Global Environmental Change 35 (2015) 82–92

Contents lists available at ScienceDirect

Global Environmental Change

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

# The influence of gendered roles and responsibilities on the adoption of technologies that mitigate drought risk: The case of drought-tolerant maize seed in eastern Uganda

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ARTICLE INFO

*Article history:*
Received 13 May 2015
Accepted 20 August 2015
Available online 2 September 2015

*Keywords:*
Adaptation
Agriculture
Drought
Gender
Technology adoption
Sub-Saharan Africa

ABSTRACT

Gender-disaggregated, household survey data for Uganda are used to examine how gendered roles and responsibilities influence adoption of drought-tolerant (DT) maize, a new technology that can help smallholder farmers in sub-Saharan Africa adapt to drought risk. Multinomial logit (MNL) regression results indicate that, compared to men farmers, women farmers have much lower adoption of DT maize, mainly due to differences in resource access, notably land, agricultural information, and credit. Differentiation of women and men farmers by various characteristics reveals that whether a male farmer was younger or older, or poor or non-poor has no significant influence on DT maize adoption; but important differences among different categories of women farmers are identified. For example, the farmer group found least likely to adopt DT maize is young, poor women household heads. MNL results also show that wives strongly influence adoption of DT maize on plots controlled by their husbands. We discuss the implications of study findings for the development of well-targeted and socially-inclusive adaptation policies.



## 1. Introduction

Maize is a central component of food security and economic wellbeing for more than 32 million households in sub-Saharan Africa (SSA) (personal communication, Tsedeke Abate, March 2015). In SSA, maize cultivation is almost completely rain-fed, and therefore dependent on the region's variable precipitation. Around 40% of Africa's maize-growing area faces occasional drought stress in which yield losses are 10–25%. Around 25% of the maize crop suffers frequent drought, with losses of up to half the harvest (CIMMYT, 2013). Some climate change models have consistently predicted increased incidence of drought for SSA (Li et al., 2009), so drought-related challenges to achieving food security will likely continue and possibly increase.

African farmers are not helpless in the face of variable and changing climates; they already adapt to climate variability and change in a multiplicity of ways (Deressa et al., 2009; Carr, 2008a; Kinsey et al., 1998; Fisher et al., 2010). However, in some parts of SSA, the magnitude and speed of the predicted changes are likely to outstrip the local efforts to manage those changes, and large public and private investments in crop breeding, irrigation infrastructure, and safety nets (*e.g.*, micro-insurance) are needed to meet the food needs of the growing human population (Burke and Lobell, 2010).

While the development of new seed technologies that can manage the stresses of likely future climatic variability and change presents numerous technical challenges, ensuring these seeds meet the needs of a diverse set of farmers presents another crucial, yet less-considered, challenge. This challenge is particularly clear when considering the needs and preferences of men and women farmers. While modern seed varieties are intended to benefit a wide range of producers, empirical studies reveal that women farmers have relatively low rates of adoption of agricultural technologies associated with increased crop yields (Peterman et al., 2010). Further, research suggests that men are more likely than women to adopt measures for adapting to climate change, such as soil conservation, tree planting, and changing crop varieties (Deressa et al., 2009). Where gender gaps characterize the adoption of agricultural technologies, women's empowerment is challenged and societies experience real costs in terms of untapped potential in agricultural output, food security, and economic growth (Ragasa et al., 2012).

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http://dx.doi.org/10.1016/j.gloenvcha.2015.08.009
0959-3780/

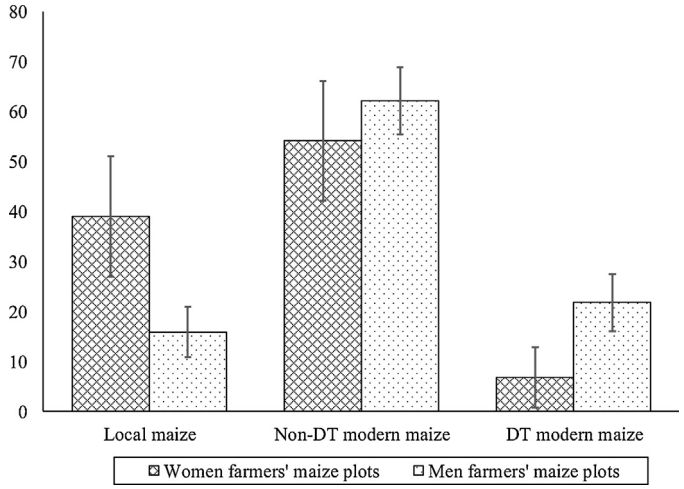


**Fig. 1.** Percentages of maize plots cultivated in different types of maize and 95% confidence intervals for the percentages, by gender of the maize plot decision-maker, CIMMYT Uganda Survey 2014.

This paper addresses the character and causes of apparent gender gaps in the adoption of modern seed varieties through the case of the Drought Tolerant Maize for Africa (DTMA) project. To reduce the sensitivity of farming systems to drought and improve food security, DTMA has developed about 190 drought-tolerant (DT) maize varieties between 2007 and 2014. Through national agricultural research systems and private seed companies, these varieties have been extended and released to farmers in 13 SSA countries (CIMMYT, 2013). On-farm trials across a range of sites in East and Southern Africa revealed that DT maize varieties out-yield popular commercial checks by 83–137% (controlled drought), 26–47% (random drought), and 25–56% (optimal rainfall conditions) (Fisher et al., 2015). At the same time, it is clear that women farmers are slow to adopt the new DT maize varieties (see Fig. 1).[1] The figure reveals a narrower gender gap in adoption in the case of non-DT modern maize (*i.e.*, modern maize bred for traits other than drought tolerance) *vs*. DT modern maize. Because non-DT varieties have been in circulation for longer than DT varieties, this trend may suggest prospects for reducing the gap in DT maize cultivation rates among women and men farmers over time. Nonetheless, the fact remains that in Uganda the initial uptake of DT modern maize is marked by a significant gender gap.

In this paper, we seek to understand how gendered roles and responsibilities influence adoption of DT maize in SSA, and therefore uncover opportunities to address and lessen gender-based differences in seed adoption. Addressing this challenge could broaden access to the potential benefits for climate change adaptation that may proceed from seed use. The paper begins with a brief overview of the place of gender in African agriculture and agricultural decision-making to frame the issue of how gender-based roles and responsibilities impact seed adoption. Household survey data for Uganda are used to empirically study local patterns of landholding and agricultural decision-making. Regression models are estimated in order to test hypotheses for the observed gender gap in DT maize adoption and to gain insights into the impact of gendered roles and responsibilities on adoption of new agricultural technologies. Empirical model results are assessed in terms of whether or not they support or refute the study hypotheses and their implications for the development of well-targeted and socially-inclusive adaptation policies (Below et al., 2012).

## 2. Gender and agricultural decision-making in sub-Saharan Africa

While it appears that DT maize presents significant benefits to African farmers, the uptake of any new agricultural technology is governed by more than its utility. A farmer's characteristics, such as gender, age, and income, shape his or her roles and responsibilities with regard to agricultural production and livelihoods (*e.g.*,Carr, 2008b; Simtowe, 2010; Buechler, 2009; Koopman, 2009; Molua, 2010), and therefore strongly influence the decision to adopt a new technology. Women are heavily engaged in agricultural production across SSA. However, in many contexts agricultural decision-making falls outside their roles and responsibilities, and women are, therefore, unable to adopt new farm technologies. For example, among the Bambara in Mali, agricultural decision-making is largely concentrated in the hands of senior men in an extended family (Becker, 1990; Akeredolu et al., 2007; Grigsby, 2004), limiting women's use of new agricultural and adaptation technologies like climate services (Carr, 2014). In other cases, women may not make decisions on agricultural technology uptake, but may still influence those decisions. Negotiation between a husband and wife over the demand for her labor, for example, can have profound effects on the rate of adoption of labor-increasing technologies. For example, studies in Mali and Cameroon have found that agricultural technology adoption occurred but husbands had to compensate their wives for increased labor supply (*e.g.*, Lilja, 1996; Jones, 1986). Other research has found that, in a range of settings, wives simply refused to supply labor, opting instead to devote time to their own enterprises (for a review, see Blumberg, 1991).

Among farmers who have agricultural decision-making responsibilities, the expectations associated with different social categories can constrain their decisions. Much literature recognizes the existence of gendered agricultural practices in many parts of the Global South (*e.g.*, Arndt and Tarp, 2000; Doss, 2002; Ezumah and Di Domenico, 1995; Gladwin, 1992; Kevane, 2011; Sachs, 1996), practices that are generally enforced through both social norms and institutions such as land tenure (Agrawal, 2003; Tripp, 2004). For example, Carr (2011) demonstrates that the convergence of a male-controlled land tenure system and widely-held gendered roles and responsibilities in Ghana's Central Region lead women to select vegetable crops that are useful for subsistence consumption, as opposed to tree crops that are both more robust in the face of climate variability and more valuable in local markets.

Finally, a growing literature recognizes that the roles and responsibilities of individuals and groups with regard to agricultural production are shaped, not through a single identity, but through the convergence of multiple identities. In the context of gender, several authors have argued that focusing on the differences between men and women overlooks more complex identities within these broad categories that influence agrarian and climate change adaptation outcomes (Carr, 2008b; Dankelman, 2002; Demetriades and Esplen, 2008; Djoudi and Brockhaus, 2011; Kaijser and Kronsell, 2013; MacGregor, 2010; Warner and Kydd, 1997). A growing literature in both gender and development, and now gender and adaptation, recognizes that gender takes meaning in the context of age, caste, and livelihoods (see Carr and Thompson, 2014 for a review). Therefore, to gain insights into the

[1] Modern maize is here defined as hybrid, recycled hybrid, or open pollinated varieties (OPVs), and is contrasted with local maize varieties. While modern maize varieties are the result of crop science breeding, local varieties are the product of centuries of selection by farmers and the natural environment. We also contrast drought tolerant (DT) and non-DT modern maize, in that DT modern maize was bred to be tolerant to drought, whereas non-DT modern maize was bred for traits other than drought tolerance (*e.g.*, yield, early maturity, disease resistance).