



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

SEPTEMBER 23 - 26, 2019 // ABUJA, FEDERAL CAPITAL TERRITORY, NIGERIA

6th African Conference of Agricultural Economists

Rising to meet new challenges: Africa's agricultural development beyond 2020 Vision



*Invited paper presented at the 6th African
Conference of Agricultural Economists,
September 23-26, 2019, Abuja, Nigeria*

Copyright 2019 by [authors]. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Empowering women with digital extension in Uganda: Effects of information and role models

Els Lecoutere,¹ David J. Spielman,² and Bjorn Van Campenhout³

Abstract

In many developing countries, agricultural extension services are generally biased towards men, with information targeted mainly to male members of a farming household and in formats that are rarely tailored to women. We conduct a field experiment among maize-farming households in eastern Uganda to test whether video-enabled extension messaging affects outcomes directly related to maize management and production. Specifically, we randomly assign men, women, and couples to view videos about improved maize management practices in which male, female, or both male and female actors are featured. We first investigate whether targeting women with information increases their involvement in productive decision-making processes. We then explore whether the provision of information in videos featuring a woman—challenging the idea that maize cultivation is a predominantly male activity—affects outcomes for women. We find that screening videos containing information on maize management and production to women increase their knowledge about improved maize management practices, their role in agricultural decision-making, the adoption of recommended practices and inputs, the quantity of maize sold to the market, and production-related outcomes on women-managed maize plots. However, we also find that challenging role incongruity by featuring women in videos has limited effects.

Keywords: women's empowerment, video-based extension, ICTs, agricultural extension, maize, Uganda

Word count: 8,477

¹ Institute for Development Policy and Management, University of Antwerp, Belgium; Els.Lecoutere@uantwerpen.be.

² Corresponding author. International Food Policy Research Institute (IFPRI), Washington, DC, USA; d.spielman@cgiar.org.

³ IFPRI and LICOS, KU Leuven, Belgium; B.VanCampenhout@cgiar.org.

1. Introduction

There are many well-established benefits to empowering women farmers in developing countries. A more prominent role for women in the farm household may lead to a more efficient allocation of scarce resources within the household, and a more equitable distribution of the returns to investments in household production (De Brauw et al. 2014; Polato e Fava & Arends-Kuenning 2013; McCarthy & Kilic 2017). Involving women in the choice of crops may also lead to more nutritious diets at the household level (Quisumbing & Maluccio 2003; Duflo & Udry 2004). More generally and from a human rights perspective, there is intrinsic value in empowering women.

A key constraint to the empowerment of women in agriculture is that women often have less access to information than men on a range of productivity-enhancing technologies and practices, which constrains their participation in strategic agricultural decisions within their households. Agricultural information generally bypasses women, and men rarely discuss agronomic practices or management choices with their wives or female partners (Lambrecht et al. 2016; Fisher & Carr 2015; Doss & Morris 2000; Doss 2001). In the extreme, women may be entirely excluded from making decisions on choice of crops, inputs, management practices, or the consumption, marketing, and disposal of agricultural products.

Despite this, agricultural extension services rarely recognize women in their role as important agricultural producers. Even though women often provide substantial amounts of labor, men are assumed to be responsible for farming and hence take most of the important decisions (Meinzen-Dick et al. 2011). Agricultural extension, rural advisory services, and agricultural information campaigns largely ignore the constraints facing women in agriculture, and thus tend to target only men within the households, thereby confirming a worldview in which women are largely absent from agricultural decision-making, particularly with regards to marketable crops.

There is a growing literature focused on dispelling this view and demonstrating the importance of empowering women in agriculture and reaching women through extension services. Considerable attention has been given to this issue in sub-Saharan Africa, where women play a significant role in the management and production of food crops (Ndiritu et al. 2014; Doss, 2001; Doss and Morris, 2000), but are generally not reached by extension services (Fletschner & Mesbah 2011; Ndiritu, et al. 2014; Kondylis et al. 2016; Lambrecht et al. 2016). We contribute to this literature by examining how the provision of extension through information and communications technologies (ICTs) affects a range of factors directly related to women's empowerment in agriculture (Alkire et al. 2013).

Specifically, we conduct a field experiment among maize-farming households in Uganda to test whether ICT-enabled extension messaging affects outcomes related to maize management and production. In this experiment, we randomly assign men, women, and couples to view videos on portable digital devices about improved maize management practices in which male, female, or both male and female actors are featured. We then examine the impact of providing women with direct access to video-based information on several measures of empowerment. Additionally, we study the impact of using gendered role models in these videos as a means of challenging the commonly accepted belief that maize cultivation is a male responsibility in the household, and that decision-making on maize cultivation is not the remit of women. Finally, we test for the presence of homophily effects in this video-enabled extension approach by comparing outcomes in households where men viewed videos with male actors against outcomes where women viewed videos with female actors.

The article is structured as follows. In Section 2, we review the literature on role models and women's information deficiencies. In Section 3, we describe the study context, experimental design, and data used in this study, followed by results in Section 4. We offer policy recommendations and concluding remarks in Section 5.

2. Prior literature

2.1. Role models and aspirations

There is a growing literature that investigates the importance of role models in challenging gender stereotypes and increasing the role of women in sectors that are traditionally male-dominated. Role models are defined as individuals who inspire people to make similar choices, or adopt a similar set of values, and to achieve comparable results (Madhavan & Crowell 2014; Porter & Serra 2017). Role models have been found to be important in challenging role incongruity, or prejudiced views and cognitive biases about the capabilities of specific social groups in specific social roles that arise from a combination of perceptions about the characteristics of members of that social group, and perceptions about the capabilities and characteristics that specific social roles require (Eagly & Karau 2002).

Role models are important in stimulating aspirations, altering choices, and improving success. Role models can update belief in one's own ability (self-efficacy) or beliefs about the returns to investments, especially for disadvantaged social groups that have few examples of success (Beaman et al. 2012; Riley 2017). Updated beliefs in self-efficacy and returns to investments can, in turn, raise aspirations and increase

people's ambitions, which create the motivation to work hard and attain the success projected by the role model (Riley 2017). The power of role models can also be linked to the fact that people's tendency to conform (i.e., not wanting to deviate from the group) can be challenged by an influential person whose behavior is non-conformist (Thaler & Sunstein 2008). However, the effectiveness of role models (or reference groups that serve as role models), depends on the social distance one feels towards the role model (proximity); the divergence of one's own achievements from those of the group or person that serve as the role model; and the extent to which that role model's (group) situation is similar and recognizable (Raghunathan et al. 2018).

In the case of role models of the same sex, the effect on and through aspirations may be complemented by the effect of challenging role incongruity. For the group whose abilities were underestimated—for instance, for women whose ability to be leaders may be questioned—this works by showing alternative possibilities. Role models who show counter-stereotype abilities, can thus challenge stereotypes about gender roles and reduce the gap in beliefs in self-efficacy between men and women. As a result, role models can improve women's aspirations to enter and do well in male-dominated domains. However, even where aspirations are improved, other constraints may prevail and prevent the translation of higher aspirations into achievement gains (Beaman et al. 2012). Indirectly, for the group whose abilities were not underestimated, role models can challenge role incongruity and that group's beliefs and stereotypes about the lesser abilities of the other group (Beaman et al. 2009; Evans 2017).

In the case of role models of the same sex, other mechanisms, including peer effects (which are linked to recognition and conformity) and gender homophily may also be at play. Gender homophily is defined as the preference for interaction with individuals of the same sex, and is linked to having more trust in individuals of the same social group (Laniado et al. 2016). Such mechanisms imply that the information contained in a message brought by role models of the same sex is better understood and more trusted, thereby contributing to changes in an individual's choices and improving her chances of success.

Role models, in real life or in media, can have a direct impact on improving aspirations, which we define here as forward-looking goals or targets (Locke & Latham 2002). Recent studies demonstrate these effects across a range of situations and mechanisms, including among Ethiopian farmers (Bernard et al. 2015); rural parents, women, and girls in India (Raghunathan et al. 2018; Beaman et al. 2012); secondary school students in Uganda (Riley 2017), women in Nicaragua (Macours & Vakis 2014), and female economics students in the U.S. (Porter & Serra 2017). Evidence shows that role models not only increase aspirations,

but also lead to changes in the choices they make with respect to aspirations for employment, labor use, careers, income, assets, and social status.

2.2. Intra-household information asymmetries

Another body of literature addresses the effects of intra-household information asymmetries on women's status, role, and welfare relative to other (typically male) household members. At the most basic level, limited or costly information may result in a lack of awareness about available resources or how to allocate them more efficiently which, in turn, may result in forgone income-enhancing opportunities or acceptance of unnecessarily high risks (Fletschner & Mesbah 2011). There is ample evidence that women face information deficiencies and asymmetries relative to men in a range of circumstances, and thus may hold weaker bargaining positions or be more vulnerable within their households or communities (Fletschner & Mesbah 2011). In agriculture, women farmers have been shown to be more deprived of information regarding good agronomic practices (Doss & Morris 2000; Doss 2001; Lambrecht et al. 2016). This may be directly linked to unequal access to agricultural extension farmers, which can in turn contribute to lower adoption rates of new technologies and practices, as shown for a wide range of crops, countries and technologies (Lambrecht et al. 2016; Ndiritu et al. 2014; Kabunga et al. 2012; Doss & Morris 2000).

From this, we recognize that women's access to information—specifically, to information provided by agricultural extension services—is subject to both extra-household and intra-household constraints. The extra-household constraints can be infrastructural and logistic, for instance, women not being targeted for extension services, women lacking the money to travel to extension training locations, or women lacking the time to attend because of household management and reproductive responsibilities. Further, extra-household constraints may come in terms of information content or delivery: it may not be adapted to women's interests or needs, or may not recognize women's role as agricultural producers, and therefore may not appeal to women. Human capital constraints may also play a role given women's generally lower levels of education in many rural contexts in developing countries. Norms limiting women's mobility, women's interaction with men, or women's heavy reproductive work burdens may impose additional constraints. These extra-household constraints to women's access to information mean that in many situations, women may rely more on informal networks for gathering information; but where these networks are gender-specific and gender-segregated, they too may face similar problems associated with asymmetric information (Fletschner & Mesbah 2011; Magnan et al. 2015).

Where men do not face those constraints, a (married) woman's interaction with her husband may often be her (intra-household) source of information. This assumption underpins most extension strategies that target the (male) household head (Fletschner & Mesbah 2011). Yet the assumption requires that the preferences of male and female co-heads within a household perfectly align; that household resources, including information, are pooled; and that households cooperate to reach Pareto-optimal outcomes. This unitary theory of the household, famously attributed to Becker (1993), has been extensively refuted in both theoretical (e.g., Lundberg & Pollak, 1994; Pollak, 1994; Alderman et al. 1995) and empirical work (e.g., Udry, 1996; Duflo & Udry 2004; Ashraf 2009; Iversen et al. 2011).

Non-cooperative models of the household posit that where preferences of the male and female co-heads conflict, an informed male co-head may choose not to share information and sustain a monopoly over information in order to allocate household resources towards his individual preferences. Information flows from male to female co-head only where the female co-head possesses some significant degree of bargaining power, or is an important intermediary in accessing resources (e.g., credit specifically designated for women) (Fletschner & Mesbah 2011). And even if preferences align and resources are pooled in the household, information flows from male to female co-head are never guaranteed: if each specializes with the household, information sharing may be deemed unnecessary or too costly. Several recent studies demonstrate these points by exploring non-cooperative models and intra-household information asymmetries in the context of developing-country agriculture and the provision of agricultural extension services (Pan et al. 2018; Kondylis et al. 2016; Lambrecht et al. 2016; Fisher & Carr 2015).

2.3. Testable hypotheses

Based on the extant literature, we formulate several hypotheses about the effect of involving women in conveying extension information as gender friendly role models, on the one hand, and the effect of involving women in receiving information, on the other hand, on different measures of women's empowerment in agriculture. We consider women empowerment to encompass both an increase in unilateral and joint decision making and outcomes. In particular, we consider changes in women's/joint knowledge about recommended agronomic practices, women's/joint share in intrahousehold agricultural decision making, women's/jointly decided upon adoption of recommended practices and input use, and the production and productivity of plots under women or joint management.

From the literature on role models we infer that women's knowledge of practices recommended in extension information campaigns can be expected to be positively affected by involving women in conveying the extension information because these women can act as role models challenging role

incongruity and because of peer effects and gender homophily effects. Such effects can be expected to be particularly strong if information recipients can relate to (one of) the messenger(s) as a peer woman farmer who becomes a successful farmer through applying the recommended practices. Role model effects by involving women in conveying extension information can be hypothesized to increase women's aspirations about farming and to stimulate women to make more ambitious choices. We expect these to translate into women being involved in more decisions about maize farming, particularly about the practices recommended by the women messengers, but also into women acting upon those choices and adopting the recommended practices, alone or jointly with their spouse. At the same time, involving women in delivering extension information, and portraying these women as successful maize farmers, may update role incongruity beliefs of men recipients (if they are involved), which may inspire them to leave more room for their spouses' agency in that domain, and/or to relax constraints to their spouses' access to complementary inputs, like for instance cash, needed to adopt the practices. The evidence of the effect of role models on success was less convincing. Yet, through the expected positive impact of involving women in conveying extension information on women's knowledge, and their involvement in decision-making and adoption, and positive effects can be expected on maize production and, productivity.

From the literature on the impact of reducing women's extension information deficiencies, we can infer that involving women in receiving information will strengthen women's knowledge about practices explained in the information extension campaign, and possibly make common knowledge about other agronomic practices more salient. If only the woman co-head receives information, joint knowledge will be only be positively affected if she does not monopolize the information. If both the woman and man co-head receive the information, women's individual and joint knowledge can increase because the woman and man co-head can consult and learn from each other. Involving women in receiving extension information can be expected to positively influence the involvement of women in decisions about maize production and the use of recommended practices, and ultimately the adoption of those practices. This can follow from their gained knowledge, a stronger bargaining position linked to their access to information and/or from the fact that the man co-head cannot monopolize the information and use it to push his preferences through. If only the woman co-head receives the extension information and she monopolizes that information to prioritize her preferences, this could additionally increase her unilateral decisions and adoption. Positive effects of involving women in receiving extension information on adoption could be limited if women have constraint access to complementary inputs, particularly capital, needed to apply the practices. If women tend to be second mover adopters, effects on adoption may also

take longer to materialize. Involving women in receiving information can be expected to result in increased maize production and productivity, potentially through positive effects on knowledge, decision-making and adoption.

3. Study context and methodology

3.1. Study context and experimental design

To explore these hypotheses further, we conducted a field experiment among smallholder maize farming households in five districts of eastern Uganda during the second maize-growing season in 2017 (August 2017 to January 2018), which is characterized by a short rainfall period. Average maize yields are significantly lower than potential in Uganda, with considerable variation across farmers. This includes gender-based variation (Sell et al. 2018), which may be attributable to perceived land ownership affecting household decision-making (Fisher & Carr 2015).

We implement our experiment according to a 3x3 factorial design, where one factor corresponds to the gender (composition) of the person (or persons) who receives the information and the other factor corresponds to the gender (composition) of the person (or persons) who delivers the information. Each factor has three levels: man alone, woman alone, or man and woman together (as a couple). The design is represented in Table 1 below, with sample sizes indicated in each of the (3x3=) nine treatment combinations, and households randomly allocated to one of these nine treatment cells.

Table 1 Experimental design layout

		Messenger		
		Man	Woman	Couple
Recipient	Man	385	385	369
	Woman	385	385	369
	Couple	342	342	369

To operationalize this design, we produced a series of videos (a version of which can be found [here](#)) that was shown to farmers according to this design. Corresponding to the recipient factor, the video was shown to either the man co-head alone within the household; to the woman co-head alone in the household; or to the man and women co-heads together as a couple. To operationalize the messenger factor, we produced three versions of essentially the same video, with the only difference being who is featured in the video. In a first version of the video, a male role model farmer is featured in the video. In a second

version of the video, the male role model is replaced by a woman model farmer. In a third version of the video, both the male and women model farmers are featured. The video itself consists of a 10-minute aspirational story where a farmer (man, woman, or a couple) recounts how s/he used to struggle with low maize yields, suggests what inputs to use, and recommends practices to successfully increase yields. One of these three versions of the video was shown privately to participants in accordance with the randomization. See Van Campenhout et al. (2018) for details.

The factorial design allows us to test our various hypotheses by comparing outcomes for different sub-groups of the sample. First, to measure the impact of giving women direct access to extension information on different measures of women's empowerment in agriculture, we compare outcomes of the 2,192 households where a woman also saw the video (either alone or as part of a couple and regardless of which version of the video was shown) to outcomes of the 1,139 households where the video was shown to only the husband within the household (regardless of which version of the video was shown). Second, to study the impact of using gender sensitive role models in extension information campaigns to challenge the common belief that maize growing is the responsibility of the man, we compare outcomes of the 2,219 households where a woman featured in the video (either alone or as part of a couple and regardless of whom the video was shown to within the household) to outcomes of the 1,112 households where only a male actor featured in the video (regardless of whom the video was shown to within the household). Third, to assess the impact of combining the involvement of women in receiving and conveying the information versus the status quo of male biased extension systems, we compare outcomes of the 2,946 households where a woman featured in the video (either alone or as part of a couple) and the video was shown to the woman within the household (either alone or as part of the couple) to outcomes of the 385 households where only a male actor featured in the video and this video was shown to only the man within the household.

3.3. Data

We collected data from randomly selected households participating in the experiment. We conduct tests for balance across our baseline characteristics and find no imbalances that would result in upward bias of results. We consistently control for baseline characteristics that appear significant in the balance tables by estimating analysis of covariance (ANCOVA) models when treatment and control outcomes are compared throughout the paper. See Van Campenhout et al. (2018) for details.

Our outcome indicators are as follows. First, we consider a woman empowered not only if she achieves things on her own, but also if she does so in partnership with the man co-head in the household.

Therefore, we look at effects on women's and joint knowledge about the practices recommended in the intervention video, the extent to which agricultural decisions with regard to maize production in the household are made by women alone or jointly, women's or joint adoption of recommended practices and use of inputs for maize production, and the production and productivity on women or jointly managed maize plots.

Second, knowledge about four different practices recommended in the intervention video is measured by the extent to which respondents answer multiple choice questions correctly about the practices. (See Van Campenhout et al. 2018) We combine the outcomes of the four knowledge questions into a women's knowledge index, respectively a joint knowledge index, constructed as the weighted mean of the individual standardized outcomes, using as weights the inverse of the co-variance matrix of the transformed outcomes (Anderson 2008). This, in addition to adjustments to the significance levels to account for family-wise error rates (FWER), guards against over-rejection of the null hypothesis due to multiple inference. We use re-randomization to construct the joint null distribution for the family of outcomes we are testing. From this family-wise sharp null, we obtained the corresponding FWER-consistent significance thresholds by determining which cutoffs yield 10, 5, and 1 percent significant hypothesis tests across all tests.

Agricultural decision-making is based on women's answers about whether she has decided upon the particular practices unilaterally, or jointly with her spouse. We consider the following decisions: planting maize on a particular plot, the timing to start planting maize (number of days after the start of the rain), the decision the spacing of maize plants and the number of seeds to plant per hill, the method chosen to fight striga infestation, and the timing of the first weeding on a particular plot. Per household, we consider the proportion of maize plots within the household on which the woman co-head reported to have decided alone about the practice in question. Following a similar procedure, we construct a women's decision-making index, based on the proportion of maize plots within the household on which the woman co-head decided upon the different practices. We also construct a corresponding joint decision-making index. We calculate FWER-consistent significance thresholds for the family of decision-making outcomes as above.

Third, we consider actual adoption of the practice as recommended in the video that women unilaterally decide upon. We look at the proportion of maize plots within the household on which the woman co-head made the decision about that particular practice alone *and* adopted the recommended practice by herself. We examine the effect on women unilaterally decided upon adoption of planting within one day after the

start of the rain, using the correct spacing and number of seeds per hill, removing striga before flowering, and doing the first weeding in the third week after planting.

We define additional indicators based on the use of inputs such as DAP, urea, organic fertilizer, hybrid seed, and OPV seed by women co-heads who unilaterally decide upon using that input. The indicator is the proportion of maize plots within the household on which a particular input was used *and* was decided on by the woman co-head. We use the same method to construct a women's adoption index, a joint adoption index, a women's input use index, and a joint input use index, and to define FWER-consistent significance thresholds.

Fifth, we measured production, area of production, and productivity-related outcomes on maize plots under female management and under joint management. Female managed plots are defined as plots about which women co-heads took at least three out five decisions. We use the total amount of maize produced in the household on women managed plots within the household as a measure of production. The area of production is the total area of the women managed maize plots in the household. Yield is the total amount of maize produced on women managed plots divided by the total area of the women managed maize plots in the household. Another indicator for yield takes the value one if the woman respondent believes the yield on (at least one of) the woman managed maize plot(s) was larger than in a normal year. To get a sense of the change in women-controlled production in total household production, we defined an indicator of the share of maize production in the household that was produced on women managed maize plots and an indicator of the share of acres under maize cultivation in the household that is women managed. We defined the each of the six indicators for jointly managed plots as well, and calculated FWER-consistent significance thresholds.

4. Results

4.1. Knowledge of recommended practices

First, we will look at women's and joint (couple's) knowledge of recommended practices as a result of involving women co-heads in receiving the information as compared to only the man co-head in the household receiving the information. A woman co-head can be involved in receiving the information when she was shown the intervention video alone and/or when she saw the video when it was shown to the couple, i.e. the man and woman co-head together.

The results in Table 2 (Model 1 Panel a) show a positive treatment effect of involving women in receiving the information, alone or as part of the couple, on the index of women's (unilateral) knowledge of 0.11.

Women's knowledge, as measured by the index, is positively affected both by showing the video to the woman co-head alone (by 0.13) or to the couple (by 0.10) (Model 1A Panel a; Model 1B Panel a), meaning there is no indication that a woman learns more or less if she is involved in receiving information as part of the couple or receiving it alone.

<<<See Table 2 [here](#)>>>

Zooming in on the topics, we observe that women particularly gained knowledge about adequate spacing and the number of maize seeds per hill, which was relatively new knowledge. Only 13% of women in the control group who were not involved in receiving the information answered correctly and this is increased by about 7 percentage points (pp) by women's involvement (Model 1 Panel a). Involving women as information recipients increased the chance that women correctly identify the longer-term strategy of combining practices and starting small by about 5 pp, even if this appeared to be common knowledge for a large proportion of women (82% of women in the control group who were not involved in receiving the information also answered correctly).

In contrast, the absence of significant treatment effects in Table 2 (Model 1 Panel b) demonstrates that, as compared to giving information to the man co-head alone, giving information to a couple or the woman co-head alone does not increase the likelihood that both the man and woman co-head are knowledgeable about the recommended practices (joint knowledge). There is no effect of showing the information to a couple vis-à-vis to showing it to the man co-head (Model 1B Panel b). Thus, our results do not confirm that joint knowledge benefits from giving the information to two people in the household. There is an indication that new information (about spacing) received by women co-heads alone is somewhat less likely to be passed on to their spouses than when men co-heads received the information, which is evident from the negative treatment effect of – 3 pp on joint knowledge (significant at 11%) (Model 1A Panel b).

Secondly, the absence of significant treatment effects in Table 2 (Model 2 Panel a and b) show that involving women as messengers of the information, where these women can function as role models or where peer effects or homophily effects (when a woman is also involved in receiving information) can be at work, is not more effective for women's knowledge, nor for joint knowledge, than a man as the messenger.

Finally, the treatment effects of the combination of involving women as messengers and involving women in receiving the information (Model 3 Panel a) on the women's knowledge index (0.07), and women's spacing and long-term strategy knowledge (5 and 3 pp, respectively) are significantly positive. Hence the combination is more effective than when a man is the recipient and the messenger of information, which

can be considered the status quo situation in extension information campaigns. But there is no indication that the combination of involving women as messengers and recipients of information is more effective for women's knowledge than just involving women as recipients since the treatment effects are not larger (possibly smaller) than in the latter case (Model 1 Panel a).

4.2. Decision-making about recommended practices

First, the effect of involving women as information recipients, alone or as part of a couple, increases the likelihood that women unilaterally decide upon the use of the recommended practices on an average plot within the household. In the group where women are not targeted with information, the likelihood that women make decisions unilaterally is low, ranging between 11% and 18% for the different practices. This is about 5 pp higher if women also receive information. These positive effects are also reflected in a positive treatment effect of 0.13 on the women's unilateral decision-making index. This increase in women unilateral decision-making seems to be mainly driven by giving the information to a woman co-head alone, which increases the likelihood of unilateral decisions by women about the different practices by about 10 pp and the index by 0.22, while involving a woman as part of a couple does not have any effect on her unilateral decision-making. This pattern is consistent with a situation in which information given to a woman is not perfectly shared with the man co-head. A table of results is available on request.

The likelihood that households in the control group, where women were not involved as recipients, jointly make decisions about the use of the different recommended practices is much higher than the likelihood that women alone make the decisions, ranging between 42% and 54%. There is an indication of increased joint decision-making about the use of the novel way of spacing (5 pp) and striga control (5 pp significant at 11%) if the couple, rather than the man co-head alone, receives the information treatment. If only the woman co-head received the information, instead of the man co-head, there are no effects on joint decision-making about the recommended practices.

Secondly, involving women as messengers does not affect the likelihood of women taking decisions by themselves, nor the likelihood of woman and man co-heads jointly making decisions about the different recommended practices. The role model effect apparently did not empower women to make individual or joint choices with regard to the recommended practices, neither did the role model effect make couples or men accept a greater participation of women in joint decisions (provided they were involved in receiving the information).

Finally, the combination of women being involved as recipients and as messengers of information, versus the status quo of a man as the recipient and messenger, has a positive effect on women's unilateral

decision-making about the different recommended practices (3-4 pp), and on the women's decision-making index (0.07), which is probably driven by women's unique access to information (as the previous results showed). The combination of women being involved as recipients and messengers does not make a difference for joint decision-making.

4.3. Adoption of recommended practices

For adoption of recommended practices, results show that involving women in receiving information, and particularly involving female co-heads alone (compared to male co-heads alone), increases adoption of agronomic practices that women unilaterally decide upon but not adoption that is jointly decided upon. (A results table is available on request). This may imply that an informed woman is not necessarily able to convince her male co-head about joint adoption, which is consistent with Magnan et al. (2015). More specifically, targeting the female co-head alone with information vis-à-vis only the man co-head, increases women's unilateral decisions to adopt timely planting by 3 pp, spacing by 0.8 pp, striga control by 8 pp, and regular weeding by 9 pp, with an index value increase of 0.15. A women's likelihood of adoption conditioned on making the decision by herself is: 27% for timely planting when she received the information alone, and 26.2% in the control group where the man co-head received the information; 3.6% for spacing versus 0.8%; 78.2% for striga control versus 71.1%; and 90.8% for regular weeding versus 88.3%.

If the couple was targeted to receive the information rather than the man co-head alone, then results for novel practices like spacing and striga control translate into a 2 and 5 pp greater likelihood of jointly decided adoption. The likelihood of joint adoption conditional on jointly making decisions is: 6.1% for spacing if the couple is targeted versus 2.9% if the man co-head is targeted; and 79.1% for striga control versus 76.4%. Targeting the couple also increased the likelihood of women decided adoption of striga control even if she was not more likely to decide on this single-handedly, implying a strong increase in the likelihood of her adopting it conditional on her unilateral decision as a result of the treatment (80.2% versus 71.1%).

Further, we find that involving women as messengers does not have any effect on women unilaterally decided adoption, nor on adoption that is jointly decided upon. Finally, there are positive treatment effects of the combination of women being involved as recipients and as messengers of extension information, versus a situation in which a man as recipient and messenger, on women decided adoption of timely planting (2 pp), spacing (0.6 pp), and striga control (3 pp). This translates into a likelihood of a woman adopting timely planting conditional on her unilateral decision of 35.4% for the treatment versus

30.4% for the control; 5.3% for spacing versus 2.3%; and 76.2% for striga control versus 70.0%. The positive impact is, again, linked to the involvement of women in receiving information, not to their involvement as messengers.

4.4. The use of fertilizer and improved seeds

Next, we present the impact of the different treatments on the use of specific types of fertilizer (DAP/NPK, urea, or organic fertilizer) and improved seeds (hybrid or OPV) by women who decided unilaterally on using the input, and by couples who jointly decided on using the input. Since the video does not promote one particular type of fertilizer or seed but rather emphasizes the importance of an appropriate combination, the effect on the index summarizing input use is of greater interest than the use of each individual input.

First, involving women in receiving information instead of targeting only the man co-head, has a positive impact on input use by women deciding upon using the different types of fertilizer or seeds as measured by the index (measured in terms of a 0.08 increase in the index value of) and on input use by couples jointly deciding upon the use of those inputs (a 0.06 increase). (Result tables are available on request.) Targeting only the woman co-head with information has a stronger effect on input use by women deciding upon the use of those inputs and targeting the couple has a stronger effect on input use by couples jointly deciding upon the use of those inputs.

Secondly, involving women as messengers of extension information, instead of a man as a messenger, has a small but significant positive effect of 2 pp on the use of organic fertilizer by women who unilaterally made the decision about its use. This is the only indication of a positive role model effect, which, maybe not coincidentally, materializes for the use of a productivity enhancing input that may be directly available to a woman and she does not need to bargain for.

Finally, the positive effects on the women's input use index (0.08) and on the joint input use index (0.06) as a result of involving women as recipients and as messengers of information (versus a man as recipient and messenger) are largely linked to the positive effects of involving women in receiving the information, although involving women as messengers may have contributed to inspire women to use organic fertilizer.

4.5. Production and productivity

First, involving women in receiving information, versus only a man, presented in Table 3 (Model 1 Panel a), has a positive effect on the total area of the women-managed maize plots in the household (0.07 acres), and almost doubles the total amount of household maize produced on women-managed plots, and the

yield on women-managed maize plots (positive effects of 35.8 kg and 50.4 kg/acre respectively). This is also reflected in a higher likelihood that the woman respondent believes the yield on the women-managed maize plots is better than normal. The share of household maize production and household maize-plot area under female management both increased by 6 pp.

<<<See Table 3 [here](#)>>>

The impact on production and productivity on women-managed plots is the result of targeting only the woman co-head with information instead of the man co-head; not of involving a woman as part of a couple since the effects of the latter are smaller and not significant (Model 1B Panel a). The results in Table 3 (Model 1A Panel a) demonstrate that providing information to solely the woman co-head increases production on women-managed maize plots with 51.6 kg, which means that production is more than twice as large as in the control group where only the man co-head received the information. The area of women-managed maize plots doubled with 0.10 acres. This is reflected in a 11 pp increase in the share of household maize production and household maize-plot area under female management. The yield increased by 75.1 kg per acre—more than twice the yield on women-managed maize plots in the control group. Women are also more likely to believe the yield on women-managed maize plots is better than normal (4 pp). While the increased women’s decision-making about and adoption of each of the five recommended practices does not mean these all occurred on maize plots under female management, there is, however, a positive correlation. We can thus infer that the increased decision-making about and adoption of the recommended practices by women as a result of (solely) involving women as information recipients paid off in higher maize production, increased area, a sense of improved yields, and higher productivity on women-managed maize plots.

We can also assume a positive correlation between joint decision-making and adoption and the likelihood that it concerns jointly managed plots (as defined here), but unlike before, we cannot infer that increased joint decision-making and adoption as a result of targeting the man and woman co-head together paid off in higher production and productivity on jointly managed maize plots since significant effects are absent (Model 1B Panel b).

Next, the effect of involving women as messengers of information rather than a man as the messenger on the productivity of women-managed plots appears to be negative (-35.9 kg/acre) for reasons that are likely unrelated to women’s decision-making or adoption of recommended practices, as we did not observe any impact on these (Model 2 Panel a). Finally, the combination of women being involved both as recipients and messengers of information, versus the status quo of a man as recipient and messenger,

has a positive impact on total maize production on women-managed maize plots (19.3 kg), area of maize grown under female management (0.05) and the belief that yield improved over time (2 pp) effects (Model 3 Panel a) which, again, are largely driven by women receiving information alone.

5. Policy recommendations and conclusions

While agricultural extension services often tend to be male-biased, they operate with an implicit assumption that it is optimal for men to share this information with their wives. This, in turn, is thought to lead to optimal crop management, production, and marketing choices. In reality, men may have an incentive to retain information privately rather than share it. This article examines the extent to which the reduction in intra-household asymmetries of information results in different agricultural outcomes, and whether the use of role models in the provision of information contribute to such outcomes. Findings show strong effects with respect to targeting of information provision to women, but limited role model effects.

Two key policy recommendations follow from the results of this study. First, if the aim of policy is to empower women by increasing their own agronomic knowledge, their independent decision-making, adoption of maize intensification measures and ultimately to boost the agricultural productivity on the maize plots they autonomously manage, then give the necessary information directly to women. If the aim is to empower women in collaboration with their men co-heads in the household, then provide extension information to the woman and man co-heads together, but do not expect that joint progress will automatically benefit women's independent agricultural outcomes. There is no indication that men extension officers would not be able to empower women in agriculture as effectively as women extension officers, so no policy changes seem needed in that regard.

Further research could explore the existence of heterogeneous treatment effects. The women involved as role model farmers in the extension information video could have had heterogeneous effects among women farmers with high and low aspirations, or among well and badly performing women maize farmers; although the literature is inconclusive about where to expect strongest effects. If heterogeneous treatment effects would exist and go in opposite directions, they could be a reason for the absence of significant effects in the full sample. Heterogeneity that is linked to women's relative bargaining power in their household, or to women's (direct) access to complementary inputs needed for adoption, such off-farm income or own capital, could exist when looking at the impact of involving women in receiving information.

References

- Abay, K.A., Blalock, G., & Berhane, G. (2017). Locus of control and technology adoption in developing country agriculture: Evidence from Ethiopia. *Journal of Economic Behavior & Organization*, 143, 98-115.
- Alderman, H., P.A. Chiappori, L. Haddad, J. Hoddinott, & R. Kanbur. (1995). "Unitary versus Collective Models of the Household: Is It Time to Shift the Burden of Proof?" *World Bank Research Observer*, 10, 1-19.
- Alkire, S., Meinzen-Dick, R., Peterman, A., Quisumbing, A., Seymour, G., & Vaz, A., 2013. The women's empowerment in agriculture index. *World Development*, 52, 71-91.
- Anderson, M.L. (2008). Multiple inference and gender differences in the effects of early intervention: A reevaluation of the Abecedarian, Perry Preschool, and Early Training Projects. *Journal of the American statistical Association*, 103(484), 1481-1495.
- Ashraf, N. (2009). Spousal Control and Intra-household Decision Making: An Experimental Study in the Philippines. *American Economic Review*, 99, 1245-1277.
- Beaman, L., Chattopadhyay, R., Duflo, E., Pande, R., & Topalova, P. (2009). Powerful women: does exposure reduce bias? *The Quarterly Journal of Economics*, 124(4), 1497-1540.
- Beaman, L., Duflo, E., Pande, R., & Topalova, P. (2012). Female leadership raises aspirations and educational attainment for girls: A policy experiment in India. *Science*, 1212382.
- Becker, G.S. (1993). *A Treatise on the Family*. Cambridge, MA: Harvard University Press.
- BenYishay, A., & Mobarak, A.M. (2014). Social learning and communication, NBER Working Paper No. 20139. Cambridge, MA: National Bureau of Economic Research.
- Bernard, T., Dercon, S., Orkin, K., & Taffesse, A.S (2015). Will video kill the radio star? Assessing the potential of targeted exposure to role models through video. *World Bank Economic Review*, 29(suppl_1), S226-S237.
- Bowen, D.H. (2015, June 6). Leveling the field for women farmers in Uganda [Blog post]. URL: <https://blogs.worldbank.org/voices/leveling-field-women-farmers-uganda>
- De Brauw, A., Gilligan, D.O., Hoddinott, J., & Roy, S. (2014). The impact of Bolsa Família on women's decision-making power. *World Development*, 59, 487-504.
- Doss, C.R. (2001). Designing agricultural technology for African Women Farmers: lessons from 25 years of experience. *World Development*, 29(12), 2075-2092.
- Doss, C.R., & Morris, M.L. (2000). How does gender affect the adoption of agricultural innovations? The case of improved maize technology in Ghana. *Agricultural Economics*, 25(1), 27-39.
- Duflo, E., & Udry, C. (2004). Intra-household resource allocation in Cote d'Ivoire: Social norms, separate accounts and consumption choices. *NBER Working Paper 10498*. Cambridge, MA: NBER.
- Fiala, N., & He, X. (2017). Unitary or noncooperative intra-household model? Evidence from couples in Uganda. *World Bank Economic Review*, 30 (Supplement_1), S77-S85.
- Eagly, A.H., & Karau, S.J. (2002). Role congruity theory of prejudice toward female leaders. *Psychological Review*, 109(3), 573.
- Evans, A. (2017). Urban change and rural continuity in gender ideologies and practices: Theorizing from Zambia, *WIDER Working Paper 2017/61*. Helsinki: UNU-WIDER.

- Fisher, M., & Carr, E.R. (2015). 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. *Global Environmental Change*, 35, 82-92.
- Fletschner, D., & Mesbah, D. (2011). Gender disparity in access to information: do spouses share what they know? *World Development*, 39(8), 1422-1433.
- Glennerster, R., & Suri, T. (2015). What is the impact of NERICA rice on yields and nutrition in Sierra Leone? Evidence from a randomized control trial. *Standing Panel on Impact Assessment* brief 69. Rome: CGIAR Independent Science and Partnership Council.
- Iversen, V., Jackson, C., Kebede, B., Munro, A., & Verschoor, A. (2011). Do spouses realise cooperative gains? Experimental evidence from rural Uganda. *World Development*, 39(4), 569-578.
- Kabunga, N.S., Dubois, T., & Qaim, M. (2012). Heterogeneous information exposure and technology adoption: the case of tissue culture bananas in Kenya. *Agricultural Economics*, 43(5), 473-486.
- Kondylis, F., Mueller, V., Sheriff, G., & Zhu, S. (2016). Do female instructors reduce gender bias in diffusion of sustainable land management techniques? Experimental evidence from Mozambique. *World Development*, 78, 436-449.
- Lambrecht, I., Vanlauwe, B., & Maertens, M. (2016). Agricultural extension in Eastern Democratic Republic of Congo: does gender matter? *European Review of Agricultural Economics*, 43(5), 841-874.
- Laniado, D., Volkovich, Y., Kappler, K., & Kaltenbrunner, A. (2016). Gender homophily in online dyadic and triadic relationships. *EPJ Data Science*, 5(1), 19.
- Locke, E., & Latham, G. (2002). Building a Practically Useful Theory of Goal Setting and Task Motivation. A 35-Year Odyssey. *American Psychologist*, 57(9), 705-717.
- Lundberg, S., & Pollak, R.A. (1994). Noncooperative bargaining models of marriage. *American Economic Review*, 84(2), 132-137.
- Macours, K., & Vakis, R. (2014). Changing households' investment behaviour through social interactions with local leaders: Evidence from a randomised transfer programme. *Economic Journal*, 124(576), 607-633.
- Madhavan, S., & Crowell, J. (2014). Who would you like to be like? Family, village, and national role models among black youth in rural South Africa. *Journal of Adolescent Research*, 29(6), 716-737.
- Magnan, N., Spielman, D.J., Gulati, K., & Lybbert, T. (2015). Information networks among women and men and the demand for an agricultural technology in India. IFPRI Discussion Paper 1411. Washington D.C.: IFPRI.
- McCarthy, N., & Kilic, T. (2017). *Stronger Together: Intra-Household Cooperation and Household Welfare in Malawi*. Policy Research Working Paper 8043. Washington D.C.: World Bank.
- Meinzen-Dick, R., Quisumbing, A.R., Behrman, J., Biermayr-Jenzano, P., Wilde, V., Noordeloos, M., Ragasa, C., & Beintema, N. (2011). *Engendering Agricultural Research, Development and Extension*. Washington D.C.: IFPRI.
- Ndiritu, S. W., Kassie, M., & Shiferaw, B. (2014). Are there systematic gender differences in the adoption of sustainable agricultural intensification practices? Evidence from Kenya. *Food Policy*, 49, 117-127.
- Pan, Y., Smith, S. C., & Sulaiman, M. (2018). Agricultural extension and technology adoption for food security: Evidence from Uganda. *American Journal of Agricultural Economics*, 100(4), 1012-1031.

- Pollak, R.A. (1994). For better or worse: The roles of power in models of distribution within marriage. *The American Economic Review*, 84(2), 148-152.
- Porter, C., & Serra, D. (2017). Gender differences in the choice of major: The importance of female role models. *Department of Economics Departmental Working Papers 1705*. Dallas: Southern Methodist University.
- Quisumbing, A.R., & Maluccio, J.A. (2003). Resources at marriage and intrahousehold allocation: Evidence from Bangladesh, Ethiopia, Indonesia, and South Africa. *Oxford Bulletin of Economics and Statistics*, 65(3), 283-327.
- Raghunathan, K., Quisumbing, A.R., Kumar, N., & Cunningham, K. (2018). Women's aspirations for the future, and their financial, social and educational investments, *IFPRI Discussion Paper 1752*. Washington D.C.: IFPRI.
- Riley, E. (2017). Increasing students' aspirations: the impact of Queen of Katwe on students' educational attainment. *CSAE Working Paper 2017-13*. Oxford: Centre for the Study of African Economies, University of Oxford.
- Sell, M., Bäckman, S., TettehAnang, B., & Niemi, J.K. (2018). The unequal efficiency gap: Key factors influencing women farmer's efficiency in Uganda. *Cogent Food & Agriculture*.
- Thaler, R., & Sunstein, C. (2008). *Nudge: Improving Decisions about Health, Wealth, and Happiness*. New Haven, Connecticut: Yale University Press.
- Udry, C. (1996). Gender, agricultural production, and the theory of the household. *Journal of Political Economy*, 104(5), 1010-1046.
- Uganda Bureau of Statistics (2006). *Uganda National Household Survey, 2005/2006*. Kampala: UBS.
- Uganda Bureau of Statistics (2013). *Uganda National Panel Survey 2012-2013*. Kampala: UBS.
- Van Campenhout, B., D.J. Spielman, and E. Lecoutere (2018). *Information and Communication Technologies (ICTs) to Provide Agricultural Advice to Smallholder Farmers: Experimental Evidence from Uganda*. IFPRI Discussion Paper 1778. Washington, DC: IFPRI.
- Van Campenhout, B., Lecoutere, E., & Spielman, D.J. (2017). ICT-mediated agricultural knowledge transfer in Uganda: What works? American Economic Association *RCT Registry*. June 15. URL: <https://www.socialscienceregistry.org/trials/2153/history/18586>