How can Small-scale Farmers in Niger be Encouraged to Adopt Rainwater Harvesting? Results from a Pilot Study

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BACKGROUND AND CONTEXT

Rainfed agriculture in the Sahel of Sub-Saharan Africa is plagued by low and erratic rainfall and strong winds, contributing to soil erosion and degradation. Rainwater harvesting through micro-catchments—small structures constructed in fields to collect soil runoff and increase soil nutrient content—is considered the best way to increase the level and duration of water stored in the soil and replenish soil nutrients. The most common micro-catchments used in the Sahel are *zaï/tassa* (soil pits), *demi-lunes* (half-moons), and *banquettes*. In combination with manure or inorganic fertilizers, *demi-lunes* can increase millet yields from one metric ton per hectare to more than 3.8 metric tons per hectare.

Based on their potential to sustainably increase yields, *demi-lunes* are part of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Bioreclamation of Degraded Lands (BDL) system and are included in numerous dissemination programs. Information on the adoption is however, limited. In Niger, it is estimated that fewer than ten percent of small-scale farmers are using micro-catchments on any part of their land. A recent pilot study by Tufts University in partnership with the Niger Ministry of Environment and the Sahel Group, sought to better understand the barriers to farmers' adoption of rainwater harvesting in Niger and to measure the impact of adoption on their well-being.

Researchers are currently working with non-governmental organizations (NGOs) and the Ministry to implement a full-scale research program in 180 villages in Niger, building upon the pilot study results. The full study will also measure the impacts of the technology on soil quality, a key constraint in Sahelian West Africa.

AN EXPERIMENT TO ASSESS ADOPTION

The study randomly assigned villages one of three interventions:

1. training alone (basic training for rainwater harvesting techniques, including the necessary equipment, conducted by the Ministry);
2. training plus an (upfront) unconditional cash transfer (UCT) worth US$ 40—about half the cost associated with constructing *demi-lunes* on one hectare of land;
3. training plus a conditional cash transfer (CCT) for every *demi-lune* of acceptable quality, similar to the value of the UCT.

DATA AND METHDOLOGY

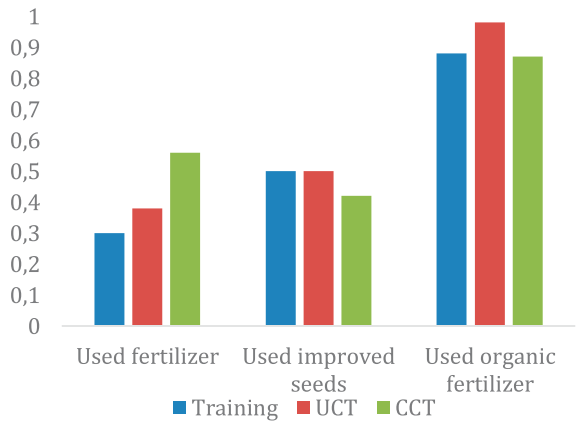
Targeting the villages most affected by soil degradation, the pilot study had a sample size of 30 villages in the Dosso region of Niger. Villages were randomly assigned to one of the three intervention arms. Within each village, 25 farmers were selected, for a total of 750 farmers. To encourage participation by farmers interested in rainwater harvesting, researchers did not inform farmers of the potential cash payments at the initial meetings. Approximately one-quarter of the selected farmers were women.

TRAINING FARMERS INCREASES THEIR PROPENSITY TO ADOPT RAINWATER HARVESTING, AND FARMERS BENEFIT FROM IT

Training alone can be a cost-effective way to get farmers to try the technology. Interest in rainwater harvesting techniques was high. A total of 637 farmers (85%) attended training regardless of the intervention group. Eighty-five percent of farmers who attended training in the "training-only" and "training +UCT" villages constructed *demi-lunes* on their plots, whereas households in "training + CCT" villages were 13 percentage points less likely to construct *demi-lunes*.

Upfront cash transfers were essential to farmers overcoming immediate credit constraints associated with hiring labor. The largest number of *demi-lunes* were constructed by farmers in the UCT villages. Whereas households in the training villages constructed about 30 *demi-lunes* per hectare, those in the UCT group constructed about 47 *demi-lunes*. Those in the CCT villages constructed fewer than those in the training or UCT group (Figure 1). In all cases, these numbers are lower than the recommended 250 *demi-lunes* per hectare. However, the number of *demi-lunes* followed the appropriate technical norms in terms of depth, size, slope and spacing, resulting in the *demi-lunes* per hectare being concentrated on one part of the parcel.

Figure 1. Percentage of farmers using agricultural inputs, by intervention group



***Demi-lune* adoption was correlated with changes in input use**. Households in the UCT villages—who had constructed more *demi-lunes* than their training and CCT counterparts—were 18 percentage points less likely to use inorganic fertilizer than those in the CCT villages. They were more likely, however, to use organic fertilizer (manure), a key complementary input for *demi-lunes* (Figure 1). Whereas inorganic fertilizers must be purchased, manure is often readily available from household livestock.

Adoption seems to have translated into higher agricultural production for key crops, and other modest improvements in well-being. Households in the UCT villages produced approximately 20 kg more millet overall than those in the training and CCT villages, with a statistically significant difference at the five percent level. UCT households had higher self-reported measures of well-being[1] and more durable assets. In particular, households in UCT villages were 12-14 percentage points more likely to own a motorcycle and cart than their training and CCT counterparts—indicating that these households were able to invest in agricultural technology and other assets.

Farmers' adoption of *demi-lunes* grew over time. Although initial results were well below the suggested technical norms of 250 *demi-lunes* per hectare, the evolution of adoption indicates that farmers were trying out the technology to see how it worked. Two years after the intervention, a qualitative study found that farmers in the training and UCT groups were constructing about 20 more *demi-lunes* a year on the same plots.

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SOURCE

Aker, J. (2017). *Are Rainwater Harvesting Techniques Profitable for Small-Scale Farmers? A Study on the Impacts of Adopting Rainwater Harvesting Techniques in Niger*. Unpublished report submitted to the Standing Panel on Impact Assessment (SPIA) of the ISPC.

[1] Respondent households were asked to rate their well-being on a five-point scale.