



What Drives Conservation Agriculture Adoption among Smallholder Farmers in Zambia?

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Key Points

1. Conservation Agriculture (CA) adoption rates by Zambian smallholder farmers have remained low despite years of promotion.
2. Though several empirical studies have investigated the determinants of adoption, the current debate about the factors associated with CA adoption in Zambia is now focused on other non-conventional variables not covered by prior studies.
3. In particular, the role of social and cultural/traditional beliefs, household farm size, and the importance of the availability of supporting CA services in the rural communities.
4. Focusing on these non-conventional variables, we find that cultural/traditional beliefs, play role in a household's decision to adopt CA. Belief in prayer and witchcraft as catalysts for success reduces the likelihood of CA adoption.
5. Availability of CA support services such as spraying services at community level increased the likelihood of adopting CA. However, households that are in communities with tractor hiring services are less likely to adopt all CA types, as the available services promoted conventional tillage than minimum tillage.
6. Households owning larger pieces of land are significantly more likely to adopt full CA than those owning smaller pieces of land. This suggests that the promotion of particular CA technologies should be tailored to suit household's landholding sizes.
7. To increase CA adoption in Zambia, there is need to address the social cultural issues at a local level and establish how they influence the communities' decision-making towards the new practice.
8. Mechanization is key to improving CA adoption; however, access to machinery without the right implements might not necessary boost adoption of CA even at community level. Thus, there is need to engage actors with machinery hiring services to provide affordable minimum tillage services.
9. CA should not be promoted as a *one size fits all* tailor made CA packages and promotional activities should be done to take into account the differences in factors influencing adoption.

INTRODUCTION: Conservation Agriculture (CA) consists of a package of farming practices based on three main principles namely minimum mechanical soil disturbance; permanent organic soil cover; and crop rotation (FAO 2001; Haggblade and Tembo 2003). Since the early 1990s, CA has been actively promoted by various stakeholders among Zambian smallholder farmers with the aim of increasing its uptake. However, despite the nearly two decades of promotion and evidence of yield benefits associated with CA, national adoption rates remain low. Several empirical studies have been carried out to investigate the determinants of adoption, disadoption, and non-adoption of CA by smallholder farmers in Zambia (For example, Grabowski et al. 2016; Haggblade and Tembo 2003; Kabwe, Donavon, and Samazaka 2005; Ngoma, Mulenga, and Jayne 2014; Ngombe et al. 2014; Nyanga et al. 2012).

Most of these studies have focused on similar sets of variables that have been posited to influence CA adoption, for instance, human capital assets, farm assets, institutional factors, risks and economic factors, and climatic conditions. For instance, (Haggblade and Tembo 2003; Ngombe et al. 2014; Arslan et al. 2013) all examine human capital, farm assets, institutional factors, risks and economic factors and climatic conditions as factors that affect the adoption of CA and CA practices while (Grabowski et al. 2016) extended the set of variables to include community variables on buyers of the produce. The current debate about the factors associated with CA adoption in Zambia is now focused on other non-conventional variables not covered by prior studies. In particular, three issues and their relationship to CA adoption and dis-adoption are at the center of this discussion, more

specifically; a) the role of social and cultural/traditional beliefs; b) role of household farm size and; c) the importance of the availability of supporting CA services in the rural communities. It is against this background that this policy brief examines these factors that might influence a household's decision to adopt CA practices.

DATA AND METHODS: Data for this analysis primarily comes from two waves of Rural Agricultural Livelihoods Surveys (RALS) conducted by the Indaba Agricultural Policy Institute (IAPRI) in collaboration with the Zambia Central Statistical Office (CSO) and the Ministry of Agriculture and Livestock. It covers the 2010/11 and 2013/14 agricultural seasons. Estimates from this data were supplemented with data from focus group discussions (FGDs) held in selected districts in agro-ecological zones I (low rainfall), IIA (medium rainfall, in southern, central and eastern parts of the country) and IIB (medium rainfall in the western parts of the country) in which CA has primarily been promoted. These districts were purposively selected based on their participation in CA promotional activities, levels of adoption and the presence of either Conservation Farming Unit or Conservation Agriculture Scaling Up project.

Households that use all three CA practises (minimum tillage, crop rotation, and residue retention) are termed as *Full* CA adopters and households that use only two CA practises (minimum tillage with either crop rotation or residue retention) are termed as *Partial* CA adopters. This is because factors affecting full CA adoption might not be the same factors affecting partial CA adoption. For more details on the data description and methods see Zulu-Mbata, Chapoto, and Hichambwa 2016.

KEY FINDINGS: The study examines the following questions asked in regards as to what drives conservation agriculture adoption among smallholder farmers in Zambia.

What General Factors Influence CA Adoption?

In general we found that educational level of the household head, female field decision makers, availability of household labour, access to information, membership in a farmer organization and credit positively influence adoption of CA. These findings are consistent with what other papers have found, for instance Kassie et al. (2012); and Ngombe et al. (2014). As expected, we find that the probability of households adopting CA is higher if the area experienced longer drought periods in the past rainfall season. Thus, an increase in the number of rainfall stress periods in a month increases the

likelihood of a household adopting CA in the next farming. Ngoma, Mulenga, and Jayne (2014) and Arslan et al. (2013), also found similar results. On the other hand the distance to the field or plot, and fields prone to erosion significantly reduces the likelihood of adopting CA.

Nevertheless, we focus on the other non-conventional variables not covered by prior studies, which are social and cultural/traditional beliefs; household farm size and; the availability of supporting CA services in the rural communities.

Do Social and Cultural Factors Influence Adoption of CA in Zambia? Social and cultural factors have not been fully explored as determinants of CA adoption in other studies, even though literature shows that they may help or hinder efforts to promote CA. Using a household's belief in witchcraft and prayer as proxies, our results showed that households who believe in witchcraft as being an important factor to make someone successful are less likely to adopt CA practices compared to those who believe otherwise. On the other hand, the results show that believe in prayer as being responsible for one's success instead of hard work reduces the likelihood of adopting full CA, but at the same time increase the likelihood of adopting partial CA. These results seem to suggest some influence though more research work is still required to be able to make conclusive recommendations. Otherwise, there is some evidence to suggest social and cultural factors may influence technology adoption in this case CA adoption.

Does Access to Farming/Agricultural Services at Community Level Influence Adoption of CA?

Most rural farmers do not possess or can afford to purchased implements and assets needed to switch to CA, however, having CA farming/agricultural services for farmers to hire in the community may help deal with this constraint. Surprisingly, we find that households that are in communities with tractor hiring services are less likely to adopt all CA types. Further inquiry with farmers revealed that the available services promoted conventional tillage than minimum tillage. Therefore, access to machinery without the right implements might not necessary boost adoption of CA.

Weeds and poor access to herbicides and limited knowledge of how to use herbicides were one of the main reasons pointed out during the FGDs for non-adoption and disadoption of CA. The results show that households that are in communities with availability of spraying services for hire are more likely to adopt all CA types. This implies that

availability and access to hiring services that support the CA practices enhances the household's decision to adopt CA.

Does Farm Size Influence Adoption of CA and the Type of CA Adopted? The households' land size might influence their decision to adopt new technologies. Households with larger farm sizes would be more likely to allocate part of their farms to try new agricultural technologies such as CA. Promoters of CA in Zambia have often focused on increasing CA adoption among households with small farms compared to larger farmers. However, the study results show that households cultivating larger pieces of land are more likely to adopt full CA than those cultivating smaller pieces of land, while landholding size did not seem to matter for the adoption of partial CA. The results also show that there is a non-linear relationship between land size and full CA adoption. Thus, the probability of CA adoption increases with farm size up to 3.54 hectares after which the likelihood starts to decline.

To understand why land size might affect the adoption of full CA, we turn to the results of the FGDs where farmers indicated that they were land constrained, and this made it difficult for them to practice crop rotation, which is a requirement for full CA adoption. These findings suggest that the promotion of CA should be tailored to suit the household's landholding sizes. Also, given that the relationship between landholding size and CA adoption vary depending on whether a farmer adopts the full CA package or partial CA, it is imperative for CA promoters to tailor make the CA package and promotional activities to take into account these differences.

CONCLUSIONS: CA has the potential to improve productivity, farm system resilience, and household's nutrition levels. Despite numerous years of active promotion in Zambia, the rates of adoption remain relatively low only 8.8% of smallholder households used CA in 2013/14 agricultural season. The current debate about the factors associated with CA adoption in Zambia is now focused on other non-conventional variables not covered by prior studies. In particular, three issues and their relationship on CA adoption and disadoption are at the center of this discussion: a) the role of social and cultural/traditional beliefs; b) role of household farm size and; c) the importance of the availability of supporting CA services in the rural communities.

Findings indicate that belief in witchcraft as the main ingredient to success reduces the likelihood of adoption CA. While belief in prayer and not

hardwork reduces full CA and increases partial CA adoption. Supportive agricultural services availability in the community were also found to influence adoption of CA. Another important finding requiring serious attention was that an increase in landholding size increased the likelihood of using CA up to about 3.54 hectares. Therefore, there might be need to relook at the current CA promotion strategy of promoting CA among smaller farmers. Similar to other studies, access to credit, information, membership in a farmer organization and past drought conditions increased the likelihood of a household adopting CA.

RECOMMENDATIONS: Based on these findings, this study makes the following recommendations:

Social, Cultural Issues: There is some evidence to suggest social and cultural factors may influence technology adoption. Therefore, before engaging in any promotion of CA, there is need to establish how these issues can influence the communities' decision-making towards the new practice. There is also need for extensive local consultation, to create an understanding of how best CA can be scaled up.

Access to CA Implements: Limited access to CA implements that reduce drudgery remains a challenge for adoption of CA. The use of draught and mechanical power can be used to address this, however, very few households own or can afford to purchase CA implements to use with their available mechanical power. Additionally, for households without tractors and/or animals, the available mechanization services at community level seem to effectively promote conventional tillage, a situation requiring immediate attention. Increasing availability and access to CA mechanical services and equipment/implements would surely go a long way in enhancing the uptake of CA in Zambia. This can be achieved in part through engaging actors with machinery hiring services into providing minimum tillage services. Further, the creation of an incentive structure to reward farmers who invest into CA implements should be considered e.g. some incentive in the lines of REDD+ initiatives could be an option.

Tailored CA Promotional Packages: Given that the factors influencing adoption of CA vary depending on whether a farmer adopts full or partial CA and the farmer type, it is imperative for CA promoters to tailor the CA package and promotional activities to take into account these factors. Research and extension should provide CA packages based on technical and socio-cultural interventions suitable for different types of farmers in different types of

environments, as no any suite of practices is suitable for all farmers in all environments.

Extension Services, Access to Information and Markets: Access to information remains a critical component in achieving broad-based adoption of CA. In areas where farmers had information on the benefits and the knowledge of implementing CA practices, adoption rates were higher. Therefore, there is need to enhance extension services nationwide through both the government and private sector. Related to access to CA services, promotion of CA should continue to be enhanced through improving farmers' access to input and output markets. Promotion of outgrower schemes and contract farming are sustainable market solutions that can be promoted to help farmers appreciate the benefits of CA, as well as make available mechanized CA services and extension to smallholder farmers. This approach would crowd in the private sector that would in turn help fill the gaps regarding input and output markets facing the smallholder farm sector.

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