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KEY FINDINGS

The most important factor that shaped the decision to adopt any of the three practices was whether neighbors had adopted them.

The importance of neighbors transcended both the availability and structure of a financial incentive.

The potential these practices have in reducing sedimentation in waterways could provide the basis for payments from hydropower producers for farmers to adopt conservation agriculture.

INCENTIVES COULD CREATE A TIPPING POINT IN CONSERVATION AGRICULTURE ADOPTION

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Conservation agriculture is widely viewed as an important strategy for maintaining healthy soils and improving long-term agricultural productivity, but also has the potential to help in managing waterways that generate a region's hydropower. However, the adoption of conservation agriculture practices among small-scale farmers in southern Africa remains low. We conducted a study in Malawi to evaluate how financial incentives affect how small-scale farmers decide to adopt the three individual practices that make up conservation agriculture. We found that adoption by neighbors was more important than any other factor, which could have implications for the overall cost of encouraging conservation agriculture across a region.

Conservation agriculture today describes three main farming practices: keeping the soil covered, reducing tillage and enhancing nitrogen through crop rotation or intercropping. Broader adoption of these practices is an important contributor to healthy and productive soils, but also to reducing erosion that can compromise waters that collect rainfall runoff and their potential for hydropower. These benefits reach individual farming households who depend on healthy soils but also regions and even nations that depend on productive food and power systems.

In Malawi, conservation agriculture has become a priority, and could particularly benefit hydropower producers in the Shire River Basin. The three practices of conservation agriculture are clearly defined in the country's Agricultural Sector Wide Approach (ASWAp), and several financial incentives for encouraging small-scale farmers to adopt them are under design and evaluation. These include those launched by the United Nations Development Programme and the Millennium Challenge Corporation.

We recently completed a three-year study in Malawi in partnership with the Malawi Department of Land Resources and Conservation (DLRC) and the National Smallholder Farmers' Association of Malawi (NASFAM) to evaluate how financial incentives affect the adoption of conservation agriculture practices among smallholder farmers. We found evidence that

incentives could trigger a tipping point in the number of farmers who adopt the practice, leading to much broader adoption in the long run.

Decision Trees toward Adoption

Our research in Malawi evaluated the impact of different financial incentive structures designed to encourage small-scale farmers to adopt conservation agriculture. While this evaluation was helpful for the context in Malawi, a broader set of questions can help us to understand just how farmers decided to adopt these practices and whether the incentives themselves are the strongest motivating factor.

To answer these questions, we interviewed or surveyed small-scale farmers from a random sample of 63 villages in Malawi's Shire River Basin, including Balaka and Machinga districts and a portion of Zomba district. Households that accepted subsidies in exchange for adopting conservation agriculture practices received a standard payment of about US \$30 for up to one acre for adoption of all three practices with a bonus payment for participation by neighboring farmers.

To explore how these farmers made the decision to adopt each individual practice, both with and without the subsidy, we combined ethnographic interviews with machine learning to help classify the order of factors that went into their decision making. This technique to effectively determine decision trees has been used extensively to explore



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similar agricultural decisions like farm planning and weed management.

Following the Lead of Neighbors

By the end of the study, adoption rates for all conservation agriculture practices increased. At the start, adoption rates were 60 percent for intercropping, 43 percent for mulching, but only 7.6 percent for zero tillage. In final survey of 1,923 farmers, 87 percent reported intercropping, 50 percent reported crop residue mulching and 39 percent reported zero tillage. Adopting all three practices was reported by 28 percent.

Drawing on our machine learning tools, we find that the most important factor that shaped the decision to adopt any of the three practices was whether neighbors had adopted them. The importance of neighbors transcended both the availability and structure of a financial incentive. In short, farmers who observed the practices providing benefits to neighbors were more likely to adopt those practices themselves.

We did find some variation in the factors that influenced farmers' decisions to adopt individual practices. The decision to adopt intercropping was influenced more by having a subsidy than the decision to adopt crop residues and zero tillage. This finding supports recent research¹ showing the adoption of conservation agriculture to be two decisions: one on intercropping and a second on mulching of crop residues over untilled soil.

The adoption of crop residues was most influenced by whether the farmer had ever been exposed to the practice. Farmers who were not offered subsidies were most influenced by whether their neighbors did it or if they had access to extension. The main factor for farmers offered subsidies was the monetary incentive.

The decision to adopt zero tillage was driven primarily by whether or not people had exposure to it. Farmers not offered subsidies adopted zero tillage when they had access to extension services or if their neighbors did it. To a lesser extent, these farmers were influenced by whether there was sufficient rain in the previous year. Those offered a subsidy were most influenced by whether their neighbors adopted the practice and, to a much lesser extent, by the monetary incentive and whether they had access to residues.

Supporting Early Adopters

As the analysis shows that neighbors and incentives are the key factors shaping adoption, in the absence of neighbors as role models incentives are likely necessary to encourage farmers to risk adopting conservation agriculture.



Members of the research team in the field in Malawi.

However, the importance of neighbors suggests that adoption may have a tipping point beyond which further adoption is self-reinforcing, which reduces the need for financial incentives.

Though these results are not necessarily universal, in Malawi's Shire Basin they do have clear implications for the development of programs aimed at improving livelihoods, landscapes and water systems. In the sustainable land management context, the potential these practices have in reducing sedimentation in waterways could provide the basis for payments from hydropower producers to encourage small-scale farmers to adopt conservation agriculture.

Payments through this kind of program may be high upfront but are likely to decline as the benefits accrue to the small-scale farmers that adopt conservation agriculture. In time, it may be possible for these payments to be phased out. The initial investment could be a necessary step for reaching the tipping point for addressing broader challenges of land degradation. 🌱

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ABOUT THE FEED THE FUTURE INNOVATION LAB FOR ASSETS & MARKET ACCESS

The AMA Innovation Lab at UC Davis mission is to conduct and support research on policies and programs designed to help poor and smallholder farmers worldwide to manage risk, adopt productive technologies and take an active part in economic growth.

With core funding from the USAID Bureau for Food Security to support the U.S. government's global hunger and food security initiative, our research agenda focuses on:

- Financial innovations and risk management
- Adoption of more productive agricultural technologies
- Synergies possible by bundling financial and technological innovations

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B A S I S

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¹Ward, P.S., et al. 2016. "Heterogeneous Preferences and the Effects of Incentives in Promoting Conservation