Agricultural Systems xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Agricultural Systems

journal homepage: www.elsevier.com/locate/agsy

Climate risk management and rural poverty reduction

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ARTICLE INFO

Keywords:
Risk
Poverty trap
Resilience
Production technology
Insurancesocial protection

ABSTRACT

Climate variability is a major source of risk to smallholder farmers and pastoralists, particularly in dryland regions. A growing body of evidence links climate-related risk to the extent and the persistence of rural poverty in these environments. Stochastic shocks erode smallholder farmers' long-term livelihood potential through loss of productive assets. The resulting uncertainty impedes progress out of poverty by acting as a disincentive to investment in agriculture – by farmers, rural financial services, value chain institutions and governments. We assess evidence published in the last ten years that a set of production technologies and institutional options for managing risk can stabilize production and incomes, protect assets in the face of shocks, enhance uptake of improved technologies and practices, improve farmer welfare, and contribute to poverty reduction in risk-prone smallholder agricultural systems. Production technologies and practices such as stress-adapted crop germplasm, conservation agriculture, and diversified production systems stabilize agricultural production and incomes and, hence, reduce the adverse impacts of climate-related risk under some circumstances. Institutional interventions such as index-based insurance and social protection through adaptive safety nets play a complementary role in enabling farmers to manage risk, overcome risk-related barriers to adoption of improved technologies and practices, and protect their assets against the impacts of extreme climatic events. While some research documents improvements in household welfare indicators, there is limited evidence that the risk-reduction benefits of the interventions reviewed have enabled significant numbers of very poor farmers to escape poverty. We discuss the roles that climate-risk management interventions can play in efforts to reduce rural poverty, and the need for further research on identifying and targeting environments and farming populations where improved climate risk management could accelerate efforts to reduce rural poverty.

1. Introduction: climate risk and rural poverty

Significant gains in food security and rural poverty reduction, associated with the Green Revolution, resulted from a combination of investments that increased production, reduced risk and enhanced market access. Subsidized inputs, such as irrigation, reduced the production risk faced by farmers and in part account for their willingness to invest in increased on-farm production and productivity. Because agricultural development efforts in the 1960s–1980s focused more on intensification of favorable areas than on the constraints in more marginal and risk-prone environments, the Green Revolution's contribution to rural poverty reduction was less evident in marginal production environments (Pingali, 2012). Despite continued efforts to improve farmer's living standards, poverty and food insecurity are still prevalent across large portions of sub-Saharan Africa and South Asia. Prevalence is often high in the drylands (i.e., rain-fed areas in dry subhumid to arid agro-ecological zones), where climate variability exposes smallholder farmers and pastoralists to major risk (Hyman et al., 2008; Dercon, 2002; Walker and Ryan, 1990; Zimmerman and Carter, 2003). Today, there are increasing calls for a second Green Revolution targeted at regions with precarious agricultural conditions such as Sub-Saharan Africa. A central challenge is to go beyond increased agricultural production per se, and mitigate risks posed by increasing variable climate and marginal production conditions to ensure that large numbers of farmers move out of poverty and increase rural prosperity.

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https://doi.org/10.1016/j.agsy.2018.01.019
Received 31 July 2017; Received in revised form 16 December 2017; Accepted 21 January 2018

Climate-related disasters impact poor countries, and the relatively poor within countries, disproportionately (Carter et al., 2007; Easterly, 2001; Gaiha and Thapa, 2006). In the face of a severe climate shock, such as a drought, flood or heat wave, vulnerable households employ a range of ex-post strategies to cope with the resulting crisis, including: liquidating productive assets, defaulting on loans, withdrawing children from school to work on farm or tend livestock, reducing nutrient intake, and over-exploiting natural resources. Although these coping strategies enable households to endure a crisis in the short term, they often reduce the household's capacity to build a better life in the future by eroding productive assets (Barrett and Carter, 2001; Carter and Barrett, 2006; Carter et al., 2007; Dercon, 2004; Dercon and Hoddinott, 2005; Hoddinott, 2006; McPeak and Barrett, 2001; Wood, 2003) and human capital (Alderman, et al., 2004; Dercon et al., 2005; Victora et al., 2008).

Risk aversion leads to under-investment and under-adoption of improved agricultural production technology. Farmers tend to use precautionary strategies to protect against the possibility of catastrophic loss in the event of a climatic shock and thus do not optimize management for average conditions, but for adverse conditions. These *ex-ante*, precautionary strategies include selection of less risky but less profitable crops and cultivars, shifting household labor to off-farm activities, and avoiding borrowing and investment in productive assets (including soil fertility) and improved production technology (Barrett et al., 2004; Dercon, 1996; Fafchamps, 2003; Kebede, 1992; Marra et al., 2003; Rose, 2001; Rosenzweig and Stark, 1989; Dercon and Christiaensen, 2011; Simtowe, 2006; Morris et al., 2007). Evidence from ICRISAT village studies in India and Burkina Faso shows that the resulting cost is much greater for those who are relatively poor within a poor farming community (Rosenzweig and Binswanger, 1993; Zimmerman and Carter, 2003). Risk aversion extends beyond farmers to institutions, impeding investment in rural areas and the development of agricultural value chains. Losses from covariant climatic or other shocks can exceed the reserves of an insurer or lender, and lead to financial market failures in many low-income countries (Besley, 1995; Miranda and Glauber, 1997; Poulton et al., 2006).

Climate-related risk contributes to rural poverty in three ways. First, *ex-ante* risk management strategies reduce the productivity and profitability of existing assets, and discourage accumulation of productive assets. Second, *ex-post* coping responses to severe or repeated climate shocks can force non-poor but vulnerable households to divest their productive assets. For some households this status will be transitory, others will fall or remain at a point below the poverty trap threshold. Third, the tendency for risk tolerance to decrease with decreasing resource endowment contributes to the higher opportunity cost of climate risk for the relatively poor (Carter and Barrett, 2006). Furthermore, with institutions or governments operating at an aggregate scale, climate risk can constrain economic opportunities and hence reinforce poverty and the potential for poverty traps at the household level (Barrett and Swallow, 2006; Carter and Barrett, 2006).

The agricultural research-for-development (AR4D) community has developed a number of agricultural production technologies and practices, such as stress-adapted crop germplasm, conservation agriculture and agroforestry systems, that aim to mitigate risk and foster resilience in the face of climate variability. Institutional interventions, such as index-based agricultural insurance and forms of social protection such as cash transfers, which have their origins largely outside of AR4D, seek to mitigate risk and build resilience through other mechanisms, and hence may play a complementary role to agricultural production technologies and practices. Understanding the mechanisms by which climate-related risk contributes to the extent and persistence of poverty provides a basis for assessing the potential for these risk management interventions to overcome the adverse impacts of risk, targeting interventions appropriately, hence, contributing to pathways out of rural poverty in high-risk environments.

The degree of impact from shocks will vary according to farmers' socio-economic status, given that the extent of asset and labor endowments affects capacity to smooth consumption in the face of shocks (Baulch and Hoddinott, 2000). Designing and targeting risk management interventions for effective poverty reduction therefore requires disaggregated understanding of 'the poor', facilitating understanding of poverty causes and dynamics (Hulme, 2003). A key distinction is between transitory and chronic poverty (Barrett, 2005). If people's assets - or related measure - fall below a poverty line but subsequently recover, then their poverty status is transitory. In contrast, when people have little or no mobility and experience poverty for extended periods, perhaps throughout their lives or between generations, poverty is chronic (Barrett, 2005). For people living in chronic poverty, risk and its impacts on farmer and institutional decision-making, contributes to conditions associated with poverty traps. A poverty trap occurs when households fall below a critical threshold of assets, below which individuals are unable to accumulate the necessary resources to escape poverty (Barrett, 2005; Carter and Barrett, 2006). People's poverty status, and whether this poverty is transitory or chronic, will affect their ability to take up agricultural production technologies and practices, and the extent to which institutional interventions for climate risk management will enhance this uptake. This raises the need for appropriate targeting to ensure that production technologies and practices, and complimentary institutional interventions, target the types of farmers best placed to pursue agricultural pathways out of poverty.

The literature that links climate-related risk to the extent and the persistence of rural poverty in these environments suggests a poverty reduction impact pathway that includes intermediary impacts of risk management interventions. The most direct impacts of these interventions are smoothed production, income and/or consumption across the range of climate variability; and protection of productive assets, including the health of household members, in the face of extreme climate events. Both of these impacts may alleviate risk-related barriers to adopting improved agricultural production technologies and practices, and accessing credit and market opportunities. Stabilized production, income and consumption; protection of human capital and productive assets during shocks; and the adoption of improved agricultural technologies and practices can all contribute to improved household food security and wealth. In time, the resulting cumulative improvement in household welfare, and investment of accumulated wealth in further farm and non-farm income generating activities, may move the household out of poverty. Consistent with this understanding of climate risk management impact pathways, this paper assesses evidence, published in the last ten years, that a set of risk-mitigating production technologies and institutional interventions contribute to poverty reduction through: (a) stabilizing production, income or consumption; (b) protecting productive assets in the face of shocks; (c) fostering uptake of credit and improved technologies; and (d) improving household welfare measures (income, food security, wealth). We discuss the state of the evidence from available impact studies, adoption and scaling issues, and the prospects for further exploiting the complementarities between the technological and the institutional risk management interventions included in this review. Finally, we discuss the roles that climate-risk management interventions can play in efforts to reduce rural poverty, and the need for further work to identify and target environments and farming populations where improved climate risk management could accelerate efforts to reduce rural poverty.

While past reviews have summarized the evidence for individual climate risk management interventions, this paper seeks to contribute to available knowledge by exploring the complementarities among technological and institutional climate risk management interventions through the lens of the identified poverty reduction impact pathway, and by incorporating a number of very recent evaluation studies. It is a contribution to a special issue, "Agricultural research for rural prosperity: Rethinking the pathways," that reviews the contribution of agricultural research-for-development to a set of pathways out of rural poverty.