



Improved Agricultural Technology Adoption in Zambia: Are Women Farmers Being Left Behind?

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Key Points

1. Generally, there is low adoption of improved technologies (fertilizers, hybrid seed, herbicides and animal traction) among smallholder farmers, however it is more severe on plots controlled (owned) by women.
2. The low adoption of improved technologies is attributed to limited access to productive resources, significant difference in access to agricultural extension services, credit, and land between men and women farmers.
3. The results show that there were significant differences between females in male-headed households compared to those in female-headed households. Females in male-headed households were more likely to access agricultural credit and adopt hybrid seed and fertilizer compared to women in female-headed households.
4. In general, the technical efficiency in maize production and yield on plots owned (controlled) by men was higher than that of women. However, the differences in the level of technical efficiency and the yield gaps are mostly explained by the disparities in resource endowment rather than the gender of the farmer.
5. To address the liquidity constraints faced by farmers there is a need to have supportive policies to enable the private sector and farmer organizations to better develop credit systems tailored to small-scale farmers.
6. The government should channel more resources towards extension services to improve the extension system.

INTRODUCTION: Adoption of improved technologies among smallholder farmers in Zambia is low. And literature on agricultural productivity has attributed the low yields experienced by smallholder farmers to the non-adoption of improved technologies. The situation, however, is more severe among the female farmers compared to their male counterparts. The productivity of women in agriculture depends heavily on their opportunity to access productive resources such as land, credit, extension and other technologies (Ragasa 2012). Despite the significant role of women in agricultural production, they have limited access to productive resources (land, labor, credit and extension) compared to men. The gender-related constraints and unequal access to productive resources often undermine agriculture production in rural areas. The literature on adoption of new (improved) technologies has recognized that access, ownership, and control over productive resources are critical elements in determining the farmer's capacity to adopt such technologies. Further, the financial

constraint among women farmers has negative implications on their technology adoption decisions. It has also been observed that in most developing countries, women farmers face cultural restrictions in accessing land than men, and also they control land that is of poor quality with insecure tenure (FAO 2010). Therefore, the links between gender and technology adoption will vary across cultures. For instance, traditionally, in most parts of Zambia, married women cannot own land independently—they have to access land through a *conjugal contract* with their husbands. However, if a woman is either divorced or widowed or single and there is no adult male in that household, they can then request for land from the village headmen. This study, therefore, takes into account the local dynamics in identifying the underlying factors that affect adoption of improved technologies among women farmers. By taking into account the gender of the household head, the study examines the adoption patterns of women in male and female-headed households. For example, if men and

women face the same constraints, but their rate of adoption of new technologies is different, then it will be imperative to design technologies that best fit the needs of each group. However, if the difference in the rate of adoption is because men and women face different constraints, then it will be important to address this unequal access to such complementary inputs in order to promote broad-based agricultural growth among all smallholder farmers (Doss and Morris 2000). A review of gender differences in agricultural productivity by (Quisumbing 1996) and (Udry et al. 1995) found that there were no significant differences between men and women farmers. The yield differences, however, were caused by differences in the intensity with which inputs such as labor, manure, and fertilizer was used on plots controlled by men and women.

DATA AND METHODS: The data used in this study primarily comes from two waves of Rural Agricultural Livelihoods Surveys (RALS conducted by the Indaba Agricultural Policy Institute (IAPRI) in collaboration with the Zambia Central Statistical Office (CSO) and the Ministry of Agriculture and Livestock. It covers the 2010/11 and 2013/14 agricultural season. Estimates from this data were supplemented with data from focus group discussions (FGDs) held in Eastern, Southern, and Central Provinces. Two districts were purposively selected in each province and in each district; two FGDs composed of both male and female smallholder farmers were conducted. The group sizes ranged from 6 to 15 members. A total of 120 participants were involved in the FGDs in all the six districts, of which 72 were male and 48 were female. Various econometric models were estimated using the RALS panel data to identify factors influencing technology adoption and technical efficiency of smallholder farmers in maize production by gender of the farmer. For more details on the data description and methods see (Namonje-Kapembwa and Chapoto 2016).

FINDINGS: Five key findings emerged from this study as follows:

First, there is low adoption of improved technologies among smallholder farmers in Zambia and the adoption rates among women farmers is much lower compared to men. Apart from improved seed use, adoption rates for fertilizer, herbicides, and animal traction use are less than 50 percent. The descriptive analysis results in Table 1 show that there is a significant difference in the technology adoption rates on plots managed by men and women. On plots controlled by men,

farmers were more likely to use fertilizer, hybrid seed, herbicides, and animal traction compared to plots owned by women. For instance, on fields controlled by men, farmers were 10% more likely to use fertilizer and improved seeds compared to plots controlled by women. Further, the results show that women in male-headed households were more likely to use fertilizer, animal traction, and herbicides compared to women in female-headed households. However, the rate of adoption of improved seed is not statistically difference between female farmers in male- and in female-headed households.

Table 1. Technology Adoption by Gender

Type of Technology	Fields for all HH	Fields for Male Farmers	Fields for Female Farmers	---Female farmers in ---	
				Male-HH	Female-HH
	A	B	C	D	E
Number of Cases	23,494	17,140	6,354	2,044	4,310
Fertilizer %	25.60	27.44	18.29	21.68	11.20
Improved Seed %	53.53	57.06	45.71	44.84	45.05*
Herbicides %	14.1	13.26	10.79	13.12	9.01
Animal Traction %	36.50	38.10	33.75	35.71	32.06

Source: RALS 2015. Notes: T-test was done to compare differences between groups. * indicates cases that are not statistically significant at 10%.

Second, results in Table 2 shows the disparities in access to agricultural resources by gender of the farmer. On average male farmers in Zambia have more access to agricultural resources such as land, labor, credit and other productive assets compared to their female counterparts.

Table 2. Access to Productive Resources

Variables	All Farmer	Male Farmers	Female Farmers	----Female farmers in -	
				Male-HH	Female-HH
	A	B	C	D	E
Landholding size (ha)	4.10	4.45	2.93	3.13	2.71
Adult equivalent	4.90	5.16	4.03	5.02	3.85
Hectares cultivated (ha)	1.26	1.37	0.87	0.91	1.07
Member of cooperative (%)	51.9	54.40	43.9	46.01	44.00*
Value Assets	13,306	15,000	7,699	3,569	6,645
Access to extension (%)	73.70	74.70	68.01	74.00	69.30
Access to credit (%)	18.50	19.90	13.80	16.80	13.30*

Source: RALS 2015.

Notes: T-test was done to compare differences between groups. * indicates cases that are not statistically significant at 10%.

The literature on technology adoption has highlighted that the differences in access to productive resources affect the rate of improved technologies adoption. It should also be noted that women in male-headed households do better regarding access to productive resources compared to women in female-headed households. For example, women in male-headed households have more access to land, labor, and credit compared to women in female-headed households. The results on access to land may not be too surprising because most women in the rural parts of Zambia access land through their spouses or fathers and as such female farmers in female-headed households may have difficulties in obtaining land.

Third: Women farmers are less likely to adopt improved technology: Regardless of the gender of the household head, female farmers were less likely to adopt the use of improved seed, fertilizer, and animal traction compared to male farmers, except herbicides use. The results on herbicide use may indicate the willingness of women farmers to invest in labor-saving technologies for weeding since they tend to bear the brunt of weeding responsibilities disproportionately.

During the focus group discussions, farmers highlighted some of the benefits they have observed from using herbicides, one of which was the reduction in the amount of time spent on weeding. However, despite these known benefits, the adoption of herbicides is still very low, and the consensus from the farmers was that limited finances prevented them from adopting this technology.

When asked the reasons why female farmers were less likely to adopt improved technologies the farmers indicated that female farmers used hybrid seed but also preferred local varieties for home consumption. They said, “It is assumed that the volume of mealie-meal (maize flour) produced from the local seed is much larger than what is obtained from the hybrid seed.” They also indicated that the maize produced from traditional varieties tasted and stored better than that produced from hybrid seeds. In addition, local varieties were much cheaper to produce because no fertilizer was required compared to hybrid seed. The seemingly low cost of production for local maize varieties and the belief that is held by some farmers has prevented some farmers especially women from adopting improved maize varieties and fertilizer. These results seem to conform to the findings that retention of traditional varieties is a common practice among female farmers whose production in most cases is limited

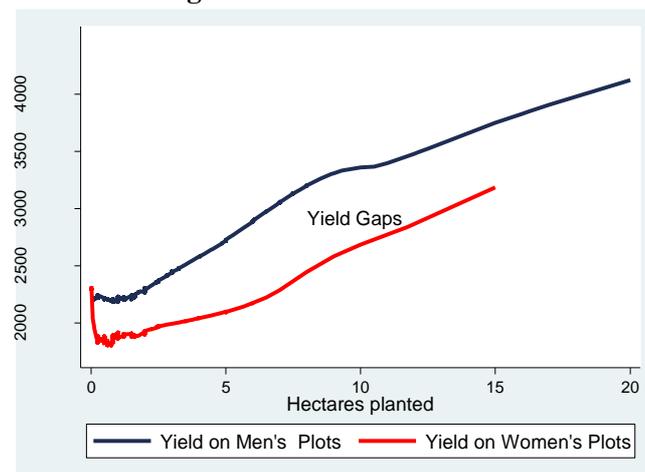
to home consumption and opposed to their male counterparts (Lunduka, Fisher, and Snapp 2012)

Fourth: Credit access enhanced female farmers’ adoption of hybrid seed: The results show that females in male-headed households who received credit were more likely to use hybrid seed compared to those females without any access to credit. These results suggest that removing liquidity constraints by making credit available to female farmers in female-headed households may help trigger more hybrid seed in Zambia.

Nevertheless, the farmers interviewed in the FGDs complained that there were limited credit facilities available for smallholder farmers (especially female farmers) in Zambia. Hence, their farming operations were not progressing due to liquidity problems. In cases where female farmers had access to credit, they could only be given very small loans that were usually too small to purchase animals or other farm equipment that could help them improve their asset base as well as efficiency in farm production. In general, commercial banks and other formal financial institutions in Zambia were reluctant to give loans to smallholder farmers who are often characterized by low levels of assets ownership and lack of collateral to secure the loans. Hence, it is important for public and private entities to find creative financial solutions to harness the assets that smallholder farmers have (Chapoto et al. 2015)

Fifth: Gender of farmer does not affect the farmer’s productivity. Furthermore, our results on gender differences in maize yield and technical efficiency show that the average maize yield on plots controlled by men is 3.78MT while on plots controlled by females its 2.75MT.

Figure 1. Maize Yield Gap between Male- and Female-Managed Plots



The estimated technical efficiency (the measure of effectiveness with which farmers (firms) utilize their inputs to produce a given level of output) on male- and female-controlled fields is 55% and 48% respectively (Figure 1). Factors found to contribute positively to maize productivity included access to credit, access to extension services, use of fertilizer and improved seeds. These factors explained the variation in both maize yield and technical efficiency in maize production on plots controlled by men and women. The variable gender of the farmer was not statistically significant and this, therefore, implies that the gender of the farmer does not affect the farmer's productivity.

CONCLUSION AND RECOMMENDATIONS:

Evidence from the study suggests that adoption of improved technologies among smallholder farmers is still low in Zambia especially among women. The main factors contributing to low adoption included limited access to productive resources. Therefore, closing the resource gap can largely improve the overall agricultural productivity among smallholder farmers in Zambia especially women.

To help increase the adoption rate of these technologies, government, and other stakeholders should consider: i) Promoting women participation in agricultural marketing as opposed to limiting their production to home consumption. The revenue generated from sales can then help accelerate the rate of adoption of improved technologies; ii) Dissemination of information about new technologies through field days, radio programs and extension visits can help improve farmers' knowledge about the technologies and therefore increase the rate of adoption; iii) Most smallholder farmers are faced with financial constraints, and this significantly affects their rate of adoption.

There is a need for supportive policies to enable the private sector and farmer organizations to develop better credit systems tailored to small-scale farmers; iv) Most smallholder farmers lack the technical capacity to benefit from improved technology fully; hence it is important to have well trained and up to date extension systems to help bridge the gap. However, Zambia like other countries in SSA is faced with underfunded, mostly understaffed and outdated extension systems. The government should, therefore, channel more resources towards extension services for the staff to be able to go into the field and interact with farmers, upgrade their extension systems as well as engage more officers to cope with the rising demand for extension services among smallholder farmers.

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