministry of Mines and Energy; Total Land Care (TLC), National Smallholder Farmers Association of Malawi (NASFAM), the Conservation Farming Unit (CFU) of Zambia attended the workshop. The survey employed multi tools to collect qualitative data through (a) desk studies (b) questionnaire survey (c) farmer field visits.

The survey involved interviewing 13 CA stakeholders which were randomly selected. The study reviewed field notes of the CA stakeholders on the pertinent issues such as (a) the key CA practices that are being promoted by different CA stakeholders b) the extent of adoption of CA by farmers (c) the empirical evidence that CA stakeholders possess that CA improves soil health, crop productivity and food security (d) the experiences of CA stakeholders on CA development (e) the technical extension capacity of CA stakeholders to improve the knowledge and skills of farmers and extension workers (f) the policy and extension framework. This study enhanced the knowledge base on CA development in Malawi which NCATF conducted to understand the level of knowledge and practice on conservation agriculture from various CA stakeholders (Mloza-Banda and Nanthambwe, 2010).

3. Results and Discussion

3.1. Conservation Agriculture Practice in Malawi

The stakeholder workshop, survey and review of the literature from Malawi revealed that one or more of the principles of CA, namely minimum soil disturbance, permanent soil cover and rotations, are being promoted by different stakeholders.

All stakeholders promoted the use of fertilizers in the early years and about 92% promote the use of manure and only 53% promote the use of herbicides (Table 1). There is none who promotes the use of lime in CA fields. Different stakeholders promote minimum soil disturbance through either use of permanent planting basins or use of old ridges or flat culture or ripping (Table 2). About 92% of the stakeholders indicated that their farmers about maize stover from their own fields and 40% from neighbours' fields. Figure 1 shows the type of soil cover promoted by stakeholders with maize stover being the most promoted one.

The study further revealed that all stakeholders interviewed promoted the use of crop legumes and 76% promoted the use of tree legumes and 15% promoted the use of cereal-legume rotations. It was shown that 84% of the stakeholders are in the technology testing stage and none is doing CA advocacy (Figure 2). Figure 3 shows the methods of enhancing CA adoption; the use of field days (92%) followed by trainings (69%), on-farm demonstrations (61%) and use of lead farmers (23%). Field visits and trainings were the most used methods by the stakeholders to build the capacity of their extension staff (Figure 4). Agroforestry (Figure 5) is the most used complementary practice to CA (84%) followed by crop rotation (62%), soil and water conservation (23%) and manure making (15%). Most common agroforestry fertilizer trees were Tephrosia, Gliricidia and pigeon peas. Only 30% of the stakeholders interviewed had systematic research protocols to obtain empirical evidence from the on-farm trials.

Table 1: Proportion of stakeholders promoting specific farm inputs

Farm input	Proportion
Fertiliser	100
Manure	92
Herbicide	54
Lime	0

Table 2: Proportion of stakeholders promoting minimum tillage

Type of tillage	Proportion
Planting basins	92
Old ridge	62
Ripping	0

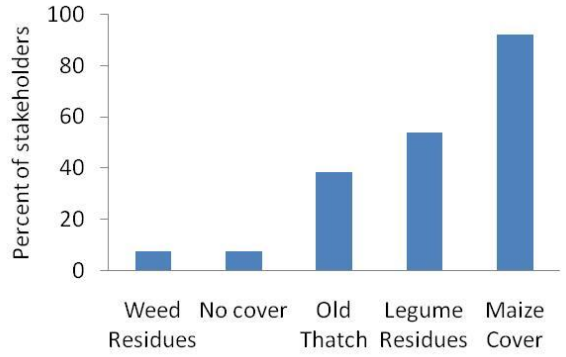

Figure 1: Type of soil cover promoted by stakeholders

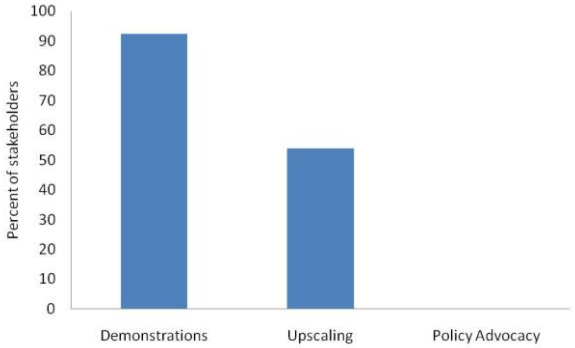

Figure 2: Level of CA promotion by stakeholders

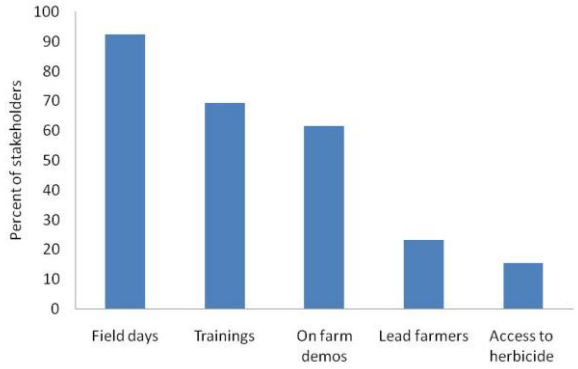

Figure 3: CA adoption methods to be promoted

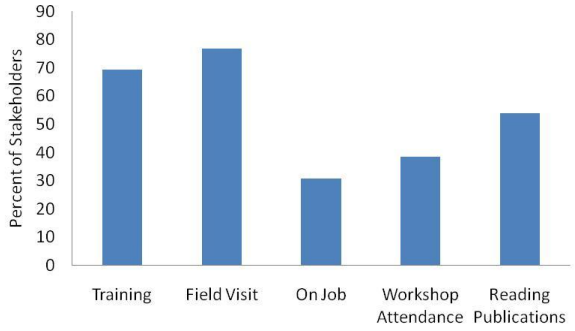

Figure 4: CA capacity building by stakeholders

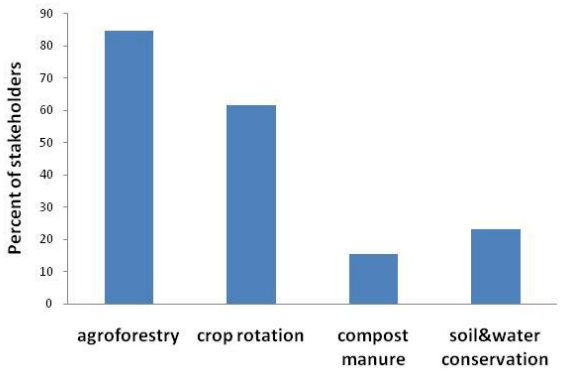

Figure 5: Complementary agricultural practices to CA

Photo by Bruce Sosola (2010)

Figure 6: Livestock feeding on maize stover in a CA field

3.2. Opportunities for Conservation Agriculture Development

The study unveiled a wealth of knowledge, skills and attitude created by CA stakeholders who have been working with farmers and extension workers in Malawi. Below are the factors that are catalysing the transformational development in tillage system:

Research for development and on farm demonstrations

The numerous on-farm demonstrations mounted by Bunda College of Agriculture through Agricultural Innovation in dryland Africa (AIDA), Farm Income Diversification Programme (FIDP), DARS, International Maize and Wheat Improvement Center (CIMMYT) and Total LandCare (TLC) have empirical data comparing maize yield, labour consumption, gross margins under CA and conventional agriculture. NGOs such as Synod of Livingstonia, Evangelical Lutheran Development Services (ELDS), Emmanuel International, Development Aid from People to People (DAPP), Catholic Relief Services, Danish Church Aid, Norwegian Church Aid, Christian Aid, CARE Malawi, Save the Children, World Vision Malawi, National Smallholder Farmer's Association of Malawi (NASFAM) and many others are scaling up CA through the use of on-farm demonstrations with their project beneficiaries. Kamtimaleka (2009) observed that increase in SOM under CA led to increased maize productivity from 4.6 t ha^{-1} to 3.4 t ha^{-1} under CA. The same author showed that farmers practicing CA had the highest gross margins of \$552 ha^{-1} yr^{-1} compared to \$316 ha^{-1} yr^{-1} for conventional tillage farmers. However, Kamwendo (2009) found that increase in soil organic matter (SOM) under CA did not significantly lead to beneficial changes in soil bulk density, matrix porosity and hydraulic conductivity.

Institutional extension capacity

CA stakeholders used different means to build the capacity of their extension workers in CA (Figure 4). FAO has helped build the capacity of CA development in southern Africa as well as in Malawi through the projects it promotes. FAO holds CA annual symposia to share experiences and knowledge in CA in southern Africa. This has built the capacity of most NGOs and Government of Malawi in understanding better the dynamics of CA development. Most NGOs also rely on reading CA materials shared at NCATF and found on the internet. Some NGO's conducted training of trainers on CA for field officers with expertise from CFU and LCRD (see Figure 6).

Partnerships and networks

National Conservation Agriculture Task Force (NCATF) provides foresight and coordinates CA development in Malawi (Mloza-Banda and Nanthambwe, 2010). The membership of NCATF includes research organizations, government departments, NGO's and Civil Society Organisations.

These NGOs collaborate in implementing CA projects together in order to share experiences and lessons, for example (i) ICRAF with NASFAM, CRS and TLC in scaling up Evergreen Agriculture (agroforestry based conservation agriculture) in Kasungu, Mchinji and Chiladzulu districts (ii) ICRAF with NASFAM, Government of Malawi and Lake Malawi Basin project in implementing an AGRA project on CA in Kasungu, Lilongwe and Salima districts (iii) CARE Malawi works with TLC in scaling (iv) Wellness and Agriculture for Life Advancement (WALA), a consortium project funded by USAID implemented by CRS, Save the Children, Total landcare, World Vision Malawi, Emmanuel International, Africare and Project Concern International in southern Malawi. CIMMYT, Department of Research Services (DARS) and TLC collaborate in CA technology testing and scaling up of CA with demo farmers in Nkhota Kota district under MACC project funded by the Royal Norwegian Embassy.

Policy support

CA projects of the stakeholders are in line with the current national development agenda such as Malawi Growth and Development Strategy (MGDS), Agriculture Sector Wide Approach (ASwap). Under the focus area of "Sustainable Agricultural Land and Water Management", the use of conservation farming technologies that build soil fertility, prevent soil erosion and conserve rain water (contour ridging, application of manure, preparation of compost, minimum tillage, agro-forestry, box ridges, tractor ploughing to break the hard hoe pan and use of herbicides as a labour saving technology) are promoted (GoM, 2010). This paradigm shift of the agricultural extension system creates a conducive environment for CA development. Although there is a strong culture of hoe usage in Malawi, a rather "slow but sure" pathway to sustainable soil health improvement will take place. Civil Society for Agriculture Network (CISANET), Landnet and Farmer Union of Malawi (FUM) are the policy advocates in agricultural development to lobby for a change from conventional agriculture to CA.

3.2. Challenges to Conservation Agriculture Development

Strong culture of ridge based cultivation

Conventional agriculture (Figure 1) is characterized by continuous tillage through ploughing and ridging, monocropping, burning of crop residues and inadequate nutrient application (Mloza Banda, 2002). During the colonial and post independence era, farming system changed gradually to the ridge based system. Most CA demonstration farmers have only allocated less than 5% of their land holding to CA demonstrations without significantly increasing. This indicates that the demo farmers have not been "transformed" enough in spite of the CA benefits over non-CA plots. Sosola *et al.* (2010) found out in a baseline study that 100% of the respondents possessed a hoe used for land preparation and other hoe based tillage including ridging. The same authors found that the reasons for using ridging cultivation were that farmers learnt it from their parents (74%), they use it as a soil and water conservation (48%) and that is the only cultivation practice that they know (24%).

Stover mining, livestock problem and multiplicity of maize stover usage

Most CA stakeholders promote maximum soil cover but the practice encourages "stover mining" from non-CA fields because usually maize stover from CA fields are never adequate to cover the soil in the recommended amounts. The maize stover spreading across the CA fields soon after harvest are fed on by roaming livestock that are set loose after harvest (Figure 6). CA farmers lamented over feeding their stover to other farmers's livestock and of livestock damaging their planting basins. Under smallholder agriculture system, ownership rights do not extend to crop residues but is rather limited to crops produce. Maize stover is often taken away by fellow farmers to be used for fuelwood, fumigating tobacco nurseries, construction purposes and feeding livestock. Most demo farmers have CA plots close to the village where close supervision is guaranteed. This alone would affect the scaling out of CA by the participating farmers to distant fields in fear of theft of stover. It is feared

that farmers would start selling maize stovers due scarcity of maize stover and its multiple uses. For instance, FAO project outsourced maize stover from another area to their demonstration farmers in Liwonde due to scarcity.

Scarcity of CA implements and herbicides

Following CFU's CA methods, there is a shortage of chaka hoes, jab planter and other support implements. Other CA stakeholders promote the use of the standard hand hoe for constructing planting basins. ICRAF, CARE Malawi, WALA consortium and NASFAM did not promote the use of herbicides in their respective projects (Table 1) whereas FAO, CRS, TLC and Concern Universal provide packages of herbicides. Farmers lamented over the price and scarcity of the herbicides on the local markets.

Long break-even point of CA benefits

Research findings indicate that SOM changes in the early stage of CA but bulk density and porosity did not change significantly though over a period of four years or more would lead to physical soil improvements (Mloza-Banda and Nanthambwe, 2010). Farmers are used to "instant" or "click" technology of improved seed, chemical fertilizer, herbicides and others which yield immediate results. Any technology that takes a relatively longer period of time to yield results would be regarded as a waste of time and resources. A similar syndrome befell agroforestry sector whereby most trees require a longer period of time for the farmers to benefits from soil health improvements (Sosola *et al*., 2010).

Lack of clear guidelines for a specific CA practice

From both the stakeholder workshop and the survey results it was clear most of the stakeholders do not have clear guidelines for promoting of CA practice as regards to suitability to agro-ecological zone. CA is not a blueprint technology to be promoted as a "one-size-fits-all" approach. Under Evergreen Agriculture project of ICRAF, farmers used both old ridge approach and planting basins depending on the topography and dryness of the areas. The dimensions of the planting basins and the spacing between the basins and rows are not uniform amongst CA stakeholders. One option is 15cm, 30cm and 20 cm for width, length and depth, respectively and the spacing of 90cm and 70cm between the row and planting basins, respectively (CFU, 2007). Others promote 45cm and 55cm whereas others 30cm by 30cm basins for width and length, respectively. FIDP and Government of Malawi promoted that the basins should be staggered to capture water more efficiently as opposed to regular patterned basins.

7. Conclusion and recommendations

The paper reveals that a number of stakeholders are promoting CA in Malawi. As such there is urgent need to synergize efforts in CA development and to advocate for radical change in tillage system. The deficiency of information persists despite some adaptive research on CA. Adaptive research is needed to develop practice appropriate for the various farm and agro-ecological conditions. CA should not be practiced as a "one-size-fits-all" as such may be counter-productive to CA advocates in the long run if the practical realities of the farmers' are not properly assessed and incorporated in the promotion of CA.

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