



How Senegal's farmers are fighting back against agricultural shocks: Exploring resilience strategies for family farms in rural areas

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Summary

This research analyzes the resilience strategies of family farms in rural Senegal in response to agricultural shocks, and assesses the effect of resilience strategies on farm productivity. Drawing on data from the 2018/2019 Senegal Annual Agricultural Survey, we identify the main factors that limit or promote the adoption of three resilience strategies: building dikes, crop rotation, and purchasing certified seed. We then assess the impact of resilience strategies on productivity using endogenous switching regression. The goal of this research is to inform agricultural development programs on rural resilience strategies and investment decisions.

Key Messages

- Faced with declining crop yields linked to agricultural shocks, farm producers in rural Senegal are adopting various resilience strategies.
- Increased commercialization enables farmers to invest in fertilizers, pesticides, and, irrigation as well as obtaining agriculture loans.
- Among all the channels investigated, irrigation and agriculture loans are consistently the most important factors that allow farmers to improve their land productivity.

Background

Over the past decades, agricultural shocks and extreme weather conditions in Senegal have contributed to the decline in agricultural production in rural areas. Due to these shocks, the agricultural Gross Domestic Product (GDP) fell from 30% in the 1960s to 20% at the end of the 1970s and is now around 10% (World Bank, 2021). This generally small-scale agriculture (with less than 2 ha of land for most farms (95%)), constitutes the main source of income and employment for the rural population in Senegal (World Bank, 2021). Despite the importance of the agricultural sector, crop productivity is low with more than half of farmers practicing subsistence agriculture, living below the poverty line and facing food insecurity.

Rural areas in Senegal are also regularly exposed to a variety of agricultural and climatic shocks that prevent farmers from accumulating the assets and human capital needed to reduce poverty (World Bank, 2006). This makes rural households even more vulnerable to climatic risks, economic risks and health risks. This vulnerability is expected to worsen with a predicted rise in temperature of 2-4°C and reduced rainfall by 5-25%, accompanied by aridification in northern Senegal and a rise in sea level of 1m by 2100 (Lacroix and al., 2021). These constraints are expected to further reduce cereal productivity

by as much as 50% (CIRAD, 2021) and increase food insecurity by 17% with nearly 47% of the population living in poverty (FAO, 2017).



(FAO)

Research methods

To examine impacts of resilience strategies in Senegal we use data from the 2018/2019 Senegal Annual Agricultural Survey (AAS). The survey includes data on 5,888 households, and includes several resilience strategies used by family farms in rural areas. Recent reports suggest Senegalese farmers use a range of strategies including crop diversification (37.5%), use of traditional practices (30%), use of seeds adapted to local conditions (22.9%), sale of livestock (27.6%), income diversification (27.5%), sale of crops (22.2%), irrigation (7.6%) and government support (20.8%) (EAA, 2021). We focus on three specific strategies: construction of dikes, crop rotation, and use of certified seed (Fig. 1).

We first use a multivariate Probit model to identify the main geographic, farm and household factors that appear to limit or promote the adoption of resilience strategies. We further leverage climate data from weather stations across Senegal, providing the ability to control for variation in rainfall, humidity, and temperature across surveyed households. Finally, we evaluate the impact of resilience strategies on productivity using an endogenous switching regression model.

Major findings

Farmers in Senegal adopt a range of resilience strategies: The Groundnut Basin is the agroecological zone where farmers have built the most dikes (35.21%) compared to other zones. Similarly, the crop rotation

system is the strategy that was most adopted by farmers in the groundnut basin (28.76%) compared to other areas. As for certified seeds, farmers in the Casamance area are those who have adopted this strategy the most (34%) compared to other areas (Figure 1).

Some resilience strategies are more common among more vulnerable farmers: The construction of dikes, crop rotation and adoption of certified seeds are significantly associated with local climate and weather conditions, and with household wealth, education level and access to labor for implementing resilience strategies.

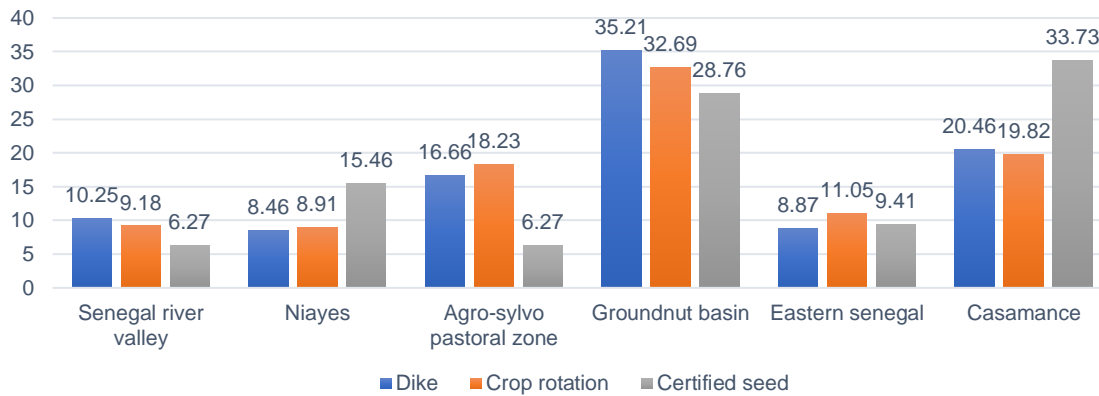


(World Bank)

Resilience strategies relate to productivity, after accounting for other factors: The adoption of various resilience strategies to agricultural shocks has a statistically significant association with agricultural productivity; One exception is that Senegalese farm households that have constructed dikes produced 248 kg/ha compared to 364 kg/ha for farmers who did not; this negative association may be a reflection of adverse field conditions faced by farmers using dikes as a coping strategy for flooding, erosion, leaching and soil nutrient depletion.

Farmers who rotated crops produced 258 kg/ha compared to 255 kg/ha for farmers who did not. The endogenous switching regression results further suggest that those who rotated crops would have produced 169 kg/ha less if they had not rotated the crops, after accounting for other farm and household factors. In other words crop rotation is strongly associated with productivity gains among farmers engaged in this practice. Similarly, the agricultural productivity of farmers who have adopted certified seeds is 421 kg/ha against 244 kg/ha for farmers who have not adopted certified seeds.

Figure 1: Resilience strategies by agroecological zone in Senegal.



Source: Senegal Annual Agricultural Survey (AAS) 2018/19

Farmers who adopted certified seeds would have produced 227 kg/ha less if they had not adopted certified seeds. These results are consistent with those obtained by Onyeneke (2020), Diallo and Donkor (2020) and Khanal et al., (2018b) in their respective countries, which show that farmers who used resilience methods such as crop rotation produced 7% more than those who did not.

Resilience strategies may not boost productivity for all farms: The endogenous switching regression model allows us to estimate the effect of resilience strategies on farmers who have adopted the strategies (i.e., the treatment effect on the treated (TT)), but also to estimate what the likely effect *might have been* if non-adopters had also implemented the strategies (i.e., the treatment effect on the untreated (TU)). For use of certified seed the treatment effect on the treated and the treatment effect on the untreated is significant and positive, suggesting many different types of farms currently benefit from or could benefit from adoption of certified seed. However for both crop rotation and construction of dikes the treatment effect on the untreated is significant and negative – in other words, for these two resilience strategies, non-adopters might not be better off with adopting these practices, suggesting other resilience strategies may be needed.

Policy implications

The research results show that family farms in rural Senegal respond to agricultural hazards

and climatic hazards by adopting strategies including construction of dikes, crop rotation and the use of certified seeds, in an effort to be resilient and prevent future hazards and to improve or maintain their agricultural yield.

The results of this study are largely consistent with those of many other studies in other countries (Di Falco et al., 2011; Diallo and Donkor, 2020; Khanal et al., 2018; Dessalegn et al., 2022). Ultimately, these results provide a basis for policies intended to facilitate the promotion of agriculture, for the design or redesign of agricultural programs and investments in the agricultural sector in rural Senegal. Findings are particularly important for the design of policies aimed at developing and promoting effective resilience strategies to deal with agricultural shocks, and hence offer guidance towards the achievement of SDG2: Zero Hunger.

While resilience strategies can be effective in supporting agricultural productivity, they can also be costly to implement. Public authorities through Extension and other support services can effectively play two roles: that of advising on the choice of appropriate strategies for each area and of trainer on the implementation of these different strategies. All of this is necessary to reduce maladaptation by farmers.

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