Bargaining-Power and Biofortification: The Role of Gender in Adoption of Orange Sweet Potato in Uganda*

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1. Introduction

Biofortification is emerging as a potentially significant strategy to the fight against micronutrient malnutrition. It involves breeding staple food crops to be a rich source of one or more key micronutrient, such as iron, zinc, vitamin A, and iodine, and disseminating these crops in areas where the rate of micronutrient deficiency is high and where poor households consume a large share of calories from staple foods (Bouis 2002; Bouis et al. 2011). Often, poverty and high prevalence of micronutrient malnutrition overlap. The success of biofortification as a public health intervention relies on convincing a large share of households in these areas to substitute conventional varieties of the low-nutrient staple food crop in their diet for the biofortified nutrient-dense variety. In many areas in rural Africa and South Asia, poor households operate near subsistence, growing most of their own food. In these settings, getting the biofortified food into the diet means fostering broad adoption of the new crop varieties by households in their fields (Gilligan, 2012). For many seed crops, adoption can be encouraged through marketing campaigns for biofortified seeds, but for crops like cassava and sweet potato, planting material in the form of vine cuttings cannot be stored, making marketing ineffective as a primary dissemination strategy. Instead, most households obtain planting material for these crops through interaction with other households. This raises a number of important questions about the role of social interaction, intrahousehold division of labor and gender in the success of adoption and diffusion of these biofortified crops.

We study the role of gender in the adoption and diffusion of biofortified orange-fleshed sweet potato (OSP) during a biofortification project that disseminated OSP to 10,000 households in Uganda from 2007 to 2009. Starting in 2007, the HarvestPlus “Reaching End Users” (REU) project introduced OSP to households in Uganda with the goal of increasing dietary intakes of vitamin A and reducing the prevalence of vitamin A deficiency. OSP is a dense source of vitamin A, is moderately higher yielding than conventional white/yellow sweet potato varieties, but is more vulnerable to rot during dry periods. The REU project involved a multi-pronged intervention, including: distribution of 20 kg of free OSP vines each to members of selected project farmer groups; trainings of farmer group members on OSP cultivation; trainings of adult female members of households in the project on the nutritional benefits of consuming OSP and other vitamin A sources; and trainings of farmer group members on marketing plus limited coordination to support marketing of OSP roots. The experimental impact evaluation of the REU project, from which this paper is drawn, was designed to compare the cost-effectiveness of two strategies to distribute and promote OSP. Model 1 consisted of vine distribution plus two years of intensive trainings; Model 2 was identical to Model 1 in year one with the elimination of training activities in year two. This design enabled a cost-effectiveness study comparing the impacts of Model 1 to Model 2, which was expected to be 30 percent cheaper to implement. For the evaluation, 84 farmers groups from 3 districts were randomly assigned into Model 1 (36), Model 2 (12) and a Control Group (36).[1] The impact evaluation showed that the REU project successfully encouraged broad OSP adoption and increased dietary intakes of vitamin A: the interventions led to adoption of OFSP by 65 percent of project households (compared to just four percent in the control group), reduced the prevalence of inadequate dietary intakes of vitamin A by children under 3 years by 32 percentage points (from a base of 48% dietary inadequacy) and reduced the prevalence of low serum retinol (retinol<1.05 μmol/L) among children age 3-5 years with low serum retinol at baseline by 9.5 percentage points (de Brauw et al., 2010).

This study examines the roles of male and female household members in the decision to adopt the OSP crop, to continue growing it over the four seasons of the project, and to distribute the crop to other households. In the project areas in Uganda, men play a leading role in crop choice decisions within the household, but our survey data show that women also play an active role in crop selection, particularly for food crops for household consumption, and that women commonly supply labor on household farms. The evaluation household survey data, collected in two rounds before the distribution of OSP vines in 2007 and at the end of the project in 2009, as well as complementary qualitative interviews (Behrman, 2011) confirm that women take the lead role in deciding what food is prepared and consumed within the household, particularly for children. For this reason, the REU project only targeted women for the nutrition trainings. Although the biofortified OSP varieties were expected to being somewhat higher yielding than conventional white and yellow sweet potato varieties, the project encouraged households to adopt OSP because it is healthier, particularly for children and women, than conventional

[1] An unbalanced randomized design was used because power calculations showed that resources were only sufficient to allow for a large enough sample to identify impacts on serum retinol in blood samples in two of the three treatment arms. Therefore, serum retinol samples were not collected in Model 2, allowing for a smaller sample in that treatment arm.

varieties. This suggests that, although men and women likely coordinated efforts on the decision to adopt the OSP crop, women may have played an essential role in fostering OSP adoption.

Although there is some gender-based specialization of tasks within the households in the sample, the degree of specialization or level of control over decision-making may be affected by the relative bargaining-power of men and women within the household, particularly as it relates to crop and food choices. We use two measures of female bargaining power to examine how intrahousehold gender relations affect OSP adoption decisions. The first measure is the share of nonland assets controlled by women at baseline. Women who own a larger share of household assets may have greater discretion over household decisions or stronger bargaining power to win concessions from their male partners. The second measure is the share of the value (or area) of the household land at baseline that is under female control. This measure directly relates to the relative control of female household members in making crop choice decisions. Using these measures of bargaining power, we estimate the role of gender in a household-level model of the determinants of OSP adoption and conduct tests of the theory of the unified household decision model (Becker, 1965, 1981). We also use data on gender of control over plots of land to estimate plot-level models of OSP adoption, accounting for the correlation in crop choice decisions across plots. In these models, we differentiate the effects of gender on crop choice by whether the plot is under the sole control of a male or female household member, or whether the plot is under joint control, often with one individual taking the lead in making decisions regarding that plot.

We also explore the relative contributions of men and women to OSP crop diffusion. Only a small amount of OSP planting material is needed for a household to start a small plot, so project households could share planting material with several other households without significantly affecting their productivity. However, the vine cuttings must be transplanted within a day or they will wither and die. This feature discourages large commercial operations selling OSP planting material. Rather, most households at baseline reported receiving their white/yellow sweet potato planting material from neighbors and friends. The potential for this exchange is shaped by the patterns of interactions between households in a community. Women and men have overlapping, but often different social or information spheres within a community. An important question is how these gender-differentiated spheres of interaction play a role in OSP crop diffusion. In related work, McNiven and Gilligan (2012) show that information networks within communities play a substantial role in first providing access to OSP planting material and later in supporting sustained OSP adoption by households outside the project. Here, we explicitly examine how gender facilitates or restricts the diffusion of this agricultural technology.

This research makes a number of novel contributions. First, it begins to explain the vital role of gender in promoting adoption and diffusion of OSP as a strategy to increase vitamin A intakes and reduce vitamin A deficiency. Vitamin A deficiency causes night blindness and contributes to child morbidity and mortality. In Uganda, vitamin A deficiency is a significant public health problem, affecting 28 percent of children under age 5 (UBOS and ORC Macro 2001). Globally, vitamin A deficiency afflicts 127 million young children (West, 2002) and is responsible for six percent of deaths of children under five (Black et al., 2008). Second, a substantial recent literature has provided new evidence on the information, resource and market constraints to adoption of seemingly profitable agricultural technologies in developing countries (see Jack 2011 for a review). However, little attention has been paid in this literature to the potentially important role of gender in promotion of agricultural technologies. In the case of OSP and biofortified crops generally, women may play a much larger role because of the importance of these crops for the nutritional status of children and adult women in the household. However, if production of staple food crops had been the purview of male household members, introduction of biofortified crops may lead to complex changes in gender roles for crop choice decisions and crop production that will be shaped by intrahousehold bargaining power. Ultimately, the result of these changes may have important implications for the success of biofortification.

This paper is organized as follows. Section 2 presents a model of gender roles in crop adoption. Section 3 describes the HarvestPlus REU OSP project and the impact evaluation and survey design. Section 4 presents the results and section 5 concludes.

2. A Model of Gender Roles in the Choice to Adopt a Biofortified Crop

[UNDER CONSTRUCTION: This section will develop a simple model of a household's decision to adopt a biofortified crop, consistent with a unitary household model as motivation for a household-level empirical model of the determinants of crop adoption. We will then develop a gender-disaggregated model of biofortified crop adoption as a function of female bargaining power, female control over land, and other household and land characteristics. We will use this to develop an empirical plot-level model of OSP adoption accounting for correlation in household decisions across plots.]

3. The HarvestPlus REU OSP Project and Survey Data

3.1 The HarvestPlus REU OSP Project

The Reaching End Users Orange-fleshed Sweet Potato project disseminated OSP from 2007-2009 in Uganda, where vitamin A deficiency is a public health problem. During the project, roughly 10,000 farm households were provided OSP planting material (vines) and complementary trainings. This was the first time that a biofortified crop with a visibly different trait (color) had been deployed on such a large scale. Through pre-intervention (baseline) and post-intervention (endline) surveys, the project assessed OSP adoption rates and whether adoption resulted in improved vitamin A intakes among young children and their mothers.

Two dissemination strategies were implemented: a more intensive and costly Model 1, and a less costly, less intensive Model 2. Both models had four primary components:

(i) develop an OSP vine distribution system including subsidized vines to households,
(ii) provide extension to men and women in farm households on OSP production practices and marketing opportunities,
(iii) provide nutritional knowledge, in particular about vitamin A deficiency, to women in these same households, and
(iv) develop markets for OSP roots and processed products made from OSP roots.

Component (i) was identical across the two intervention arms; Model 1 and Model 2 households received identical quantity of OSP vines on average during the same period in 2007. Components (ii) and (iii) were provided for two years in Model 1 and for one year in Model 2, at a savings of roughly 30 percent of total model costs. These trainings were accomplished through the use of a pyramidal structure of extensionist trainers working for nongovernmental organizations (NGOs) and promoters trained by these extensionists who, in turn, instructed fellow members of pre-existing farmers' groups or community organizations.

Several other aspects of the project and the sample could shape the role of gender in OSP adoption. For example, at baseline, sixty percent of farmer group members in the project were women and all households in the evaluation sample included at least one household member age 3-5 years old.[2]

3.2 The Evaluation Survey Data

The sample includes 84 farmer groups from three districts: Kamuli, Bukedea, and Mukono. These districts were selected for the REU project because white- and yellow-fleshed sweetpotato is commonly grown and consumed there and these districts are relatively close to potential markets for orange-fleshed sweetpotato. There are 36 farmer groups in Model 1 (M1), 12 in Model 2 (M2), and 36 in the Control (C) group. These farmer groups and the village that is home to the largest number of its members represent the sample clusters in the data. Farmer groups were sampled from a list of active farmer groups in each district obtained from the nongovernmental organization (NGO) implementing partners based on consultation with local leaders. Farmer-group sampling was stratified by district. Farmer groups were then randomly assigned into the three evaluation arms (M1, M2, C) within districts (in proportions 12:4:12) to assure even spatial coverage. The sample is unbalanced, with fewer farmer groups in Model 2, because it was determined that the large samples required for biochemical assessment were too costly to include in all three intervention arms. Blood samples were only taken in households in the Model 1 and Control groups.

The analysis of dietary intakes and biochemical assessment rely on three reference groups of individuals: children age 3-5 years old at baseline, the mothers or primary caretakers of these children, and children age 6-35 months. The first group, the "primary child reference group" for the Uganda study, was designed so that most of these children would age out of the Ugandan government's vitamin A supplementation program within a few months before the endline survey. This will improve the capacity of these children to respond to the vitamin A received through dietary sources, including orange-fleshed sweet potato (OFSP).

[2] Children age 3-5 years at baseline comprised the first reference group for dietary assessment. In addition, a smaller second reference group of children age 6-35 months old was included in the sample for dietary assessment primarily by selecting siblings of the first reference group. The first reference group was designed to include older preschool children so that this cohort would age out of eligibility for vitamin A supplementation by the endline survey, so that measurement of serum retinol in blood samples at endline would not be confounded with access to vitamin A supplements at child health days.

Households were selected for the sample from among households with children age 3-5 years of age (36-71 months). Statistical power calculations suggested that 14 households per cluster in Model 1 and Control farmer groups would be needed to detect the minimum effect size desired for serum retinol measured in blood samples, after allowing attrition of two households per farmer group. In Model 2 farmer groups, the required household sample size per cluster was determined by the desired minimum effect size for dietary intake of vitamin A, measured in μg of retinol activity equivalent (RAE) per day. That analysis indicated that 12 households would be needed in Model 2 groups (columns 4-5 of Table 4.1). We sampled 14 households in Model 2 groups to maintain comparability with the other groups and to allow for some attrition in the sample. The sample also needed to include a smaller number of young children, age 6-35 months, in order to assess the impact of the interventions on their dietary intake of vitamin A. In most farmer groups, the children in this age range were sampled from among the younger siblings of the primary reference children. In some farmer groups, an additional household was added to the sample to reach the target number of children age 6-35 months.

Based on the needed number of individuals in each reference population, a sample of 14 households was drawn from each farmer group. In addition, another five households that were not members of the sample farmer groups were added to the sample from each village that was the primary location of the sample farmer groups in order to measure spillover effects of the program in terms of diffusion of the OSP vine technology. In some farmer groups, additional interviews were conducted as additional insurance against attrition, providing a baseline sample of 1,594 households.

Data collection in Uganda took place in two survey rounds, a baseline survey in 2007 and an endline survey in 2009. The survey included a detailed socioeconomic survey and a nutrition survey, including a detailed 24-hour dietary recall module. Serum blood samples were also collected in both survey rounds in order to measure serum retinol concentrations for children in the target age groups. Each survey round also included a farmer group survey conducted with the farmer group chairperson or other leader, a community survey, and a price survey.

In total, 1473 of the 1594 households in the baseline survey were re-interviewed in 2009. This represents an attrition rate of 7.6 percent over the two-year period, which is reasonably low relative to other panel surveys.

Measures of intrahousehold bargaining power were constructed using gender-differentiated data from the survey on asset ownership and control over land. For each asset in the baseline asset module, respondents were asked what proportion of the value of the asset was jointly owned, owned only by the household head, or owned only by the spouse of the household head. Similarly, respondents were asked which household member made the crop choice decisions on each plot, allowing for up to two responses. These data were used to create estimates of the share of land and nonland assets exclusively owned by women, exclusively owned by men or jointly owned. These measures of relative bargaining power within the household are summarized in Table 1. Women have exclusive control of only 16 percent of land assets and 22 percent of other assets. Respondents reported that 25 percent of land assets and 31 percent of nonland assets were jointly owned by men and women. By district, there is considerable variation, with a clear pattern of much higher share of land (59 percent) and nonland assets (62 percent) under exclusive control by men in Bukedea.

4. Results

We begin by testing the Unitary Household Model in a household-level random effects model explaining the determinants of OSP adoption over seasons 2-4 of the project, from 2008-2009. Results are presented in Table 2. In a model estimated on all households in the REU project (column 1), there is no effect of the share of land assets or nonland assets under exclusive female control on the probability of the household growing OSP that season. This result is consistent with the Unitary Household Model; the relative bargaining position of household members has no effect on the probability of OSP adoption. The model also shows some persistence in adoption decisions across seasons. Adopters in the previous season are roughly 30 percentage points more likely to be growing OSP this season. It is interesting that not too many other factors affect adoption probabilities. The relatively small number of households that had previously grown OSP were weakly significantly more likely to grow it in the current season. Also, the probability of growing OSP is declining in the number of years that the household has had a member in the farmer group, suggesting that newer members may be more willing to try new agricultural technologies. The results also show that the rate of adoption is much lower in

Bukedea district than elsewhere and that the adoption rate is declining over time, at what appears to be an accelerating rate.

Female-headed households, which may or may not include a male partner, show larger effects of bargaining power. The probability of OSP adoption is declining in the share of nonland assets exclusively controlled by women. Also in female-headed households, the probability of OSP adoption is increasing in the share of area under sweet potato cultivation at baseline. The pattern of effects for male-headed households looks similar to that of all households in the project.

Next, we consider more explicitly the role of gender differentiation in control over crop choice decisions on land parcels the household owns or controls for cultivation. Figure 1 shows the response from the survey to the question, "Who decided what to grow on this parcel?" in first season of 2009. Respondents were allowed to give up to two responses. The figure shows that the most common arrangement, on nearly 60 percent of parcels, is that control over crop choice is joint, but that the male takes the lead in making the decision. However, on 20 percent of parcels only women make decisions on crop choice, which in part reflects the number of single-headed households headed by females. However, only 4.5 percent of parcels are reported to be under exclusive male control, while the remaining 16.5 percent of parcels are under joint control with a woman taking the lead in the decision making. The figure also shows that in Bukedea, the pattern of male dominance of control over crop choice decisions is magnified, with more than 80 percent of parcels under join control, but where the male takes the lead in the decision.

Table 3 shows the probability of OSP adoption and area planted by gender-differentiated control over the land parcels. On average, the probability of adoption of OSP in 2009 is higher for parcels under exclusive female control than for parcels under exclusive male control or under joint control but with the male taking the lead. Area planted under OSP is also higher on average on parcels exclusively controlled by women than on those exclusively controlled by men. This suggests that women may be more inclined to adopt OSP, but these simple differences in means do not control for selection into parcel control within the household or the joint decision of the household concerning what to grow on all of its parcels.

Table 4 presents a determinants model of the decision to grow OSP at the parcel level by season. The results show that on parcels in which only women make crop choice decisions, or when crop choice decisions are joint but a woman takes the lead, OSP is significantly more likely to be grown, on average, in a model without control variables. After controlling for a large set of observable variables, OFSP is significantly more likely to be planted on parcels with joint control, but where a woman was listed first in order of control. In a model conditional on whether the household is growing OFSP on any parcel, parcels controlled by women are not significantly more likely to have OFSP than those with joint control in which men have primary control, but parcels controlled only by men are significantly less likely to have OFSP.

The previous models do not account for the fact that decisions on what to grow are correlated across parcels within the household. When we account for this in estimation, the pattern of effects is somewhat weaker, as shown in Table 5. We also acknowledge that gender of control over parcels is not fixed and the estimates need to be adjusted for this. Moreover, these estimates do not identify whether effects are gender differences in preferences, information or specialization.

Next we address the question, in Table 6, about whether smaller farms are more egalitarian. The qualitative research suggested that agriculture decision-making may be more egalitarian on small farms. For OFSP adoption, evidence does not support 'small but equal' hypothesis. Gender control over parcels has a larger effect on OFSP adoption in small farms than in large farms.

5. Conclusions

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Table 1: Gender differentiation in asset ownership at baseline, 2007

	Female exclusive ownership	Male exclusive ownership	Joint ownership
Share of value of land owned, 2007	0.161	0.591	0.248
Share of value of nonland assets owned, 2007	0.219	0.488	0.308
By District			
Land, 2007			
Kamuli	0.204	0.457	0.349
Bukedea	0.108	0.739	0.154
Mukono	0.182	0.550	0.268
Nonland assets, 2007			
Kamuli	0.215	0.402	0.400
Bukedea	0.164	0.623	0.227
Mukono	0.281	0.420	0.317

Table 2: Determinants of OSP adoption by season, 2008-09

	REU Project Households	Female-headed REU Project Households	Male-headed REU Project Households
	(1)	(2)	(3)
Adopted OSP last season	0.310***	0.141	0.307***
	(0.031)	(0.103)	(0.033)
Fraction of land exclusively owned	0.038	0.365*	-0.011
by female household members, 2007	(0.070)	(0.217)	(0.076)
Fraction of nonland assets exclusively owned	-0.029	-0.540**	0.032
by female household members, 2007	(0.069)	(0.232)	(0.074)
Female-headed household, 2007	-0.013	--	--
	(0.068)		
Household size, 2007	-0.001	0.005	-0.001
	(0.004)	(0.014)	(0.004)
Household head education	-0.005	0.006	-0.006*
	(0.003)	(0.015)	(0.003)
Quintile 2: Total expenditure per adult eq.	0.005	0.092	-0.010
	(0.031)	(0.138)	(0.033)
Quintile 3: Total expenditure per adult eq.	0.026	0.024	0.030
	(0.032)	(0.105)	(0.034)
Quintile 4: Total expenditure per adult eq.	0.018	-0.098	0.023
	(0.034)	(0.150)	(0.036)
Quintile 5: Total expenditure per adult eq.	0.017	0.101	0.008
	(0.034)	(0.130)	(0.037)
Total land area, 2007	0.003	-0.010	0.005
	(0.004)	(0.009)	(0.004)
Female share of land area, 007	-0.006	-0.064	-0.003
	(0.031)	(0.153)	(0.033)
Whether had access to lowland parcel, 2007	0.017	0.139	0.008
	(0.021)	(0.105)	(0.022)
Share of 'good' soils, 2007	-0.041	-0.082	-0.035
	(0.025)	(0.091)	(0.027)
Ever grew OSP	0.070*	0.359**	0.064
	(0.042)	(0.150)	(0.045)
Ever changed farming practices as a result	0.013	-0.068	0.010
of advice received	(0.022)	(0.094)	(0.023)
Mother knows what vitamin A is, 2007	-0.016	0.000	-0.020
	(0.072)	(0.000)	(0.072)
Mother has access to any radio	0.020	-0.043	0.022
	(0.021)	(0.084)	(0.022)

Farmer group leader	0.027	-0.020	0.037
	(0.027)	(0.098)	(0.029)
Number of years as a farmer group member	-0.002**	0.021	-0.002**
	(0.001)	(0.025)	(0.001)
Share of sweet potato in planted area, 2007	0.105	1.208***	0.084
	(0.069)	(0.417)	(0.071)
Ever give advice on farming, 2007	0.036	0.184	0.026
	(0.024)	(0.119)	(0.025)
Bukedea	-0.253***	-0.172	-0.264***
	(0.029)	(0.127)	(0.030)
Mukono	0.003	-0.008	-0.003
	(0.028)	(0.106)	(0.030)
Second season 2008	-0.064***	-0.103	-0.060**
	(0.024)	(0.072)	(0.026)
First season 2009	-0.178***	-0.152**	-0.184***
	(0.024)	(0.074)	(0.026)
Constant	0.669***	0.708*	0.690***
	(0.094)	(0.363)	(0.096)
Observations	1305	138	1167
Number of households	435	46	389

Notes: Models are random effects household panel data models estimated over 3 seasons from 2008-09. *significant at the 10% level; . **significant at the 5% level; ***significant at the 1% level.

Figure 1: The distribution of control over crop choice decisions on household parcels

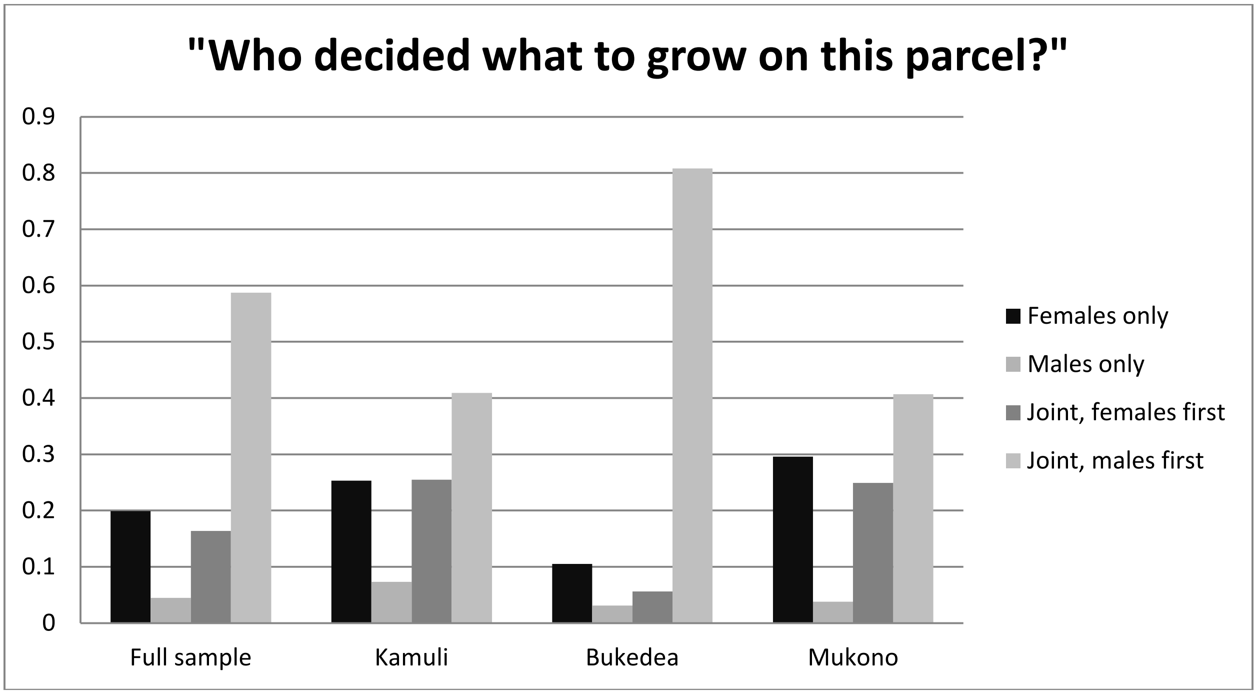

Table 3: Mean probability of OSP adoption and area planted by gender demographics

	Females only	Males only	Joint, females first	Joint, males first
	(1)	(2)	(3)	(4)
Grow OSP on this parcel	41.6[a,c]	28.7	47.4	35.9
OSP area planted on this parcel (Ha)	0.073[b]	0.054[b]	0.092	0.099

[a] Significantly different from (2) "Males only". [b] Significantly different from (3) "Joint, females 1st".
[c] Significantly different from (4) "Joint, females 1st".

Table 4: Effect of gender in control over parcel decisions on OFSP adoption

VARIABLES	Unconditional	Conditional on observables	Conditional on household adopting OFSP
Parcel control: female only	0.233**	0.040	-0.167
	(0.088)	(0.126)	(0.123)
Parcel control: male only	-0.336	-0.335	-0.702**
	(0.233)	(0.247)	(0.278)
Parcel control: joint, female listed first	0.470***	0.256**	0.061
	(0.105)	(0.108)	(0.114)
Household size		-0.010	0.010
		(0.020)	(0.021)
Female headed household		-0.049	0.066
		(0.188)	(0.182)
Household head age		0.013***	0.004
		(0.004)	(0.005)
Household head education		0.016	0.014
		(0.014)	(0.014)
Log of monthly expenditure per adult equ.		0.099	0.092
		(0.073)	(0.092)
Second tercile of landholdings, 2007		-0.292**	-0.136
		(0.109)	(0.133)
Third tercile of landholdings, 2007		-0.637***	-0.412**
		(0.105)	(0.167)
Share land area controlled by females, 2007		-0.045	0.010
		(0.119)	(0.143)
Share of land with good soils, 2007		-0.306***	-0.162
		(0.108)	(0.128)
Total household land area, 2007			-0.018
			(0.021)
Share of sweet potato in land area, 2007			0.110
			(0.249)
Household member is Farmer Group Leader		0.294**	0.383**
		(0.131)	(0.155)
Household was recruited to join Farmer Grp		0.021	-0.001
		(0.084)	(0.116)
Distance to FG meeting place		0.003	0.004
		(0.004)	(0.005)
Ln of farmer group size		-0.509	-0.116
		(0.365)	(0.323)

Season 2		0.058	0.256***
		(0.060)	(0.072)
Season 3		-0.115*	0.086
		(0.065)	(0.081)
Season 4		-0.656***	-0.039
		(0.070)	(0.069)
Constant	-0.572***	0.206	-0.852
	(0.058)	(1.482)	(1.551)
Observations	5723	5089	3159

Notes: Dependent variable is 1 if OFSP grown on this parcel in this season, 0 otherwise. Models are logit models. Sample is farmer group member households in treated farmer groups. Omitted category for Parcel Control is joint, male listed first. Standard errors adjusted for stratification by district and clustering at the farmer group level. * significant at the 10% level, ** significant at the 5% level, *** significant at the 1% level.

Table 5: OFSP adoption, correlated decisions across parcels

Dep Var: Grow OFSP on this parcel	Incl. Other Parcel Controls (1)	Household Fixed Effects (2)
Parcel control: female only	-0.077	-0.124
	(0.052)	(0.247)
Parcel control: male only	-0.292	-0.656*
	(0.098)***	(0.345)
Parcel control: joint, female 1st	0.091	0.232
	(0.046)**	(0.191)
No. other parcels: female only	-0.088	
	(0.022)***	
No. other parcels: male only	-0.035	
	(0.024)	
No. other parcels: joint, female 1st	-0.133	
	(0.016)***	
No. other parcels: joint, male 1st	-0.116	
	(0.012)***	
Observations	5032	4490

Notes: Other control variables not reported.

Table 6: OFSP adoption by size of landholdings

Dep Var: Grow OFSP on this parcel	Land area < 3.25 acres (1)	Land area ≥ 3.25 acres (2)
Parcel control: female only	-0.011	0.021
	(0.034)	(0.037)
Parcel control: male only	-0.269	-0.007
	(0.078)***	(0.052)
Parcel control: joint, female 1st	0.057	0.047
	(0.030)*	(0.032)
Observations	2405	2627

Notes: Other control variables not reported.