An overview of Albert's Mvula's recently published PhD research on the 'Social-ecological sustainability of the Tiyeni deep-bed farming system in Malawi'

Background to the research

Food insecurity and rising poverty levels remain Malawi's major development challenges. This is largely due to the country's reliance on rainfed agriculture, that leaves millions vulnerable to the impacts of climate change and land degradation. Unsustainable farming practices coupled with population growth and poor infrastructure further add to the livelihood pressures facing resource-poor smallholder farmers. In the search for solutions to these problems Conservation Agriculture (CA) has emerged during the last two decades as a popular alternative and purportedly sustainable means of achieving food security, poverty reduction, and environmental sustainability. It achieves this through the adoption of three core principles: (1) reduced or minimum soil disturbance, (2) permanent organic soil cover, and (3) crop diversification and rotation, which collectively can deliver agroecological enhancements including higher levels of water infiltration, an increase in soil biological activity, improved soil structure and fertility, and better crop yields. As a result, many development NGOs have sought to mainstream CA practice into their field programmes, citing it as a critical climate-smart agricultural adaptation. One form of CA that has been championed in Malawi since 2005 has been Tiyeni's Deep-Bed Farming system (DBF).

At the start of this PhD research in 2017, field evidence sugegsted that DBF had significant impacts in terms of improving soil and water conservation and crop yields in those areas where it had been adopted. However, there remained significant knowledge gaps in understanding what works, where, why and how, and the overarching questions of:

a) what combinations of different environmental and social factors influence the effectiveness of the DBF components?
b) what is the nature of the interactions between these?
c) what are the outcomes of such interactions?

This three-year project therefore aimed to explore these questions, and analyse:

a) the impacts of DBF on soil physical and chemical characteristics and how these influence maize productivity;
b) DBF's contributions to farmers' livelihoods, social capital and knowledge exchange, and
c) the nature of on-farm site-specific DBF adaptations and the extent to which they contribute to farmers' resilience.

Methodological approach

Investigating these required the adoption of interdisciplinary research approaches that span divisions in agricultural research traditionally characterised by environmental analysis on the one hand, and socio-economic livelihood analysis on the other. The research therefore adopted a Social-Ecological Systems Framework (SESs) approach which sees these two areas as inextricably linked. Using this to structure the investigations, the fieldwork for this research undertook on-farm soil, water and crop yield monitoring, as well as assessments of DBF's livelihoods and institutional sustainability. Both were undertaken using a series of Participatory Learning and Action (PLA) methods that placed farmers and their experiences central to the data collection and analysis. These were conducted in six communities of farmers within 45km radius of Mzuzu city where the DBF was first developed and promoted. Field investigations included direct comparisons of DBF and traditional agricultural practices over a two year period.

What did the results show?

The data suggested that DBF resulted in immediate improvements in soil's physical parameters like de-compaction, rainwater infiltration and significant reduction in soil erosion. Conversely, marginal increases in nitrogen, organic matter and organic carbon levels were observed. Consistently high maize yields in all DBF plots were recorded with further analysis showing a strong correlation between these and the physical structure of the soil (i.e. lower bulk density).

The extent to which improved maize productivity translates to improved livelihoods is, however, often limited by the small plot sizes in which farmers have adopted DBF. The reasons for this relate to the complex social-ecological situation of each farmer, but generally relate to labour availability, soil type, and their perceived expectation of Tiyeni in terms of support. Regardless of plot sizes, the poorest of society, widows, and the elderly under acute food shortages benefit the most from DBF's high maize yields and the income this can bring. However, there is huge potential for wealthier farmers with access to more land to benefit the most should they be willing to invest in the DBF and extend its coverage.

The research also found that farmers' collaboration and communication between each other increase the more they engage in group DBF activities, and this enhances the sharing of experiences and hence adaptive capacity. This is essential for climate-smart agriculture. Conversely, however, this does decline as farmers' groups become inactive and their contact and support from Tiyeni reduces over time. This is indicative of some level of dependency on Tiyeni, which is not uncommon among other NGO-farmer extension relationships. The challenge here though, is how to enhance Tiyeni's extension approach so that it strengthens social capital among farmers for the long-term, and the research suggests the need to invest in this area of practice.

Similarly, the research evidenced many instances of farmer experimentation in the different components of DBF (in addition to DBF adoption being an experiment and on-farm adaptation in its own right), that represent on-going adaptations that support positive livelihood outcomes. However, it was noted that such experimentation was not explicitly supported in the Tiyeni extension model during the period this research was undertaken. Incorporating more 'space' for innovation, experimentation and adaptation within the DBF could potentially lead to better livelihood outcomes, although his requires further investigation.

Conclusion

This three-year PhD research was the first to apply a more inclusive and holistic SES framework to the field study of CA and Tiyeni's DBF, and succeeded in illustrating how different social-ecological conditions influence different outcomes for DBF practice in real field scenarios. Tiyeni's DBF was shown to have a significant impact on crop productivity, with the main influential factor being the changes in soil structure that DBF brings. While the complete DBF 'package' does not suit every farmer due to the nature of their land and livelihood assets, this does not stop some farmers from adopting elements of the DBF that works for them. In this way, the study provides a compelling rationale for better consideration of site-specific uniqueness in delivering CA across sub-Saharan Africa. More generally, lessons learnt through the study have the potential to improve DBF and other CA practices, helping various agricultural stakeholders to contribute to the improvement and sustainability of millions of resource poor farmers' livelihoods in Malawi and beyond.