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What do we mean by 'women's crops'? A mixed methods approach

A. Orr, T.W. Tsusaka, S. Homann Kee-Tui, and Harry Msere

ICRISAT, Nairobi, Kenya, a.orr@cgiar.org

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International Crops Research Institute for the Semi-Arid Tropics

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Abstract

A ‘Women’s Crop Tool’ was developed to measure women’s control over decision-making for crop production, sales, and use of income. We tested the tool for groundnuts in Eastern Province, Zambia, using a mixed methods approach that involved Focus Group Discussions (FGDs) and a quantitative household survey. Women in FGDs reported higher levels of control than women in the household survey. We argue that the more extreme results from the FGDs are due to the nature of the research question over the ‘power to name’. FGDs provided a public space for a struggle over meaning that exposed latent conflicts over gender roles, gender identities, and the conjugal contract. Mechanization of groundnut shelling has increased male participation in this activity. We used Propensity Score Matching (PSM) to determine whether the introduction of shelling machines reduced women’s control over groundnuts, as measured by the weighted women’s gender control index (WGCI), constructed by aggregating the scores obtained from the Women’s Crop Tool. Results showed that the shelling machine significantly increased the women’s WGCI, while the area planted to groundnuts and the volume of groundnut sales had no significant effect on the women’s WGCI. Contrary to the conventional wisdom, therefore, the commercialization of groundnuts has not reduced women’s control over groundnuts, while women perceived that the introduction of the machine sheller had increased their control over decision-making.

Keywords: Groundnuts, women, gender, mechanization, commercialization, propensity score matching, Zambia.

JEL classification: Q110, Q130, L660

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"Africa is the region of female farming par excellence*"* (Boserup, 1989: 16)

1 Introduction

Writers on 'women's crops' use the term in two different ways. The first is where women provide the labour for crop production, while the second is where women control the product itself. Research has focused primarily on the first usage, or the gender division of labour. A century ago, most of the labour for crop agriculture in SSA was provided by women and men were responsible only for clearing land (Baumann, 1928). This is no longer true. A survey of cassava-growing areas in six SSA countries in 1989-91 revealed that 51% of total labour requirements for root crops, rice and maize, were provided primarily by men (Enete et al., 2002). Similarly, analysis for Ghana has shown that no crops were grown exclusively by women, whether by households headed by women, or on fields held by women, or on fields from which women kept the income (Doss, 2002). Thus, the concept of 'women's crops' has limited value for understanding the gender division of labour.

By contrast, less attention has been paid to what has been called the 'gender division of control' (Geisler, 1993:1970). We were alerted to this at a recent meeting with women farmers in Zambia (Orr et al., 2014). Survey data showed that women working alone contribute only 6% of the labour for groundnuts, while men and women working together provided 25 % (Mofya-Mukuka and Shipekesa, 2013: 19). But when we suggested this meant that groundnuts was not a 'women's crop', the result was uproar. This prompted us to re-think what we meant by 'women's crops'.

This paper develops a simple tool to measure women's control over crop production, marketing, and use of crop income. The tool is not restricted to crops, however. One of us used the same tool to measure changes in women's control over livestock (Appendix 1). In this paper, however, we focus on the case of groundnuts in Zambia. In Zambia, groundnuts are regarded as a 'women's crop' and Eastern Province, where this research was conducted, is the centre of groundnut production, accounting for one-third of the area planted. Six in ten households in Eastern Province grow groundnuts, the majority in fields of below 1 ha. One-fifth of groundnut harvested is sold, mostly to private buyers (Mofya-Mukuka and Shipekesa, 2013). Recently, increased demand for groundnuts has resulted in new investment in seed production, processing, and grain trading. The Eastern Province Farmers' Cooperative (EPFC) is a farmers' organization that buys and sells groundnut seed. Shelling groundnuts is generally done manually by women but in 2012 EPFC distributed shelling machines to selected seed producer groups.

We test six hypotheses regarding 'women's crops':

1. Women have greater control over some crops than others;
2. Men and women have conflicting views on women's level of control;
3. Women maintain their control over groundnuts by allowing men control over other crops;
4. The higher women's share of the workload, the greater their control over the crop;
5. Machine shelling of groundnut does not reduce women's control; and
6. Commercialization of groundnut does not reduce women's control.

We used a mixed methods approach, combining qualitative and quantitative instruments. The growing use of qualitative methods for policy purposes has led to interesting debates over how best to combine them with quantitative methods (Kanbur, 2001). The integration of both methods (Q-squared) is particularly useful for the study of social processes that are difficult to capture using conventional survey methods (Davis and Baulch, 2011). Yet although qualitative methods provide insights into perceptions and processes, testing hypotheses still requires the use of quantitative methods (Gladwin et al., 2002). In this paper, we use Q-squared methods to (1) compare the results obtained from different methods and explore the reasons for divergence (2) test hypotheses suggested by qualitative methods and (3) to help interpret the findings from a household survey.

The paper is divided into six sections. The next two sections present a conceptual framework and describe our data and methods. Section Four presents results, while Section Five discusses some implications for mixed methods, commercialization, and our understanding of ‘women’s crops’. Finally, we summarize our conclusions.

2 Conceptual Framework

Figure 1 shows a conceptual framework for the analysis of ‘women’s crops’. The relevant features of this framework are discussed below.

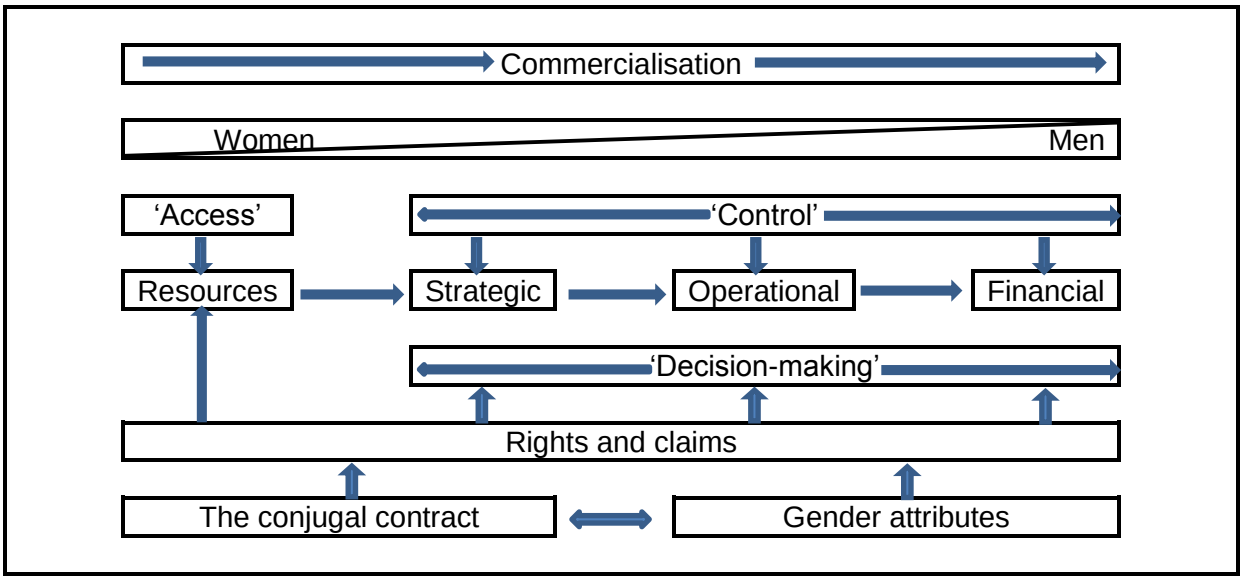
‘Commercialization’ is the process by which the objective of crop production shifts from home consumption to sale. Figure 1 hypothesises that as crops become commercialized women’s access and control is reduced while men’s increases. Consequently, crop commercialization disempowers women because they can no longer enforce their claims to access and control.

We distinguish three different types of control. As Doss (2001: 2077) argues, ‘women’s crops’ should be defined not only by who controls the output, but also by ‘who chooses the crops to grow and who makes the management decisions’. We define ‘strategic’ control as the power to choose ‘how’ resources are allocated between competing crops. We define ‘operational’ control as the power to choose ‘what’ and ‘when’ crop management operations are implemented. This is similar to Kabeer’s (1999) distinction between ‘policy-making’ and ‘management’ control. Finally, we define ‘financial’ control as the power to choose ‘who’ receives the realized value or income from the crop.

‘Decision-making’ is the term generally used by social scientists to operationalize ‘control’. The standard practice is to identify key decision points, identify what role women play in making these decisions, and combine the answers into a single index (eg. Alkire et al., 2013). In Figure 1, we use the concept of ‘decision-making’ to cover decisions about all the three types of control – strategic, operational, and financial.

We distinguish between ‘access’ and ‘control’. Access is a precondition for control but access alone does not guarantee control over how resources are used. ‘Access’ has been defined as ‘the ability to derive benefits from things’ (Ribot and Peluso, 2003: 153), which implies effective control, or ‘the right to use and benefit from a productive resource’ (Berry, 1989: 1). In Figure 1, however, we define access as the ability (at least in theory) to use a given resource, without implying control over or the use of benefits.

Figure 1: Conceptual framework



'Rights and claims' are the mechanisms by which individuals negotiate 'access' and 'control'. It is not always easy to distinguish between them. Ribot and Peluso (2003: 155) define a 'right' as 'an enforceable claim'. A 'right' is therefore a claim whose validity is recognized either by law, custom, or popular opinion, whereas a claim is not so recognized. Thus, claims are 'rights in the making' that may become rights over time. In Africa, rights to property are complex because, unlike in European law, they are not unique and indivisible. Women and men can have rights over different uses of the same plant (Howard and Nabanoga, 2007) or, as in the 'house property complex' in eastern Africa, rights to different categories of cattle (Oboler, 1996), or hold rights on behalf of others, as women hold rights in cattle for their sons (von Bulow, 1992).

'Rights' and 'claims' to control are mobilized in two ways. First, they are operationalized in the 'conjugal contract' that 'sets the terms by which husbands and wives exchange goods, income, and services, including labour' (Whitehead, 1981: 88). Just like rights, the terms of conjugal contract are not fixed but are re-negotiated in response to changing circumstances. Second, rights and claims are mobilized by the identification of specific 'gender attributes'. These are culturally defined ways of classifying resources in terms of whether they share male or female traits. The social construction of gender is expressed in these attributes and in the conjugal contract, which are interlinked. 'Women's crops', for example, are defined by feminine attributes, such as their importance for 'relish' or a balanced meal, and the responsibility of women to provide this part of the household diet becomes part of the conjugal contract.

3 Data and Methods

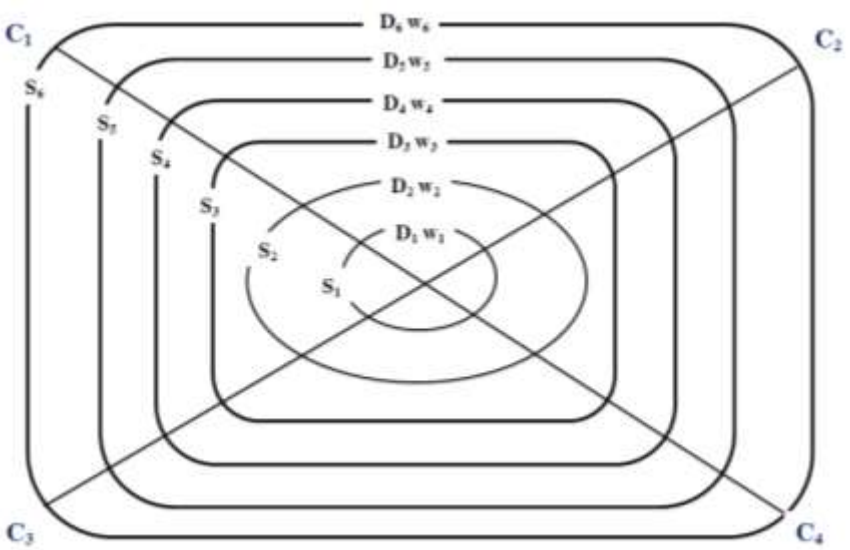
Measuring 'women's 'control'

Figure 2 shows the tool we developed to measure 'women's control'. The crops (C_1 – C_4) in each quadrant are the crops for which women's control is compared. The decisions (D_1 – D_6) are the key decisions for crop production and sale for which the degree of women's control is measured. The scores (S_1 – S_6) measure the degree of control that women have over these key decisions. Finally, the weights (W_1 – W_6) are the relative importance that women give to these key decisions (D_1 – D_6). The weighted scores are aggregated to produce a gender control index.

The household-level sex-disaggregated weighted gender control index (WGCI) can be defined for each crop as follows:

$WGCI_g = \frac{\sum_{j=1}^{k} W_{jg} S_{jg}}{\sum_{j=1}^{k} W_{jg}}$ where the subscript *j* is a decision, *k* is the number of decisions (i.e., 6 in the case of Figure 2), and *g* refers to either male (husband) or female (main wife).[1]

Figure 2: The 'Women's Crop Tool'



Qualitative data

For qualitative data, we held focus group discussions (FGDs) with three types of EPFC seed producer groups, namely (1) groups with more than three years' experience of selling to EPFC, which we called 'commercial' groups (2) groups that had at least three years' experience with the machine sheller, which we called 'commercial sheller' groups, and (3) groups that had recently joined EPFC, which we called 'non-commercial' groups. We purposively identified six villages that had EPFC seed producer groups in one of these categories. We requested group leaders to arrange groups of eight men and eight women, which we felt was the ideal number for discussion. However, numbers proved difficult to

[1] We used the term 'main wife' to denote the eldest or first-married wife in a polygamous household.

regulate and the actual number was sometimes more than eight (Table 1). A total of 123 men and women participated in 12 FGDs, giving an average group size of 10.

Table 1: Sites for Focus Group Discussions (FGDs), Eastern Province, Zambia

Village	District	Group	Seasons with EPFC	------Number in FGD----------			--------Distance (km)----------	
				Men	Women	Total	To tarmac	To Chipata
Kagunda	Chipata	Commercial+ Sheller	6	8	9	17	2	55
Mafuta	Chipata	Commercial+ Sheller	6	16	9	25	13	54
Bwanunkha	Chadisa	Commercial	3	9	8	17	33	40
Kapenya	Chipata	Commercial	5	8	8	16	3	58
Kazingizi	Chipata	Non-commercial	1	8	12	20	6	45
Stephen	Chipata	Non-commercial	1	10	18	28	0	40
Total				59	64	123	10	49

We began in plenary by asking participants the word they used to describe 'control' over decisions about crop production or sale (Appendix 2). Four different Chichewa words were suggested (Table 2). They varied in meaning from 'being in charge' (*kulamulira*) to 'following an agreed plan or procedure' (*ndondomekho*). Although this meant it was not possible to use a common definition across all six villages, we ensured a common understanding of 'control' by using *kulamulira* (the closest equivalent in Chichewa to the English word 'control'), as a reference point in all the FGDs. Separate FGDs were held with men and women. Each FGD scored how much control they believed that *women* had over each decision, using a percentage scale of 0-100. The FGDs also scored the importance of each decision for overall control on a 0-5 scale. Scores were preferred to ranks because they captured not only the relative importance of each decision but the degree of difference between them (Abeyasekera et. al., 2002). After completing the exercise each group presented its results to the other in a plenary session, and the results were discussed.

Table 2: Chichewa words used for 'control' by focus groups, Eastern Province, Zambia

Chichewa	English translation	Village where this definition was used
Kulamulira	To command, be in charge, be responsible for (Guerin, 1985)	Stephen
Kulongola	To go before, lead, or accompany (Guerin, 1985)	Mafuta
Kudongosola	To arrange, to put in order, to speak in order (Scott, 1965)	Kagunda, Kazengizi
Ndondomekho	Plan, procedure, order (Paas, 2013)	Bwanunkha, Kapenya

Quantitative data

For quantitative data, a household survey was conducted with smallholder farmers in three purposively selected villages at least 15 km apart within the same agro-ecological zone. Kagunda (where we conducted FGDs) is the 'treatment' village that contains an EPFC seed producer group where a machine sheller has operated successfully for two crop seasons. The two 'control' villages without a machine sheller were Kapenya (where we conducted

FGDs), and Mkhazika village in Katete district (where we did not conduct FGDs). To elicit the gender division of control, we interviewed the husband and his main wife separately, with the husband interviewed by a male enumerator and the wife by a female enumerator (Appendix 3). Since the objective was to compare perceptions between men and women, only households with both male and female adults were selected for interview. Within each village, 100 households (i.e., 200 individuals) were randomly selected for interview, giving a total of 100 households from the village with the machine sheller and 200 households from the two villages without a machine sheller.

To compare the gender division of labour and control, we also collected gender-disaggregated data on the perceived share of workload for different crop management operations, including land preparation, planting, fertilizer application, weeding, harvesting, stripping (groundnuts only), transport to storage, shelling (groundnuts only), winnowing, sorting and grading, and transport to market. These were weighted using data on labour requirements from on-station trials conducted at Chitedze Research Station, Malawi, during the 2013 crop season, except for the time taken for transport to market which was collected from each household. The household-level gender share of workload (GSW) can be defined for each crop as follows:

$$GSW_g = \frac{\sum_{j=1}^{k} w_{jg} S_{jg}}{\sum_{j=1}^{k} w_{jg}}$$

where w is the labour requirement, S is the perceived share of workload expressed in percent, the subscript j is the stage in the farming process, k is the number of stages involved, and g refers to either the husband or the main wife.

Methods

To test hypotheses 1-4, we used univariate and bivariate analysis. Since both WGCI and GSW are indicators of *perceived* levels and the sum of men's and women's figures is generally not equal to 100, relatively objective indicators of control and workload can be defined by taking the average of men's and women's perceptions. That is, the relatively objective control indicators for women and men can be defined as:

$$OWGEI_f = \frac{1}{2}\{WGEI_f + (100 - WGEI_m)\}$$

$$OWGEI_m = \frac{1}{2}\{WGEI_m + (100 - WGEI_f)\}$$

where f and m refer to female and male, respectively. Likewise, the relatively objective gender share of workload can be defined as:

$$OGSW_f = \frac{1}{2}\{GSW_f + (100 - GSW_m)\}$$

$$OGSW_m = \frac{1}{2}\{GSW_m + (100 - GSW_f)\}$$

Obviously, $OWGEI_f + OWGEI_m = OGSW_f + OGSW_m = 100$ holds for each household. The deviation of these indicators from parity (i.e., 50) is worth being statistically tested to further understand the gender gap in decision-making and workload.

To test hypotheses 5 and 6, we used multivariate regression analysis. Because we have cross-section and observational data, the results are open to sample selection bias because access to the machine sheller was not randomized. To reduce this bias, we used matching techniques. That is, from the non-sheller groups we chose the observations whose relevant covariate variables took values as close as possible to the values found in the sheller group. The key covariate is the area planted to groundnut, which is significantly greater in the sheller group ($p < .000$).

Rosenbaum and Rubin (1983) suggest that it suffices to match individuals based on balancing score measures, such as the propensity score, as opposed to the vector of observable covariates *per se*. A conditional probability of group membership (propensity score) is predicted from observed covariates by logistic (or probit) regression, to create a counterfactual group. To test for robustness, we employed different matching algorithms. In view of the small sample size, our first choice of matching algorithm was nearest one-neighbour matching (Becker & Ichino, 2002; Dehejia, 2005), but other algorithms were also used. For the nearest one-neighbor matching, matching without replacement is also considered. Without replacement (and a caliper), the variance of the estimator decreases since more information on the control group is used. However, the matched pairs can differ considerably in their propensity scores (Dehejia and Wahba, 2002). For the radius matching, there is no way of determining, *a priori*, an acceptable size for caliper (Smith and Todd, 2005), and the appropriate caliper that achieves a balance while minimizing the loss of observations and the variance of the estimator was found by trial and error.

After performing the matching algorithms, we conducted the covariate imbalance test to confirm the validity of the matching. Finally, the following regression model is estimated by including the households from the sheller group and the matched households from the non-sheller groups:

$$y_i = \beta_0 + \beta_1 x_i + \beta_2 S_i + \varepsilon_i \quad (i \in matched\ pairs)$$

where y is women's WGCI for groundnut, x is a vector of covariates (groundnut area size, same religion (dummy), husband with official duty (dummy), main wife with official duty (dummy), polygamy (dummy), gender sum of age, gender gap in age, gender sum of groundnut farming years, gender gap in groundnut farming years, household headcount, household adult female ratio, MV area ratio (all crops), S is the group dummy (1 for the sheller group, 0 otherwise), ε is the random error term, and i refers to the household. Groundnut production, sales, and area planted are multicollinear and therefore cannot be included in the regression at the same time. Among the three, we opted for area planted because we judged that self-reported figures for production and sales were less reliable. Lastly, β_2 is designed to capture the average treatment effect on the treated (ATT) to be estimated.

If there are unobserved variables that affect assignment into treatment and the dependent variable simultaneously, a hidden bias might arise to which matching estimators are not robust. To address this issue, we follow the bounding approach proposed by Rosenbaum (2002) and applied by DiPrete and Gangl (2004) and Becker and Caliendo (2007). In short, the approach allows us to determine how strongly an unmeasured variable may influence the selection process to undermine the implications of the matching analysis. Sig+ (p-value) is obtained from Wilcoxon signed rank tests for the ATT while setting the level of hidden bias

to a certain value Γ, which reflects our assumption about unmeasured heterogeneity or endogeneity in treatment assignment expressed in terms of the odds ratio of differential treatment assignment due to an unobserved covariate. At each Γ a hypothetical significance level is calculated, which represents the bound on the significance level of the treatment effect in the case of endogenous self-selection into treatment status. By comparing the Rosenbaum bounds at different levels of Γ we can assess the strength that unmeasured influences would require in order that the estimated ATT would have arisen purely through selection effects. Hodges-Lehmann point estimates and confidence intervals for the ATT are also provided.

4 Results

Hypothesis 1: Women have greater control over some crops than others

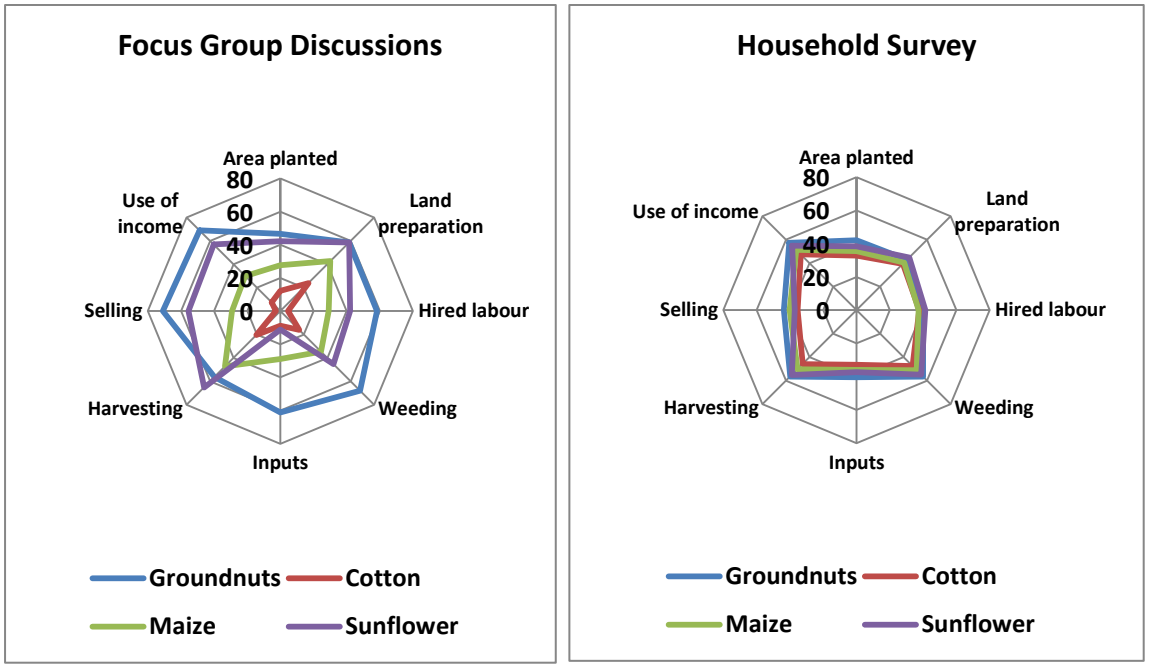
Figure 3 compares the weighted scores for women's perceptions of control over eight key decisions for groundnuts, sunflower, maize, and cotton. The left hand panel presents results from the FGDs while the right hand panel shows results from the household survey.

In terms of crops, the results show a marked contrast between cotton and groundnuts. Women perceive they have little control over decisions about cotton production, and minimal control over selling and use of cotton income. By contrast, women feel that they control all the major decisions about groundnuts right from planting to the use of groundnuts income. Maize occupies the middle ground, with control shared fairly evenly between women and men.

In terms of method, women in FGDs perceived greater differences in control than women interviewed in the household survey. This was particularly true for groundnuts and cotton. By contrast, women in the household survey perceived fewer differences in control between the four crops. Even so, the difference between cotton and groundnut for the household survey is statistically highly significant for all eight decisions.[2] In this respect, the qualitative and quantitative results are similar.

[2] The *p*-value for the paired t-test is < 0.001 for all eight decision categories.

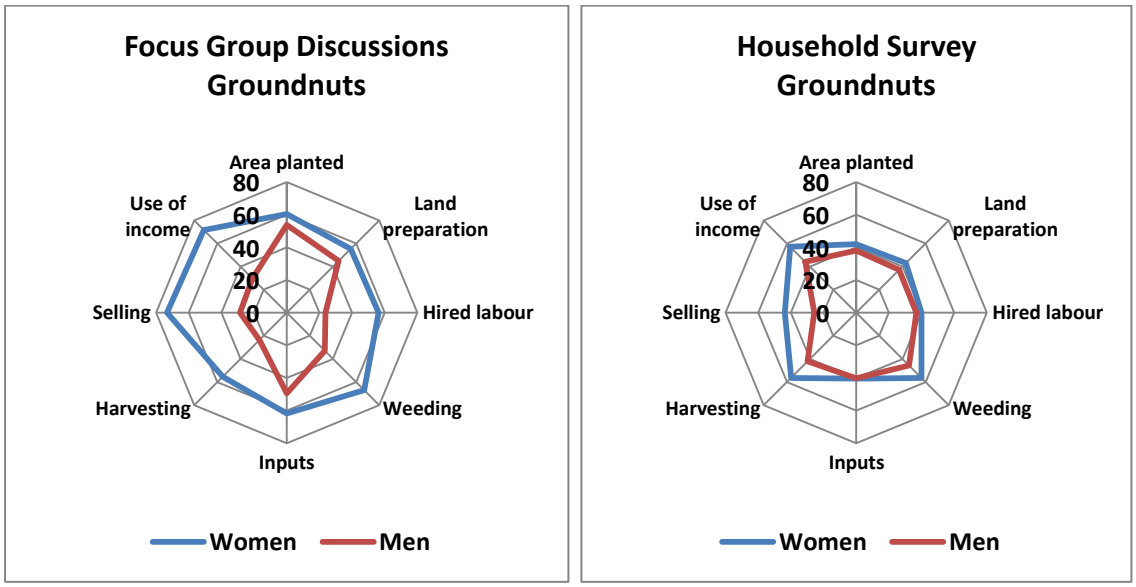
Figure 3: Women's perceptions of control over groundnuts, cotton, maize, and sunflower in Eastern Province, Zambia (weighted scores)

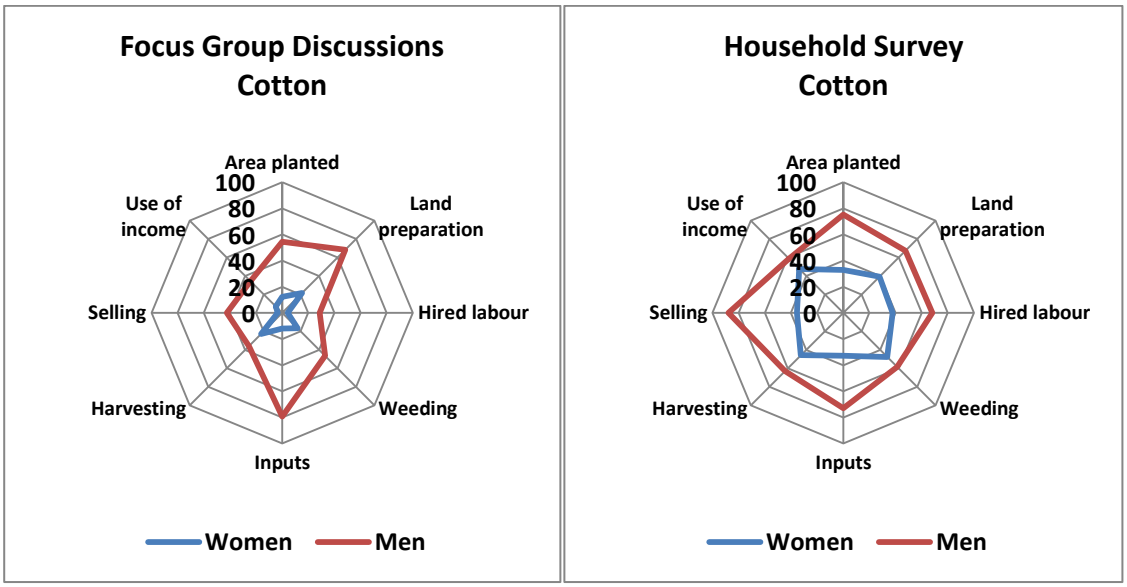


Source: Focus Group Discussions and Household Survey, 2014

Figure 4 compares perceptions of control for groundnuts and cotton. For groundnuts, women perceived themselves as having more control (blue line), while men perceived themselves as having less control (red line). For cotton, the opposite is true. Women perceived themselves as having very little control, whereas men perceived themselves as having more control. In terms of method, both FGDs and the household survey gave similar results. However, women in the FGDs perceived they had greater control over groundnuts, and less control over cotton than did women in the household survey.

Figure 4: Perceptions of control for groundnuts and cotton, Eastern Province, Zambia





Source: Focus Group Discussions and Household Survey, 2014

Figure 5 shows the type of control that women in FGDs perceived they had over groundnuts, cotton and maize. Women's control over groundnuts covered all three types of control – strategic, operational, and financial. By contrast, although women had some operational control over cotton for land preparation, weeding and harvesting, their strategic and financial control was very limited. For maize, men were dominant, but women enjoyed a relatively high degree of strategic control (33 %), operational control (even for decisions on inputs and hiring labour), and financial control (29%).

Figure 5: Types of control for groundnuts, cotton, and maize

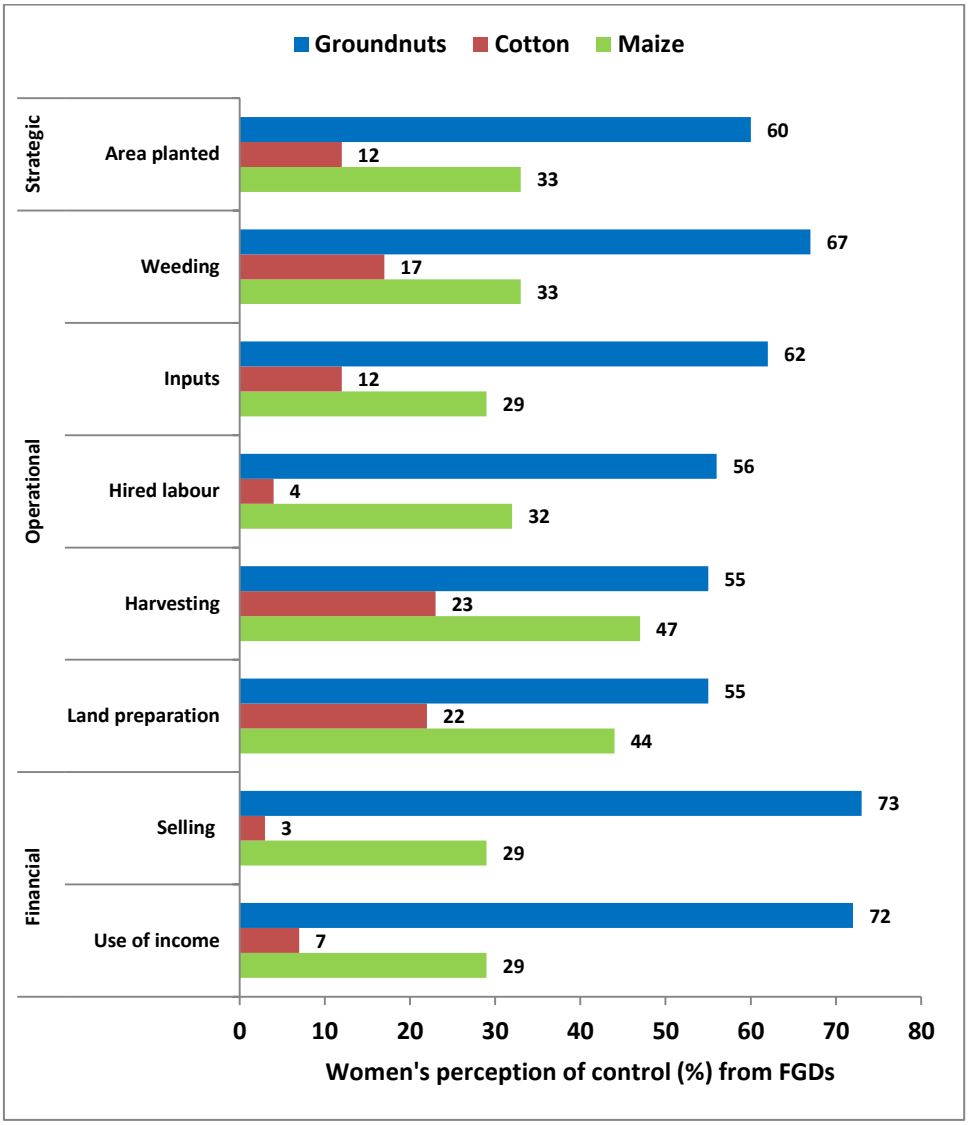


Figure 6 shows differences in the type of control exercised by women in EPFC groups with and without the machine sheller. The results show that women in groups with access to a machine sheller perceive they have greater control over land preparation, weeding, harvesting, and the use of income from groundnuts. These differences were statistically significant at the 5 % level or above.[3] In other words, mechanization is associated with increased operational and financial control but not with greater strategic control (area planted) which remained firmly under male control.

Figure 6: Types of control over groundnuts, by access to machine sheller

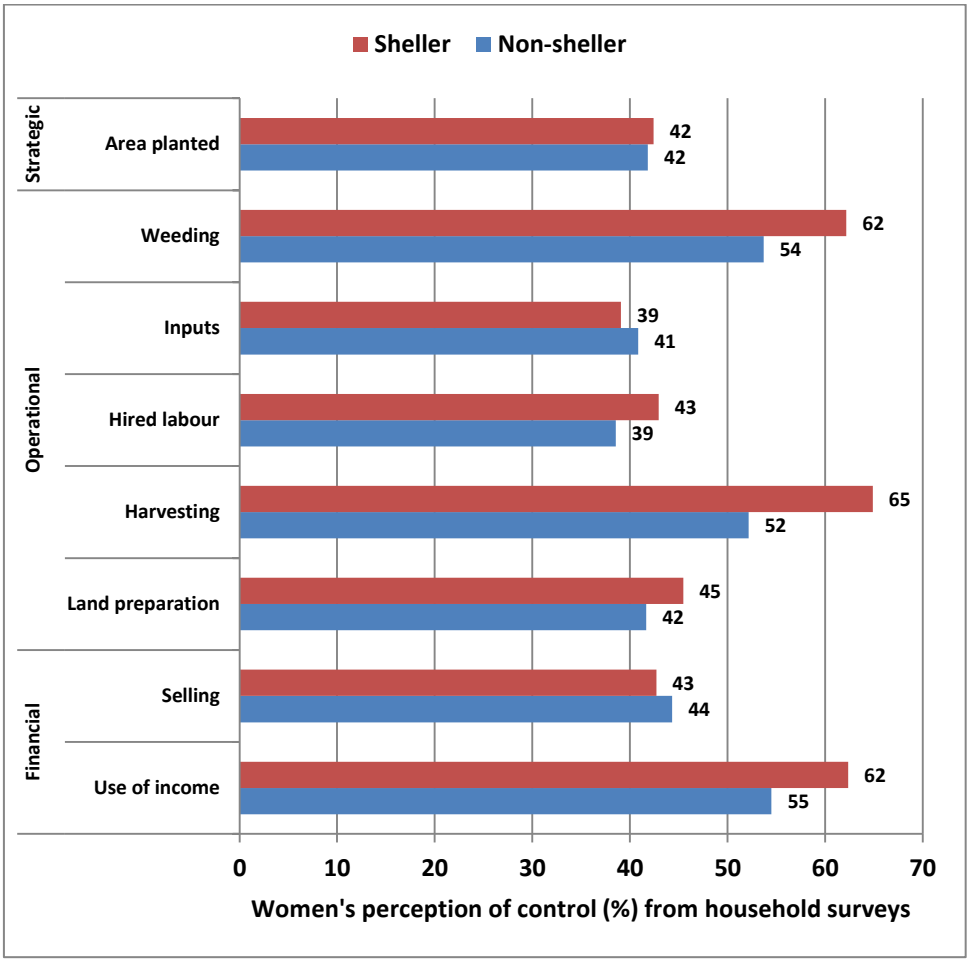


Figure 7 shows the relative importance that men and women in FGDs gave to different types of control. Men gave greatest weight to strategic control over land, and operational control over land preparation, and cash inputs. Interestingly, they gave relatively less weight to financial control, either in terms of selling crops or the use of crop income. Women, by contrast, gave the greatest weight to financial control. They gave relatively less importance to strategic control over land and operational control over crop management. However, they attached greater importance to operational control over crop management than men, particularly for weeding, hired labour, and harvesting.

[3] *p*-values: land preparation (0.0976), weeding (0.0167), harvesting (0.0016), use of income (0.0296).

Figure 7: Weights given to different types of decisions (%)

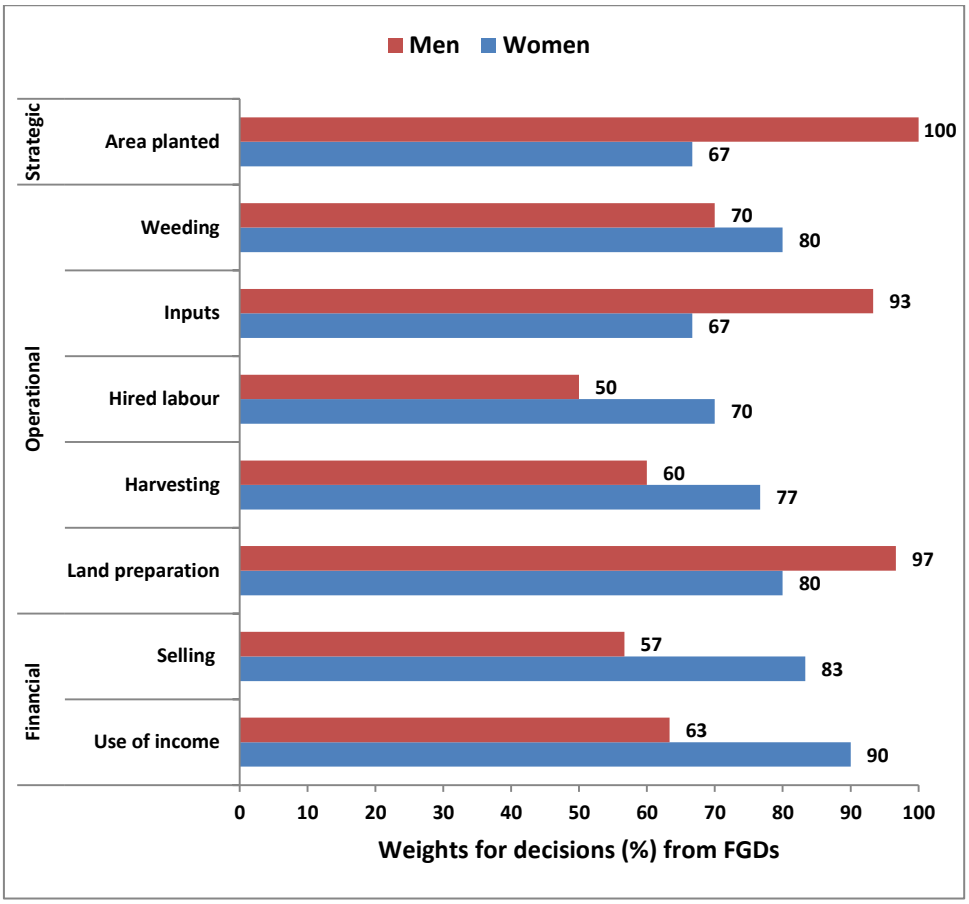


Table 3 shows the result of the single sample t-test on the deviation of the Objective Weighted Gender Control Indicator ($OWGEI_f$) and the Objective Weighted Gender Workload Indicator ($OGSW_f$) from parity. Women’s control in decision-making was significantly lower than 50 for all four major crops, meaning that men have greater control than women. Nevertheless, the mean and t-statistic imply that women had some control over groundnut and sunflower, the two ‘women’s crops’. By contrast, women’s workload for groundnuts was significantly greater than men’s, whereas men did more work for maize and cotton.

Table 3: Single-sample t-test on deviation of Objective Weighted Gender Control Indicator ($OWGCI_f$) and Objective Weighted Gender Workload Indicator ($OGSW_f$) from parity (50%)

	Objective Weighted Gender Control Indicator ($OWGCI_f$) as perceived by women				Objective Weighted Gender Workload Indicator ($OGSW_f$) as perceived by women			
	N	Mean (%)	t-statistic	*p*-value	N	Mean (%)	t-statistic	*p*-value
Maize	287	39.3	-19.2	0.000	287	47.1	-5.7	0.000
Groundnuts	286	43.4	-11.0	0.000	286	55.4	5.6	0.000
Cotton	206	36.8	-17.4	0.000	209	40.5	-2.0	0.051
Sunflower	183	44.1	-6.5	0.000	192	53.9	1.5	0.124

Source: Household Survey, 2014

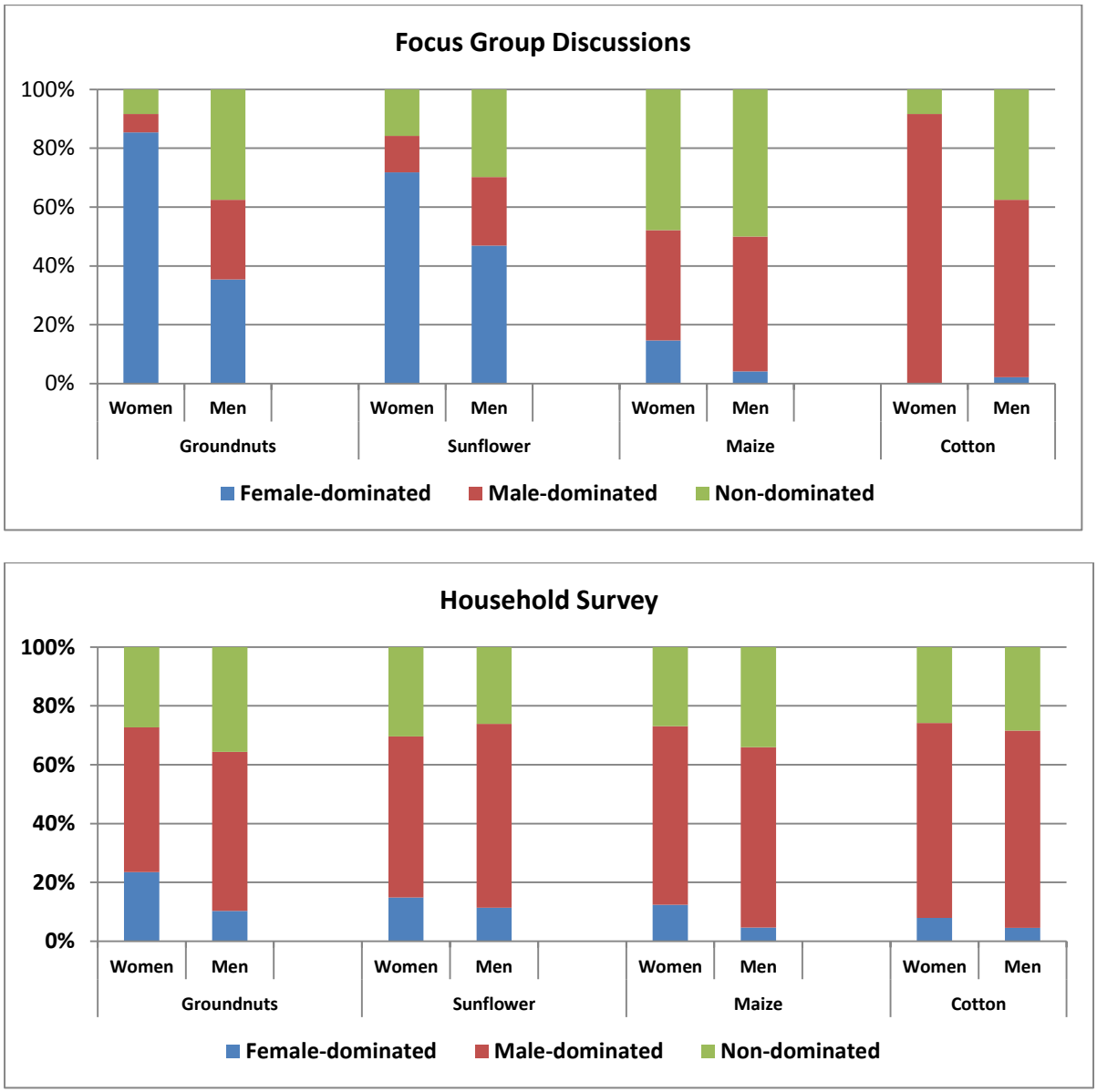
Hypothesis 2: Men and women have conflicting views on women's level of control

Another way to present information on 'control' is to ask who dominates decision-making. Figure 8 classifies the weighted scores for the eight decisions into three groups: male-dominated, female-dominated, and non-dominated. The threshold used to measure domination was a score above 50 %.

The results from the FGDs show that cotton is regarded as a 'man's crop', with women viewing 92 % of all decisions as dominated by men, while men see 60 % of all decisions for cotton as dominated by men. By contrast, women saw groundnuts and sunflower as 'women's crops', with 85 % and 61 % of decisions for these crops dominated by women, respectively. However, men saw things differently. In their view, only 35 % of the decisions for groundnuts were dominated by women, almost the same share as dominated by men (27 %). In the case of sunflower, men saw only 46 % of decisions as dominated by women. Despite the conflicting views on the absolute levels of women's control, however, men recognized women's control as being relatively high for groundnuts and sunflower, the two 'women's crops'. By contrast, both men and women saw maize as a crop where over 60 % of decisions were non-dominated and where control was shared.

In terms of method, the FGDs and household survey gave similar results for cotton. Both men and women perceived this as a man's crops over which women had limited control. However, the FGDs and household survey differed in their results for groundnuts and sunflower. Women in FGDs perceived much greater control over these crops than women in the household survey. For example, women in FGDs saw 85 % of decisions for groundnuts as dominated by women, while those in the household survey saw only 23 % as dominated by women. Women in the household survey also saw men as having more control over maize, with only 27 % of decisions non-dominated.

Figure 8: Contrasting male and female perceptions of who dominates key decisions



Source: Focus Group Discussions and Household Survey, 2014

Table 4 presents the result of the paired t-test on the difference between women's control perceived by women and women's control perceived by men. In other words, the test compared the difference between $OWGEI_f$ and 100 - $OWGEI_m$. The difference was statistically significant in all cases. In other words, women believe that they have more control over decision-making than men think they have.

Table 4: Paired t-test on perceived difference in women's control

	N	Women's Control		Mean Difference	t-statistic	*p*-value
		Women's perception	Men's perception			
Maize	287	42.9	35.6	7.3	8.5	0.000
Groundnut	286	47.7	39.1	8.6	9.3	0.000
Cotton	206	39.4	34.1	5.3	6.2	0.000
Sunflower	183	45.0	43.1	1.9	2.9	0.004

Source: Household Survey, 2014

Hypothesis 3: Women maintain control over groundnuts by conceding men's control over other crops

Table 5 shows the magnitude and statistical significance of correlation between women's control over groundnuts and men's control over maize and cotton, as perceived by men and women. Contrary to expectation, the relation is negative and statistically significant, implying that the higher women's control over groundnuts, the higher their control over maize and cotton. The same applies to men's perception as well.

Table 5: Correlation between women's control over groundnuts with men's control over maize and cotton

	Women's control over groundnut vs.	
	Men's control over maize	Men's control over cotton
Women's perception	- 0.760*	-0. 587
	p = 0.000	*p* = 0.000
Men's perception	- 0.753	- 0.497
	p = 0.000	*p* = 0.000

* Pearson's coefficient of correlation

Hypothesis 4: The higher women's share of the workload, the greater their control over the crop

Table 6 compares the correlation between women's share of the workload (GSW_f) for maize and groundnuts, with their degree of control over these crops, as measured by their total control (WGCI) and their control over the use of income. The results show that workload and control are positively correlated. The results show that workload, total control, and control over use of income are positively correlated. For women, the correlation between their share of the workload and their control was statistically significant for

both maize and groundnuts, suggesting that women's workload did confer some degree of control. For men, the correlation between workload and control was statistically significant for maize but not for control over the use of income from groundnuts.

Table 6: Correlation between shares of workload and control in farming of maize and groundnuts

Gender	Control	Maize	Groundnuts
Women	Total control	0.462 *	0.278
		p = 0.000	*p* = 0.000
	Control over use of income	0.222	0.269
		p = 0.001	*p* = 0.000
Men	Total control	0.111	0.032
		p= 0.061	*p* = 0.596
	Control over use of income	0.157	0.095
		p = 0.012	*p* = 0.116

* Pearson's coefficient of correlation.

Hypothesis 5: Machine shelling of groundnuts does not reduce women's control *and* ***Hypothesis 6: Commercialisation of groundnuts does not reduce women's control***

Table 7 presents the outcome of the balancing test and the estimates on ATT for differing matching methods. For algorithms (6), (7), and (9), bandwidth=0.002, caliper=0.06, and caliper=10 are used, respectively. In general, the estimates of ATT are found to be statistically significant and positive, indicating that the machine sheller leads to an increase in $WGEI_f$ for groundnut by an approximate range of 5 to 8. This suggests that a reduction in women's drudgery (i.e., hand shelling) by introducing the machine sheller increases women's empowerment in groundnuts. The sign of the bias is negative, meaning that the estimator without matching underestimates the effect of the treatment.

Table 7: Average Treatment Effect on the Treated (ATT) with alternative matching algorithms

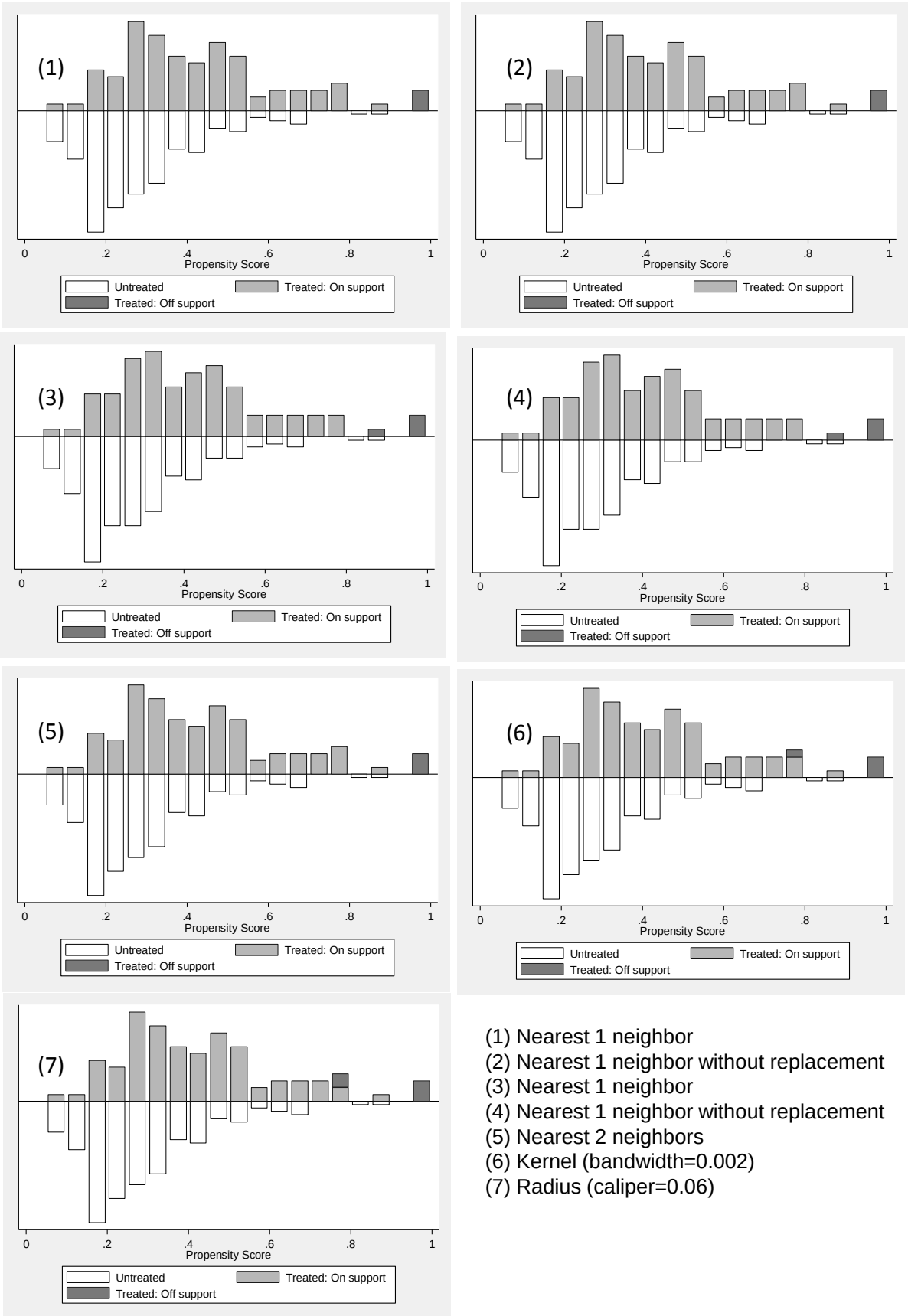
	Matching Algorithm		Propensity Score Type	Pseudo R^2	LR χ^2 (*p*-value)	Mean Standardized Bias	Sample Size on Common Support		ATT (*p*-value)
							Treated	Control	
(0)	Before matching		-	0.120	40.67 (*p*=0.000)***	19.368	89	176	5.001 (*p*=0.005)***
(1)	After matching	Nearest 1 neighbour	Logit	0.041	9.83 (*p*=0.631)	12.912	86	176	5.669 (*p*=0.033)**
(2)		Nearest 1 neighbour without replacement	Logit	0.032	3.65 (*p*=0.989)	6.256	86	176	6.530 (*p*=0.002)***
(3)		Nearest 1 neighbour	Probit	0.066	15.54 (*p*=0.213)	13.099	85	176	7.557 (*p*=0.003)***
(4)		Nearest 1 neighbour without replacement	Probit	0.020	4.68 (*p*=0.968)	9.605	85	176	5.338 (*p*=0.013)**
(5)		Nearest 2 neighbours	Logit	0.013	3.10 (*p*=0.995)	6.468	86	176	7.890 (*p*=0.001)***
(6)		Kernel (bandwidth=0.002)	Logit	0.028	6.50 (*p*=0.889)	8.947	86	176	6.586 (*p*=0.005)***
(7)		Radius (caliper=0.06)	Logit	0.008	1.75 (*p*=1.000)	4.634	84	176	5.558 (*p*=0.006)***
(8)		Mahalanobis	-	0.078	19.24 (*p*=0.083)*	15.605	89	176	5.948 (*p*=0.016)**
(9)		Mahalanobis with caliper (=10)	-	0.088	18.32 (*p*=0.106)	11.778	75	176	4.763 (*p*=0.065)*

***, **, and * indicates statistical significance at 1, 5, and 10 % levels, respectively.

In all of the PSM cases, both the overall sample balancing and the statistical significance of the ATT estimator are well achieved. On the other hand, Mahalanobis metric matching is not effective in our case because the matching does not give a particularly high weight on the decisive variable (i.e., area planted). As plain Mahalanobis matching leads to imbalance (p=0.083), we also tried imposing different levels of caliper. It was found that caliper=10 barely achieves balance (p=0.106), though the estimated ATT is no longer statistically significant.

Figure 9 shows the overlap of the propensity scores between the treated and control groups on and off the common support for algorithms (1)-(7) by histogram with 20 intervals. All the PSM algorithms exhibit similar patterns of overlap, with the high end of propensity score in the treated group tending to go off support.

Figure 9: Balance for propensity score algorithms



(1) Nearest 1 neighbor
(2) Nearest 1 neighbor without replacement
(3) Nearest 1 neighbor
(4) Nearest 1 neighbor without replacement
(5) Nearest 2 neighbors
(6) Kernel (bandwidth=0.002)
(7) Radius (caliper=0.06)

Among the PSM cases, the nearest 1 neighbour without replacement algorithm offers the best match, and the ATT estimator is statistically highly significant. [4] To confirm the balance achieved by algorithm (2), we conducted a t-test of mean difference in the most important covariate, the area planted to groundnuts. The result showed that the percentage bias between the treated and control groups reduced from 63.8 to 11.2, the t-statistic from 5.51 to 1.10, and the *p*-value from 0.000 to 0.274, which confirms the validity of this matching.

Table 8 shows the results of the matched regression using the selected matching algorithm. The women's Weighted Gender Control Index ($WGCI_f$) is positively related to membership of a sheller group, and the coefficient is statistically significant at the 5 % level. This implies that the machine sheller increases women's control over groundnuts. Other covariates also significantly affected women's control. In polygamous households, women may be more influential than those in monogamous households. As spouses become older, women exhibit more control. On the other hand, the older husbands are than their wives, the less control is held by women. In Zambia, older couples are more likely to have separate economic activities (Harrison, 2000: 58). Higher rates of adoption of improved seeds result in lower control for women, suggesting that men's active participation in farming decisions reduces women's control.

Table 8: Result of Matching Regression (nearest 1 neighbour without replacement)

Dependent Variable: Women's Gender Control Index ($WGCI_f$) for groundnuts				
Treatment Variable: Sheller Group (yes=1)				
Matched Regression	Variable	Coefficient	t-statistic	*p*-value
F (13, 158) = 2.58	Sheller Group (yes=1)	6.56	3.17	0.002
p-value = 0.003	Area planted to groundnuts	1.82	1.37	0.172
R^2 = 0.175	Spouses of same religion (yes=1)	0.88	0.41	0.681
	Husband has official position in EPFC group (yes=1)	-2.00	-0.53	0.594
	Wife has official position in EPFC group (yes=1)	1.80	0.48	0.632
	Polygamy (yes=1)	10.71	2.31	0.022
	Sum of age	0.11	2.00	0.047
	Gap in age (age of husband – age of wife)	-0.37	-1.79	0.076
	Sum of experience with groundnuts	-0.11	-1.42	0.157
	Gap in experience with groundnuts Experience of husband – experience of wife)	0.09	0.28	0.782
	Household size	-0.37	-0.74	0.462
	Household adult female ratio	-31.60	-1.71	0.089
	Area planted to improved seed, all crops (%)	-8.57	-2.16	0.033
	Constant	59.69	5.68	0.000

Although the area planted to groundnuts is a key determinant of receipt of treatment (i.e., provision of machine shellers), its effect on women's control is not statistically significant. Moreover, replacing area planted to groundnuts with the volume of groundnuts sold also

[4] In many cases, however, matching with replacement gives better balancing than matching without replacement.

gives an insignificant coefficient (p = 0.307). Since neither the area planted to groundnuts nor the amount of groundnuts sold is negative or statistically significant, this suggests that the commercialization of groundnuts does not reduce women's control.

Table 9 summarizes the Rosenbaum bounds for the ATT. The table shows the gamma values at two critical levels (just below and above the upper bound significance level of 5 %) in multiples of 0.1. The critical level of Γ at which we would have to question the identified ATT is between 1.9 and 2.0, i.e. if an unobserved covariate caused the odds ratio of treatment assignment to differ between the treatment and control groups by a factor of about 2.0. For the selected algorithms, it would require a hidden bias of Γ between 1.2 and 1.3 to render the ATT spurious. Note that Rosenbaum bounds indicate the worst case scenarios. Low values for Γ do not necessarily mean that the ATT is insignificant, weak, or unreliable (DiPrete and Gangl, 2004).

Table 9: Rosenbaum bounds for the ATT

	Matching Algorithm	Γ	sig+	sig-	t-hat+	t-hat-	CI+	CI-
(2)	Nearest 1 neighbor without replacement	1.2	0.029	0.000	3.846	6.759	-0.120	10.894
		1.3	0.056	0.000	3.278	7.525	-0.614	11.685

N = 86 matched pairs
gamma - log odds of differential assignment due to unobserved factors
sig+ - upper bound significance level
sig- - lower bound significance level
t-hat+ - upper bound Hodges-Lehmann point estimate
t-hat- - lower bound Hodges-Lehmann point estimate
CI+ - upper bound confidence interval (a = 0.95)
CI- - lower bound confidence interval (a = 0.95)

4 Discussion

These results raise questions regarding mixed methods, the impact of commercialization on gender relations, and the meaning of 'women's crops'.

Mixed methods

Although results for both FGDs and the household survey identified groundnuts as a 'women's crop' and cotton as a 'man's crop, the results from FGDs were more extreme, with women perceiving greater control over groundnuts and less control over cotton (Figure 3). Similarly, whereas women in FGDs saw 80% of key decisions for groundnuts as dominated by women, those in the household survey saw decision-making as dominated by men (with only 20% of decisions dominated by women) (Figure 4). Again, women in FGDs claimed reciprocity between their control over groundnuts and men's control over cotton. "*If a woman wants to plant 50 kg of groundnut seed, men won't allow it and say it's too much, but they will plant 50 kg of cotton seed. So we don't allow then to deny us, since we don't deny them for cotton*" (Kapenya). *"Women control land for groundnuts because men dominate decision-making on land for maize"* (Kapenya). But the household survey showed that the reverse was true: women with greater control over groundnuts also enjoyed greater control over cotton and maize (Table 5).

How can we explain these differences? Women in FGDs might have exaggerated their control over groundnuts for several reasons. FGDs offered women an opportunity to defend their 'right' to control over groundnuts as a 'women's crop'. "*We make a bowl of peanut butter for the men and the children. The rest is for us. It's our money*" (Kapenya). "*Men neglect groundnuts, but when it's time for marketing they start interfering*". (Kazingizi). "*Men come with a bleeding heart, not forcibly, but know that if they come humbly their wife will increase the amount of money from groundnuts she will give them*" (Kazingizi). By contrast, FGDs also offered men an opportunity to stake claims for greater control over groundnuts as they became more commercialized. "*Next year if the market is good, we will take total control of groundnuts*" (Kagunda).

Women resisted these claims, defending their 'right' to groundnuts, on the grounds of their greater workload. "*If men want a few peanuts to eat, they will help, but that's all, they don't feel it's their job to weed groundnuts*" (Kazingizi). "*Few men pay attention to the groundnuts field. When you work there, that's when your husband takes a bath and goes to drink beer*" (Kapenya). "*Men won't even bother to step there*" (Kapenya). "*My husband would rather weed cotton than groundnuts*" (Kapenya). This argument is supported by the results from the household survey, which shows a significant correlation between women's share of the workload for groundnuts and control (Table 6). This implies that 'women's crops' are associated with the relative amount of labour that women contribute to the crop, as well as control over decision-making. In general, the relative contribution to labour is strongly associated with influence on decision-making in farming processes.

Women in FGDs might also have downplayed their control over cotton to legitimize their right to groundnuts*. "No matter what you say, cotton is up to the men"* (Kapenya). "*You can't even say anything about hired labour for cotton, it's a man's crop. That's the way marriages end*" (Kazingizi). As for control of cotton sales, "we *can't even try*" (Kapenya). "*They don't even tell you they've sold cotton. You count 10 bales then you see that two bales have gone, but they*

don't even mention anything about the money" (Kizingizi). "*Cotton gives ownership of money to go and drink beer and even marry another wife"* (Kapenya). Women's role was simply to provide labour. "*You can work a few days on the groundnuts but the rest of the time you need to weed cotton. You can't even say anything*." (Kazingizi). By contrast, men saw more decisions for cotton as made jointly with women (Figure 5).

Another reason for contrasting results between FGDs and the household survey is group pressure. 'Women' are not a homogeneous group. Women in FGDs may have felt compelled to show solidarity with others or been influenced by more vocal members of the group, or deferred to the views of older, better-off members with more to lose if they lost control over groundnuts. The 'Asch effect', where members subordinate their own judgement to that of the group, is well known to social psychologists (Asch, 1955). Although Participatory Rural Appraisal (PRA) relies heavily on small groups, however, group dynamics have not received systematic treatment in the development literature.[5] A trawl through all 66 volumes of *Participatory Learning and Action* yielded not one study of how such dynamics affected the results from FGDs. Where gender rights are at stake, FGDs may polarize opinions. However, experience using FGDs resolve conflicts of interest remains 'a frontier for participatory methods' (Chambers, 1994: 1445). This would make an interesting topic for further research.

Mixed methods often produce contrasting or even conflicting results (Davis and Baulch, 2011). Other studies on gendered decision-making have noted discrepancies when using different methods (von Bulow, 1992: 543). Decision-making is a complex process that is not easy to capture qualitatively let alone quantify. Data on household decision-making are 'simple windows on complex realities' that show the direction of control rather than exact measurements (Kabeer, 1999: 447). In the words of one woman participant, decisions about control are 'bedroom decisions', a private matter between husbands and wives. Although researchers consider them informal, for villagers FGDs are in fact a formal, very public arena, where the views expressed are normative (what 'ought to be') rather than 'what is' (Mosse, 1994: 508). The value of FGDs on 'women's crops', therefore, was to make these 'bedroom' decisions visible and bring normative views on 'women's crops' into sharper focus.

Commercialization and gender relations

Contrary to expectations, women did not perceive the machine sheller and commercialization as reducing their control over groundnuts. Instead, the sheller increased women's perceived control, while commercialization (in the form of increased area planted or volume of sales) had no significant effect (Table 9). Women in EPFC groups with access to the machine sheller had greater levels of control over key decisions like harvesting and use of crop income (Figure 6).

[5] The original Asch experiment involved a group of seven to nine men, all but one of whom were primed give the incorrect answer. Group pressure resulted in incorrect answers by the minority group member in 32 % of cases. Further experiments revealed that the minority member gave the same percentage of incorrect answers when the majority against them was only three to one (Asch, 1955).

Insights from FGDs help explain these quantitative results. Firstly, shelling groundnuts by machine significantly reduced women's workload. In one day a machine sheller did the work of 20 women.[6] However, mechanization also opened the door to men's control. "*Men got interested in the machine. Women will shell one bag a day then stop and do household chores, but men can spend the whole day shelling 20 bags. When it was shelled by hand, men had no control*" (Kagunda). However, women had no objection to sharing control for shelling. *"Women decide to use the groundnut sheller because they know that men will not help shell by hand".* "*While women cook, men can be busy doing the shelling"* (Kagunda). Thus, women in villages with machine shellers were happy to relinquish some control over the arduous task of hand shelling groundnuts in exchange for access to men's labour. In addition to shelling, men now searched for improved seed, checked if groundnuts were ready for harvesting, and provided a bicycle or ox-cart to take groundnuts to market.

Men exerted strategic control over groundnuts through their right to land. Eastern Province lies within Africa's 'matrilineal belt', where marriage is uxorilocal and land is inherited from mother to daughter (Lancaster, 1976).[7] However, when in 1941 Africans from overcrowded reserves were re-settled in Chipata district on land alienated by the Crown and the North Charterland Concession, the colonial state vested rights to land in male village 'headmen' who gave usufruct rights to male heads of household (Pletcher, 1979; Skjonsberg, 1989: 26). Consequently, although most villagers belonged to the matrilineal Chewa tribe, marriage was usually virilocal ("*A woman doesn't come with land*") and land was owned by men. This gave men control over how much land women could plant to groundnuts. Although women did not challenge men's right to land, they argued that giving women more land to plant groundnuts would benefit the whole household. "*We don't come with land but if we have control of land other decisions will be easier to make*" (Kazingizi). "*You cannot talk of cash income from groundnuts if you don't have control over land*" (Kazingizi). Higher prices for groundnuts had made men more receptive to this argument. However, men could also use improved access to land as a bargaining chip to claim greater control over income from groundnuts.

Women had the right to ask for their own fields, on which they enjoyed full control over the crop (Box 1). However, such fields were uncommon. In 1985-86 they accounted for 13 % of the total area planted to groundnuts and legumes, but only 6 % where households were headed by men (Kumar, 1994: 46-48). For maize in 2010-11, men controlled 95 % of the area planted on the largest maize fields, whereas their wives controlled just 5 % (Shipekesa and Jayne, 2012: 5). Women invoked this right for various reasons, but usually where husbands had broken the conjugal contract (Skjonsberg, 1989: 34; Harrison, 2000: 58).

[6] The machine sheller used by EPFC seed producer groups is operated by three people and can shell four 50 kg bags in one hour or 32 50 kg bags in a working day of eight hours, averaging 533 kg per person. In one eight-hour day a woman can shell 25 kg by hand. Thus, in one working day the machine sheller does the work of 20 women. Farm Management data from Eastern Province in the 1970s show that it required 2,426 hours ha^{-1} to cultivate groundnuts, of which 950 hours (39%) was spent on shelling (Skjonsberg, 1989, p. 46 note 9).

[7] The prevalence of matrilineal inheritance in this region has been attributed to the tsetse fly, which prevented the accumulation of cattle for bridewealth exchange, and a higher incidence of slavery, with female slaves used to attract male settlers and increase the population under a chief's control (Lancaster, 1976: 549).

Women justified this not as a demand for greater autonomy but as a way to meet family obligations. However, it was granted on condition that it production on fields that were cultivated jointly did not suffer, and could be revoked. Thus, by giving men the right to their wives labour, the conjugal contract also set limits on how much land women could cultivate independently. Separate fields are more common for cash crops (Harrison, 2000: 58). Consequently, the right to a field of their own gave women another way to keep control over the income from groundnuts.

Men’s access to cash income gave them more control over hired labour and over inputs. ”*You can’t cultivate a big area if you don’t have control over* ganyu” (Kazingizi). Cash also gave men control over inputs. “*Men control inputs for maize because they have money in the pocket. It’s not possible for women to keep money for so long until August. It your husband finds out it will create conflict*” (Kapenya). “*Men have more control over seed selection because there are an increasing number of companies that sell seed, and men provide the cash to buy*” (Kagunda). Women’s lack of ready cash forced them to pay hired labour in kind. “*They keep groundnuts from previous season to hire workers. They give a certain measure of nuts against a certain portion of land to be cleared*” (Stephen). Once again, male control over cash limited the potential for women to expand groundnut production without help from their husbands.

Women were therefore engaged in a difficult balancing act: keeping their ‘right’ to control over groundnuts while reducing their own workload by using men’s labour for shelling, which in turn exposed them to male ‘claims’ for greater control. But women were in no doubt that they had the best of the bargain. “*Men now do shelling. They never used to do that”. “Men never used to help us but now they know there’s money, they have joined us, so we are very happy*” (Kazingizi village). Thus, women saw reduced control over shelling not as losing control but as liberating them from drudgery.

Box 1. Women's Fields

Although land in Eastern Province is generally owned by men, wives may be given their own fields. We interviewed four women in Kagunda village to learn how this affected women's control. All four women were groundnut growers and members of an EPFC Seed Production Group. They were not intended to be representative but to illustrate the varied household-level processes that determined whether women had a groundnuts field of their own.

Code	Age	Years married	Years with own field	Area planted to groundnuts (acres)	
				Own	Joint
A	38	15	3	2	7
B	42	23	1	1.5	4
C	38	3	0	0	5
D	37	12	2	3	2

Why did women want their own field? Women wanted their own field to control the income from groundnuts, which they could spend as they liked without consulting their husbands. However, they had different reasons for wanting control. Mai A wanted to support her parents back in her natal village (husbands helped their own parents) and also to buy items she liked. Mai B had a drunken husband who broke the conjugal contract by squandering the income from groundnuts, so she needed control to pay for essentials like school fees. Mai C wanted to buy consumer goods from village traders (*malonda*) without having to wait for her husband to agree. Mai D objected to what she saw as her husband's extravagance on DVDs and batteries rather than on essentials like school fees and children's clothes. Thus, the motives ranged from to ring-fencing expenditure on basic household needs to meeting social obligations and buying small luxuries.

How did they acquire their own field? All four women agreed they had a right (*ufulu*) to ask for a field of their own, but they also agreed that men had a right to refuse this request or to take the field back. Mai A convinced her husband that yields on their joint field would not be affected, and budgeted so she could hire labour for her own field at peak periods. Mai B asked her parents and parents-in-law to force her husband to give her a field for groundnuts, while he kept control of the income from cotton and maize was cultivated jointly. Mai C agreed to work on her own field only after work on their joint field was over. Mai D's husband married into the village (the *chikonwene* system) which gave her more control over how land was allocated. She and her husband agreed to have separate groundnut fields, but to work on each other's fields in rotation.

Conclusion: A field of their own gave women full control over crop sales. Women still had to prioritise work on joint fields, because the right was conditional on production on joint fields being unaffected. Nevertheless, the right to ask their husbands for land shows how women can use 'custom' to increase their control over groundnuts and also the power of social institutions to influence how the benefits from commercialization are shared.

Source: Household case studies, Kagunda village, 2014

Women's crops and 'the power to name'

Our results confirm previous research on the absence of a clear gender division of labour for crops in SSA. None of the four crops analysed were grown exclusively or even primarily with women's labour.[8] However, our results provide evidence for a gender division of control, particularly for groundnuts and cotton.

'Women's crops' are part of a wider system of beliefs on gender roles. Among the matrilineal Chewa, crop agriculture was historically the concern of women because men were away for long periods occupied in hunting and trade (Morris, 1988). Although our survey area was no longer matrilineal, the older culture was reflected in traditional beliefs about gender roles. Women were responsible for the daily meal, and for the relish crops. Responsibility for maize, the staple food crop, was shared between men and women. Men were responsible for providing cash for essential items and for buying maize when it ran out.[9] As elsewhere in eastern Africa, the association of cash income with men goes back to the colonial period, when the imposition of hut tax forced men to supply labour for wages on white-owned farms and mines (Pletcher, 1979).

Women in FGDS echoed these traditional beliefs. "*Groundnuts are a food, so we control food for the household"* (Kapenya). "*Maize [decision-making] is always 50:50 because it's food for the family"* (Kazingizi). "*Maize is a critical crop. If a man decides not to keep some bags to eat, it's his responsibility to find piece-work to earn cash to buy maize*" (Kapenya). "*When we need income quickly, we decide to use the sheller. The man is responsible for bringing in cash income*" (men's FGD, Kagunda). "*Men have to make sure there's money in the house. That's why they're interested in groundnuts*" (Kazingizi). Hence, the conjugal contract acts as a reference point both for women defending their right to groundnuts and for men staking claims to the cash from groundnut sales.

This also helps explain why men take over 'women's crops' as they become commercialized. At one level the motivation is economic, the wish to boost income. At a deeper level, however, the motivation is cultural, to protect their identity as men. The representation of groundnuts as a 'woman's crop' reflects a cultural definition of gender in which cash for household needs is provided by men. The commercialization of women's crops challenges this definition by putting cash into the hands of women. From a male perspective, when women insisted that groundnuts should remain a 'woman's crop' they were usurping male identity. *This* explains why the subject of 'women's crops' aroused such strong emotions in FGDs, and why opinions were so polarised. An economistic view that sees gender conflicts in purely material terms misses this cultural dimension. Men take over 'women's crops'

[8] Similarly, the 2010 Crop Forecast Survey for Zambia showed that men and women provided equal shares of labour for maize and rice, while women provided 60 % of the labour for cassava (Shipekesa and Jayne, 2012: 3).

[9] Our main source for traditional gender roles and responsibilities in the survey area is the 1977 study of Kefa village (Skjonsberg, 1989: 37-38, 83, 88). Kefa is located 30 km from Chipata town, compared to an average of 50 km for our survey villages (Table 1). For similar traditions in other parts of Zambia, see Geisler (1993) for the southern region and Crehan (1983) for the north-west. We use the label 'traditional' in a restrictive sense because pre-colonial views of gender roles may have been very different (von Bulow, 1992).

because cash is part of what makes them men and commercialization should affirm this identity and not threaten it.

Commercialization threatens the conjugal contract because it reverses traditional gender roles. Women now find themselves growing a cash crop that rivals cotton. To maintain the conjugal contract, therefore, means re-thinking the status of groundnuts as a 'women's crop'. For some men, the solution is to make groundnuts a 'men's crop'. According to the men's FGD in Kagunda, *"Groundnuts are not necessarily a women's crop because it fetches a higher price than cotton". "Groundnuts are not a women's crop. This house was built with money from groundnuts".* For others, the solution is to make groundnuts a crop for both women *and* men. "*We never used to consider groundnuts as a crop for men but now this is changing". "It used to be a woman's crop. Now it's a crop for everyone"* (plenary, Kagunda). Women, on the other hand, were torn between wanting to retain control and the knowledge that without greater involvement by men they will be not reap the full benefits of commercialization. They rationalized their reduction in control by an ideology of altruism, seeing it as the price they must pay to bring greater benefits for the family. "*We thank men for coming in to help growing groundnuts, we can go higher and higher*". Nevertheless, the idiom they used was still one of men 'helping' women rather than being treated as equal partners.[10]

What we are witnessing, therefore, is a dispute over meaning. Commercialization threatens not just gender roles, but also the classification of groundnuts as a 'women's crop'. This classification is defended by women but contested by men, who see groundnuts taking on the attributes of 'men's crops'. This dispute over language and how words are used is also a dispute over control.[11] Control the meaning, and you control the product. Consequently, the commercialization of 'women's crops' results in heated debates over 'the power to name' (Carney and Watts, 1990: 230).

The 'power to name' uses a set of attributes that classify crops according to cultural beliefs about gender roles. We can see this most clearly in the introduction of new crops. When hybrid maize was first introduced in Zambia, its poor taste and storage qualities made it more suitable for sale, so it was named a 'man's crop' (Geisler, 1993). Similarly, improved cowpea in northern Ghana became a 'men's crop' because it needed chemical sprays, and knowledge of 'medicine' belonged to men (Padmanabhan, 2007). For 'women's crops' in Zambia, women in FGDs identified four attributes: (1) no market (ie. low prices) (2) little labour by men (3) used as relish and (4) needed patience because crops have to be shelled or picked from a pod. While men may not succeed in re-naming groundnuts as a 'men's crop' (based on the 'male' attribute of high market prices), they may succeed in re-naming groundnuts as somehow gender-neutral, like maize. "*Groundnuts are now the main cash crop. Husbands have to decide with their wives how to use the income from groundnuts. The decision has to be made jointly. Men deciding alone would mean the end of the marriage*"

[10] The idiom of men 'helping' (*thandiza*) women in crop production reflects women's historical role as the primary cultivators in matrilineal inheritance systems, and confirms the relevance of Boserup's model of African agriculture as a 'female farming system' (Morris, 1988: 51).

[11] We follow linguistic philosophers in believing that meaning does not consist in the object it names but in the way it is used in language (Skinner, 1969: 37-38).

(men's FGD, Kagunda). Re-naming groundnuts as '*a crop for everyone'* leaves open the thorny question of ultimate control.

Disputes over 'women's crops' are often framed in militaristic terms as a gender 'conflict' where men and women contest 'terrain', establish 'beach-heads' and turn households into 'battlegrounds' (Carney and Watts, 1991). This framing is based on the saga of irrigated rice in The Gambia, which has become the paradigmatic case of how commercialization disempowers women. The case of groundnuts in Zambia seems different, because commercialization does not deprive women of long-established customary rights to land and their own labour. Without such rights, women in Zambia must rely on their bargaining power. Instead of openly challenging men's strategic control over land or their right to income from cotton, women groundnut growers have adopted a strategy of bargaining and negotiation, welcoming greater male participation while seeking to retain operational and financial control. As elsewhere in Africa, the need for their labour puts women in a strong bargaining position. "*If a man just keeps and spends his money, women will not cultivate his [cotton] field next season*" (Bwanunkha). "*If my wife doesn't agree, we cannot grow cotton*" (Kagunda). Bargaining has proved an effective way for women to retain control as their crops become commercialized (Sorensen, 1996). Failing that, the 'weapons of the weak' - passive non-compliance, evasion, and deception - can be just as effective as open resistance (Scott, 1986). The outcome may therefore be determined by mutual interest rather than by victory for one side. As happened with women's vegetable gardens in The Gambia, what starts as a war of words over 'the power to name' can end in a compromise that leaves women with a significant degree of control (Schroeder, 1996).

Viewing women's crops as a 'dispute over meaning' also helps us understand why the FGDs gave extreme results. They created an 'intraface' or 'a social situation where men and women interact over the topic of assigning meaning' (Padmanabhan, 2007: 60-61). By problematizing the issue as one of 'women's crops', we created an arena where conflicts over meaning, gender roles, the conjugal contract, and gender identities were brought to the surface and given a voice. This public exposure of decisions that are usually hidden within the household ('bedroom decisions') proved explosive, as if we had lit a fuse. In future, we need to be aware of these dynamics. The Women's Crop Tool is not a neutral tool, like a crop calendar or a village map, but is about 'the power to name' and on this issue men and women cannot afford to be neutral.

6 Conclusion

The value of a tool depends on whether it is easy to use and whether it gives useful results. The Women's Crop Tool meets both these criteria. Its simplicity makes it flexible enough to be used either qualitatively in FGDs or as part of a quantitative household survey, while its application to groundnuts in Eastern Province, Zambia, gave results that have implications both for methodology and for the study of commercialization.

In terms of methodology, we obtained contrasting results when the Women's Crop Tool was used in a mixed methods approach. Specifically, when we used the tool in FGDs, women claimed greater control over groundnuts and less control over cotton than when we used the tool in a household survey.

We attribute the more extreme results from FGDs to two factors. The representation of groundnuts as a ‘woman’s crop’ depends on its gender attributes, which are culturally determined. When these attributes are changed by commercialization, the result is a dispute over meaning over ‘the power to name’ the crop. Disagreement between women defending their right to name groundnuts as a ‘women’s crop’ and men seeking to name groundnuts as a ‘men’s crop’ generated strong emotions and helps explain the polarized results from FGDs. Second, group dynamics play a role. Participants may have been influenced by other group members, particularly if they were in the minority and, since group members were from the same village, they may have deferred to members who were older or better off. Although FGDs are widely used in development, the literature on participatory methods has no studies on how such dynamics might affect the validity of the results obtained from small groups.

For the study of commercialization, we used the Women’s Crop Tool to test the hypothesis that commercialization reduced women’s control over groundnuts. The aggregate scores from the Women’s Crop Tool were used to construct a Weighted Gender Control Index, using data collected from 300 households. Contrary to expectation, the results showed that women did not perceive that mechanized shelling, increasing the area planted to groundnuts, or higher groundnut sales, reducing their control over groundnuts. Women have several ways to defend the status of groundnuts as a ‘women’s crop’. These include exploiting their economic power as suppliers of family labour, invoking ‘custom’ to obtain their own fields, and standing on the conjugal contract in which women provide relish for the family meal. The ultimate impact of commercialization on women’s control depends on these institutional factors and thus on the local context, which makes the final outcome hard to predict.

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Appendices

Appendix 1. Dynamics in women's control of goats in Zimbabwe

Sabine Homann-Kee Tui[1], Thabani Dube[1], Trinity Senda[2] and Andre van Rooyen[1]

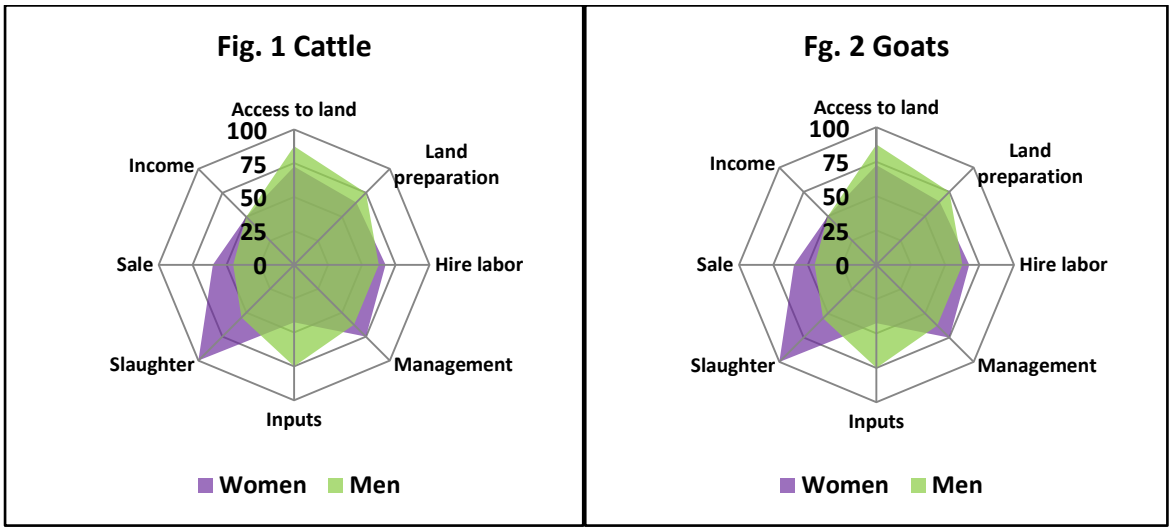
[1]International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), PO Box 776, Bulawayo, Zimbabwe[2] Matopos Research Institute, Private Bag K5137, Bulawayo, Zimbabwe

One of the most common questions posed by the research and development fraternity is how does market-oriented development affect women? Will our interventions help empower women or end up changing the balance of roles and responsibilities in rural communities for the worse?

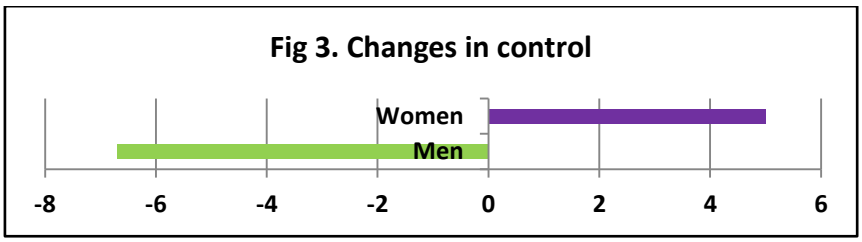
We used the gender tool to answer this question in semi-arid Zimbabwe's mixed crop livestock system. Most households in Zimbabwe own cattle and goats. Traditionally, cattle management was viewed as being in a man's domain with women tending to goats. Goats represent smaller bundles of cash that women use to pay for food, education or health-related expenses. One goat pays for 150kg of maize, the staple food, so selling four-six goats can provide enough food for a family for a year.

ICRISAT and partners have been working on improving the small stock sector for the last decade. Using an Innovation Platform approach allowed the various stakeholders including research, development, government and the private sector to work together to solve the bottlenecks along the value chain. The IP established auctions for goats and helped to raise funds to build sale facilities. Through discussions that encouraged the understanding of the roles of various stakeholders, the local government decided to reduce levies to encourage a higher turnover of animals, and large abattoirs sent representatives to buy goats from Gwanda. Today, most farmers sell goats at the auction as opposed to the farm gate. Farmers have also started to reinvest in their goat herds. Given these promising market developments, we wanted to now understand how, if at all, the role of women has changed.

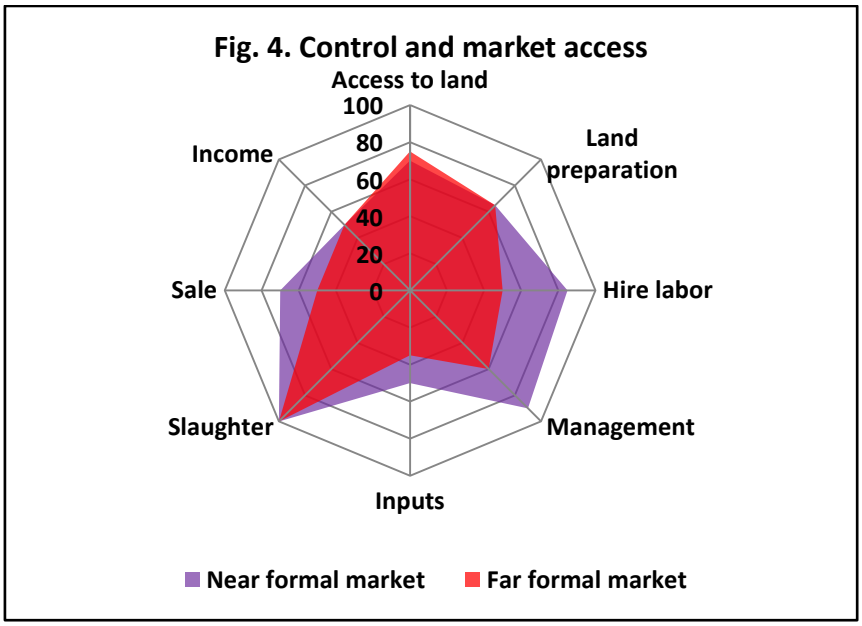
We used the tool with four groups with men and women present. When comparing the decision making for women and men over livestock, the tool showed us that men make more of the decisions over cattle, whereas women and men share the decisions over goats jointly (Figure 1, Figure 2). Of most importance is the fact that women have an equally strong say in when and where goats are sold and how the income from those sales are used. This confirms the fact that goats (unlike cattle) are an important livelihood strategy for women and their successful management of these assets will have a positive impact on the income and nutrition and food securities of their families.



Both women and men perceive that women make more decisions on goats than before (Figure 3). In other words, women have gained decision making power with regards to goats. They attribute this to the fact that men seek off-farm income, leaving women to manage the farms on a day-to-day basis. Both women and men see this as an advantage, a sharing of their mutual responsibilities to their families. They also see that women continue to grow in their ability to make these decisions as a result of training programs and market exposure.



While this result mirrors the general trend of men pursuing off-farm income with women making on-farm decisions, it was important to tease out the differences that may exist when comparing families living near well-established markets and those living far from those markets. This would pinpoint the specific effects of markets and the recent interventions. Figure 4 illustrates that market development has not restricted women's control over goats. In fact, it is to the contrary. Women living near the recently established formal goat markets feel that they have a stronger influence on decision making over goat marketing and sales as compared to the area far from formal markets, proving that the market development efforts have not hindered or harmed women's roles in their communities. They have actually helped women make better decisions and make greater gains from their livestock than before.



Using the gender tool helped us determine the effects of our interventions on the gender dynamics within households and confirmed that the Innovation Platform and market-led development approaches followed by ICRISAT and partners have benefitted women positively. These sorts of approaches with particular care placed on understanding the gender dynamics will be key methods to shape research and development interventions to better serve the needs of the many African women farmers.

Appendix 2. Applying the ‘Women’s Crop Tool’ in FGDs.

Step 1.Choose crops for analysis. They should be crops that are widely grown and with which farmers are familiar. Second, they should include at least two crops that are widely recognized as ‘men’s crops’ or ‘women’s crops’ that can provide a benchmark against which other crops can be measured. Four crops are recommended as the most that should be attempted in one exercise and fewer if you want to include more decisions.
Step 2. Prepare the diagram by drawing the circles, the boxes, and naming the crops before you go to the field.
Step 3. Agree on the definition of ‘control’ that will be used in the exercise. This should be done in the plenary session before splitting into men’s and women’s groups, so that both groups use the same definition. Emphasise that you are not asking about ‘participation’ or the share of labour they contribute to each crop, but about their power to make decisions.
Step 4. Complete the boxes for ‘control’ using scores of 0-100 (percentages) or 0-10. You can either complete one crop at a time or complete each key decision at a time. We tried both methods and there does not seem to be much difference between them.
Step 5. Once you have completed the scores for each crop, move to scoring the importance of each individual decision. The objective here is to obtain a set of weights to use in constructing an overall index. We used a scoring of 0-5 for this component. This scoring is generic, rather than for an individual crop. Which decisions is it most important to control and why?
Step 6. Once you have completed the generic scoring, ask about recent changes in control for the crop you are particularly interested in. Changes can be shown as arrows up or down or an equal sign for no change. For decisions where groups identify a change in control, ask them to specify what this means by giving concrete examples.
Step 7. When each group has finished, reconvene in plenary to compare results and let each group ask the other questions. Ask one member of each group to present results for their group. To save time, restrict the presentation of results to one crop that you are particularly interested in.

Lessons from experience

1. The exercise takes time. The complete exercise took about 2 ½ to 3 hours. We provided soft drinks and snacks at the end to thank farmers for their participation.
2. Each group requires a facilitator, a note-taker, and someone to take photographs while discussions are in progress. Voice-recorders are useful for capturing how groups reach a decision and direct speech.
3. Groups start slowly but will complete the decision-making boxes quite quickly once they get the idea.
4. Limiting the size of the group to eight improved participation and quality of the discussion.
5. Continually remind groups about the difference between ‘participation’ in activities and ‘control’ `over decisions.
6. At Step 4, it is often difficult to obtain convincing explanations on figure, e.g., explaining only the difference across crops but not across aspects, or vice versa.
7. At Step 5, participants tended to misinterpret what they are expected to answer, e.g., answering the feasibility of actually acquiring control rather than the potential positive impact or importance. It is necessary to carefully monitor the situation.
8. The plenary session at the end added little new knowledge but was important to bring the two groups together.

Appendix 3. Applying the ‘Women’s Crop Tool’ in Household Surveys.

In the last crop season (2012-2013), what was the level of influence of household head on decision making on the following matters? Answer what level (%) of “decision making” or “control” does the household head have over these decisions? Give the percentage. (For example: 0% means spouse only, 10%-40% means spouse leads, 50% means you and spouse equally, 60%-90% means you lead, 100% means you only)

For groundnut, has the level of control increased, decreased, or stayed the same over the last three seasons? Circle one.

	Activities for decision-making	**Household Head’s Control**							**Remarks**
	Choice of crop								
A111	What crop to grow in the field	%							
		Maize	**Groundnut**				**Cotton**	**Sunflower**	
		1	2	3			4	5	
A112	Seed selection (local seeds)	%	%	↑	=	↓	%	%	
A113	Seed selection: (improved seeds, hybrid)	%	%	↑	=	↓	%	%	
	Management								
A114	How much land to cultivate	%	%	↑	=	↓	%	%	
A115	Use of draft power	%	%	↑	=	↓	%	%	
A116	Use of family labor	%	%	↑	=	↓	%	%	
A117	How much/when to spend on hiring labor	%	%	↑	=	↓	%	%	
A118	How much of chemicals to buy (fertilizer/pesticide/herbicide)	%	%	↑	=	↓	%	%	
A119	When to apply chemicals (fertilizer/pesticide/herbicide)	%	%	↑	=	↓	%	%	
A120	When to weed	%	%	↑	=	↓	%	%	
A121	When to harvest	%	%	↑	=	↓	%	%	
A122	When to carry from field to storage	%	%	↑	=	↓	%	%	
	Post-harvest								
A123	When to shell (kutongola)		%	↑	=	↓			
A124	How long to dry	%	%	↑	=	↓	%	%	
A125	When/how much to sell or store	%	%	↑	=	↓	%	%	
A126	Use of crop income	%	%	↑	=	↓	%	%	