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Climate-Smart Agriculture: capturing the synergies among mitigation, adaptation and food security

EMERGING EVIDENCE FROM ZAMBIA

Key points:

- High levels of dis-adoption (~95%) of minimum soil disturbance (MSD) in the whole country. Dis-adoption in the Eastern province is significantly lower;
- There is a very strong and robust relationship between the district level variation in historical rainfall during the growing season and MSD adoption and its intensity;
- Farmers seem to use MSD as a strategy to mitigate the risk of rainfall variability, providing indirect evidence of a synergy between the main component of conservation farming and farmers' capacity to adapt to climate variability.
- The presence of extension services in a given village affects positively both adoption and intensity of adoption of practices analyzed.

In Zambia, emerging evidence on conservation farming (CF) is based on the analysis of two rounds of the Supplemental Survey to the Central Statistical Office's 1999/2000 Post Harvest Surveys (Rural Incomes and Livelihoods Surveys; RILS), which were implemented in 2004 and 2008,[1] as well as district level historical Rainfall Estimate data (RFE) and Harmonized World Soil Database (HWSD). We analyze the determinants and the intensity of adoption of two important pillars of CF: minimum soil disturbance (MSD) and crop rotation (CR).

The analysis shows **surprisingly high levels of MSD** (zero tillage/planting basins) dis-adoption (around 95%) in the whole country, while dis-adoption in the Eastern province the hub of CF projects in Zambia is significantly lower. Nationwide, only 5% of the households practiced CF in 2008, down from 13% in 2004, which raises the question of the widespread suitability of this practice. Eastern province is the only province with a significant increase in adoption rates between the survey years: 14% in 2008, up from 8%. We also document **lower dis-adoption and higher continuing adoption rates for CR**. The RFE data compiled for the project shows that the onset of the rainy season critical for planting has been gradually delaying in the past 10 years.

Our econometric analyses based on panel data methods that control for time-invariant household characteristics fail to provide evidence for the oft mentioned determinants of adoption of CF in the literature. We find no evidence for the role of labor constraints, age or education in adoption decisions for MSD. For CR, however, **education** plays a positive role.

[1] We thank the Indaba Agricultural Policy Research Institute (IAPRI) and the Zambia Food Security Research Project (FSRP) for providing the data.

These results suggest that most socio-economic variables are correlated with household level un-observables variables (e.g. farmer ability or openness to innovation) in cross-sectional studies confounding the effects of variables included in analyses.

Soil nutrient availability constraints increase farmers' incentives to adopt CR and to allocate a larger share of land to this practice. We capture the oft-mentioned shifts in the onset date of the rainy season with a variable that measures the average delay in the onset date in the past 10 years. The longer this **delay in the onset of the rains** in a district, the more likely households are to adopt both MSD and CR, indicating that an ever later arriving rainy season may increase the incentives to adopt a system that allows for immediate planting upon the onset of the rains potentially an important adaptation strategy.

We find a very strong and robust relationship between the district level variation in **historical rainfall** during the growing season and adoption as well as the intensity of adoption of MSD in Zambia. This finding suggests that farmers are using MSD as a strategy to mitigate the risk of rainfall variability, providing evidence – albeit indirectly – of a **synergy** between the main component of CF and farmers' capacity to adapt to climate variability. Further research is needed to directly assess whether this practice decreases yield variability over time as suggested by these findings.

Another robust finding is that the coverage of **extension services** in a village (i.e. the proportion of households that received information on minimum tillage or crop rotations) positively affects both adoption and the intensity of adoption of both practices analyzed here.
A key outstanding question however, is the degree to which extension services included the provision of subsidized inputs, which is not possible to disentangle in these dataset.

Understanding the respective importance of information and subsidized input provision is essential to design future programs for CF promotion.

Despite these unanswered questions, the analysis does clearly indicate that better screening of agro-ecological and socio-economic constraints and incentives for adoption of CF are needed in order to achieve effective and durable adoption of CF in Zambia. It also suggests that alternative approaches to sustainable agricultural intensification that better address the constraints and objectives of sustainable agricultural intensification in the near term in Zambia is needed. This may include modifications of the current CF technologies as well as broadening the range of technologies considered to include other forms of sustainable land management and agricultural intensification.

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