

GENDER-RESPONSIVE APPROACHES FOR ENHANCING THE ADOPTION OF IMPROVED MAIZE SEED IN AFRICA

A MANUAL FOR PLANT BREEDERS AND TECHNICIANS



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Table of Contents

Acknowledgments	i
Foreword	ii
Definitions	iii
1. Introduction	1
2. Plant breeding: What does gender have to do with it?	2
2.1 Why gender issues are important in agriculture and for plant breeding	4
2.2 Understanding gender roles and responsibilities in maize production	7
3. Gender-responsive participatory varietal selection	16
4. Gender-responsive approaches to promoting and disseminating new maize varieties	25
4.1 Gender considerations in contract seed production	25
4.2 Gender-responsive awareness creation and promotion of maize varieties	27
5. Creating a gender-responsive organizational culture for breeders	34
References	37

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The current on-going project Stress Tolerant Maize for Africa (STMA) was launched in 2016. The project aims to help farmers mitigate the combined effects of multiple stresses such as drought, heat, poor soil fertility and diseases that affect maize production and farming, to improve food security and smallholders' livelihoods across sub-Saharan Africa. STMA builds on strong partnerships formed in the Drought Tolerant Maize for Africa and Improved Maize for African Soils (IMAS) projects that achieved major successes in African maize seed systems. For more information, visit <https://stma.cimmyt.org/>.

CIMMYT - The International Maize and Wheat Improvement Center - is the global leader in publicly-funded maize and wheat research and related farming systems. Headquartered near Mexico City, CIMMYT works with hundreds of partners throughout the developing world to sustainably increase the productivity of maize and wheat cropping systems, thus improving global food security and reducing poverty. CIMMYT is a member of the CGIAR System and leads the CGIAR Research Programs on Maize and Wheat and the Excellence in Breeding Platform. The Center receives support from national governments, foundations, development banks and other public and private agencies. For more information, visit www.cimmyt.org.

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Foreword

Improved varieties of seed are a critical entry point for boosting agricultural productivity, enhancing resilience to climate change, and improving household incomes and nutrition. Plant breeders and technicians play a vital role in the process of transforming African agriculture by developing high-yielding, nutrient-rich, stress-tolerant crops and marketable crop varieties. Women make important contributions in agriculture in sub-Saharan Africa but have less access and control compared to men over critical agricultural resources, including quality seeds of improved varieties. CIMMYT seeks to develop maize technologies that are responsive to the needs and preferences of both men and women and is committed to improving women's access to improved maize seed from the formal seed sector. Through research undertaken by the Stress Tolerant Maize in Africa (STMA) and other projects, CIMMYT is working to close the gender gap in agricultural productivity. Through its work with maize breeders, seed companies and agro-dealers in Africa,

CIMMYT raises awareness of the specific constraints that women farmers face and provides these actors with the knowledge and skills to address these constraints.

This publication provides a resource to help maize breeders and technicians be gender-responsive at all stages in the process of developing new maize varieties. It provides practical suggestions on how to carry out participatory varietal selection (PVS) and gender-responsive approaches to promoting and increasing awareness of improved maize seed. The manual also highlights the importance for agricultural research organizations of going beyond promoting gender-responsive agricultural research to create a gender-responsive organizational culture.

CIMMYT is proud to contribute through this publication to developing a new breed of gender-responsive maize breeders and technicians in Africa.



Martin Kropff
Director General

Definitions

Gender: The socially and culturally-constructed ideas about what it means to be male or female in a particular society or context.

Gender gap: A disparity between women's and men's condition or position in society based on gendered norms and expectations.

Gender norms: Gender norms are unwritten social 'rules' which influence women's and men's roles and behavior. These norms can promote or limit the ability of women and men to maximize opportunities related to agricultural production, commercialization and other activities.

1.

Introduction

Breeding programs face the challenging task of developing crop varieties that are highly productive, marketable, nutritious and resilient to pests, diseases and climate change. At the same time, to ensure acceptability and widespread adoption, these materials need to meet the needs of the end users specifically smallholder producers and consumers. Most national breeding programs understand that farmers are highly diverse in terms of gender, wealth, and access to resources – all factors that influence their preferences for varietal traits. Many breeding programs, individual breeders and technicians grapple with the problem of how to ensure that the differences in trait preferences between men and women farmers are assessed, how to decide which preferred traits are a priority, and when women are an important beneficiary group. Moreover, some breeders may not be totally convinced about the importance of gender considerations in breeding.

This training manual, written for maize breeders and technicians, explains the importance of gender in maize breeding in Africa, and provides practical guidelines

on aspects of gender-responsive maize breeding. It does not, however, provide in-depth guidelines on gender-responsive breeding. The manual draws on the research carried out by CIMMYT and partners on gender, plant breeding and seed systems. It can be used by maize breeders and technicians to improve their knowledge, or by trainers as part of a broader training program for plant breeders.

The first section defines the concept of gender and why it is important for agriculture and plant breeding. The second section provides guidelines for carrying out participatory varietal selection (PVS), an approach used by many maize breeding programs in Africa, in a gender-responsive manner. Section three discusses ways to ensure that gender concerns are addressed in promoting and distributing improved maize seed. Based on the argument that gender-responsive breeding should be part of an overall effort to promote gender-responsive agricultural research, the final section suggests ways to create a gender-responsive organizational culture in agricultural research organizations.

2

Plant breeding: what does gender have to do with it?

The term gender is widely used but is often misunderstood. Gender refers to learned social roles and responsibilities associated with what it means to be a man or a woman in a particular society and context. Sex refers to the biological and physiological characteristics that define men and women. Sex and gender are not the same, although some sex characteristics may influence gender roles, while gender refers to learned social roles and identities associated with what it means to be a man or a woman.

Gender roles are shaped by culture, religion, and economic, political and social factors. They determine how responsibilities and resources such as land and livestock are distributed between men and women. Worldwide, women as a group face discrimination and inequalities in terms of not having the same access as men to resources such as land, and not being allowed to do things such as travel on their own, grow certain crops, do certain jobs, attend school etc. The concept of gender sees inequality between men and women as a problem rooted in power at both the personal level and at the level of society as a whole. It is important to understand that gender is not about women but about the relationship between men and women. Because gender is defined by society based on traditions and practices and shaped by economic and political factors that change over time, gender roles and responsibilities can and do change.

The concept of gender also recognizes that all men and women are not the same; they differ in terms of factors such as age, ethnicity, wealth, education, marital status, religion etc. For example, wealthy producers, whether men or women, may have sufficient land, labour and cash, whereas poor men and women producers may have less of these resources. According to the culture in some societies, however, women, whether wealthy or poor, are not allowed to travel on their own or go to secondary school.

Most gender-related development interventions target women. So why do we focus on women if gender means both men and women? Worldwide, women as a group face discrimination and inequalities in terms of access to productive resources such as land, and are restricted by cultural norms that limit their mobility, their ability to grow certain crops, engage in certain occupations, attend school etc. In order to ensure that women have equal opportunities and personal freedom, development programs and efforts tend to focus first on women to make sure there is a 'level playing field'. At the same time, it is important to engage with and involve men even where activities primarily target women to ensure their cooperation and involvement in transforming unequal gender relations.

Box 1: Sex and gender are not the same thing



Sex

Determined by biology: women give birth, have breasts and menstruate; men have testicles, facial hair and higher muscle mass.

Universal for all human beings

Unchanging, although surgery and other treatments can change sex characteristics

Gender

Constructed by society; in many societies, it is mainly women who are responsible for cooking and looking after the home

Differs between and within cultures: in many societies, both men and women can only have one spouse; in other societies, men are allowed to marry more than one woman, while in a few societies, women can have more than one husband

Changes over time; in the past in many societies, only men were allowed to vote, run for political office or drive

2.1 Why gender issues are important in agriculture and for plant breeding

Paying attention to gender issues in African agriculture is important for improving agricultural productivity and profitability, food and nutritional security, and for reducing poverty through empowering women. This is because worldwide, and particularly in sub-Saharan Africa, women play an important role in agriculture but face more severe constraints than men in accessing productive resources, services and markets.

Women make up nearly 50% of the agricultural labor force in Africa, with huge differences in this figure among countries and by crop. For example, women make up 36% of the agricultural labor force in Côte d'Ivoire

and Niger and 60% in Lesotho, Mozambique and Sierra Leone (FAO, 2011). In East Africa, it is estimated that women constitute just over 50% of the agricultural labor force. As Figure 1 shows, women's contribution to cereal production in Uganda, Tanzania, two regions of Nigeria and Niger ranges between 21% and 55%. Some African countries and other parts of the world have seen an increase in the proportion of females in the agricultural labor force in recent decades due to increased male migration, civil strife and HIV/AIDS (FAO, 2011).

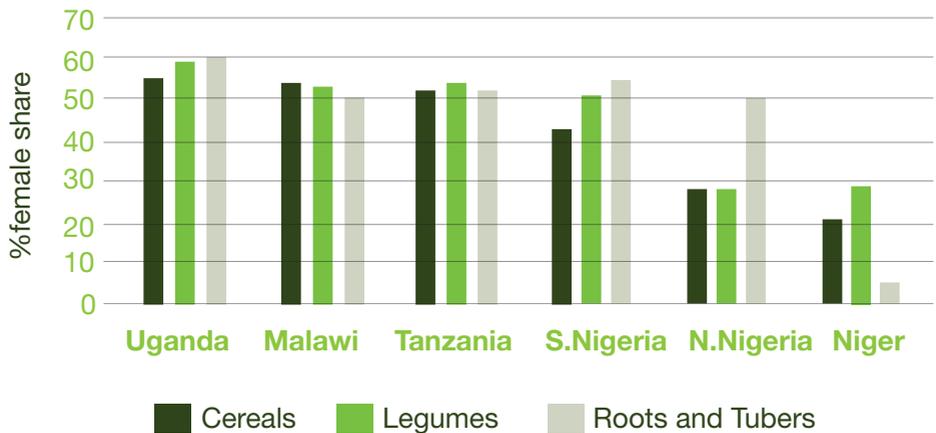


Figure 1. Female share of agricultural labor in cereals, legumes, and root and tuber crops in selected African countries, 2009-2011. Source: Palacios-Lopez et al., (2017).

Despite their importance in agriculture, women represent only 15% of land owners and often have access to smaller plots and land with poorer soil quality. Compared to men, women tend to have less access to labor (both household and hired) which leads to lower productivity. Generally, women have less access than men to extension and advisory services, technologies, inputs and credit. In Malawi, adoption of modern maize varieties was 12% lower for wives in male-headed households, and 11% lower for female household heads than for male farmers (Fisher and Kandiwa, 2014).

This 'gender gap' hinders women's productivity and reduces their contribution to the agricultural sector and to the achievement of broader economic and social development goals. FAO estimates that closing the gender gap in access to resources would enable women to increase yields on their farms by 20-30%, this would increase agricultural output in developing

countries by 2.5-4% and reduce the number of hungry people in the world by 12-17% (FAO, 2011).

Addressing gender issues is critical for improving food and nutrition security because men and women play different roles in providing food for their households. Women play a key role in food selection, preparation, child feeding and nutrition decision-making. Research also shows that increasing the resources that women control leads to improved child health, nutrition and education outcomes. Poverty reduction also needs to be addressed using a gender lens. Women typically have fewer assets than men (land, livestock, houses etc.) and use them differently. Improving women's ownership and control over assets (e.g. livestock, land, homes, equipment etc.) generates income for women and their households and leads to sustainable poverty reduction and self-reliance.



Women make up nearly

50%

of the agricultural labor force in Africa



Women represent only

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Given the importance of both men and women in African agriculture and their different roles and responsibilities, it is critical that breeding to develop high-yielding, nutrient-rich, stress-tolerant crop varieties takes into account the needs and preferences of both men and women producers and the different constraints they face.

Gender-responsive breeding requires:

- Acknowledging and understanding men's and women's needs and preferences
- Developing varieties that meet the preferences and needs of both men and women producers

- Being accountable to BOTH men and women producers
- Facilitating equitable participation of men and women along maize seed value chains
- Fostering a gender-equitable and supportive work environment for women breeders

The end results of gender-responsive breeding are higher rates of adoption and greater impact of improved varieties among a diverse population of producers.



Improving women's access to land, information, improved seed and other resources would enable women to increase yields on their farms by

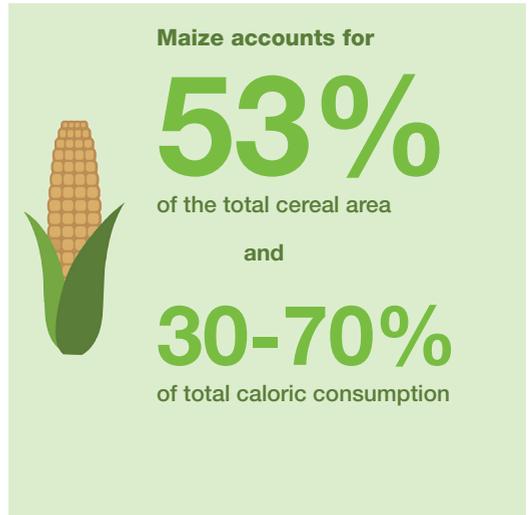
20-30%

This would reduce the number of hungry people in the world by

12-17%

2.2 Understanding gender roles and responsibilities in maize production

Maize is the most important food crop in sub-Saharan Africa, particularly in eastern and southern Africa where it accounts for 53% of the total cereal area (FAO, 2010) and 30-70% of total caloric consumption (Langyintuo et al., 2010). By 2025, maize will be the developing world's largest crop, with demand expected to double by 2050 from its present level in eastern and southern Africa. Gender-responsive breeding and research are needed to develop varieties and technologies that will boost productivity in maize-based systems, improve nutrition, and contribute to improved livelihoods. Since breeding programs have a national focus, breeders need to be aware of the different roles and responsibilities of men and women maize producers across cultures and contexts.



The following questions can help provide the information needed:

- What activities are men and women, male and female children involved in at each stage of production, post-harvest operations and marketing?
- On which plots is maize grown? Who manages/owns each plot? Who makes decisions on each plot? Who controls the harvest and earnings from the maize grown on each plot?
- Do men and women farmers have different preferences in varietal traits?
- Do men and women have different production and marketing constraints?
- Who is responsible for allocating maize for sale and for household consumption?

Key findings from research on gender and maize production in sub-Saharan Africa are summarized below.

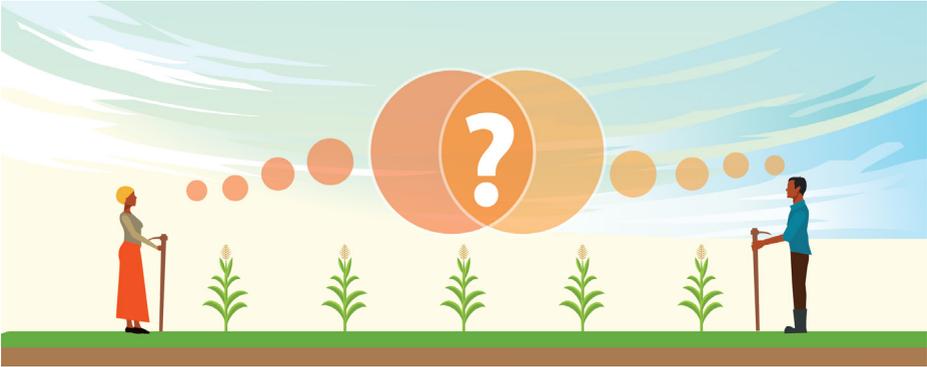


Maize: a man's or a woman's crop?

In sub-Saharan Africa, maize is grown by both men and women but the importance of the crop for each gender varies by location. Whereas in the past, modern maize varieties were perceived as a man's crop and local maize was seen as a woman's crop, the increased involvement of women in growing maize for the market, and the use of hybrid maize for both home consumption and sale, make this distinction no longer useful.

While women maize farmers may live in male-headed households or in female-headed households, the gender of the head of household tends to influence access to resources such as land, labor and information. Women in female-headed households tend to have less access to land,

male labor and information about modern technologies, which lowers their productivity. On the other hand, women farmers in male-headed households are often overlooked by researchers and rural advisory services, on the assumption that their husbands are the 'real' farmers and will pass on information to them. It is important to recognize that married women in male-headed households are farmers in their own right; they may have preferences about maize varieties and technologies that differ from those of their husband and do not necessarily receive technical information from them.



Where is maize grown?

It is important to know on which plots maize is grown and who manages the crop, as this has important implications for decision-making and control over income from maize sales. In many parts of eastern and southern Africa, maize is grown on a household plot cultivated jointly by men and women. In

other parts of Africa such as Kwara State in Nigeria, women grow maize on plots that they manage and control (Ayinde et al., 2016). In some communities, farmers grow maize on both household- and individually-owned plots.



Gender division of labor

In sub-Saharan Africa, both men and women are involved in carrying out maize production tasks, but the gender division of labor in maize production varies by location. As Table 1 shows, in male-headed households in Tanzania and Mozambique, both men and women as well as children are involved in all maize production tasks. Women are more likely to carry out weeding in Tanzania, while men are slightly more likely to be involved

in land preparation and planting (Adam et al., 2018a). In Mozambique, men are more involved in land preparation and planting and women are somewhat more involved in harvesting and threshing (Adam et al., 2018b). Two tasks are gender-specific in both countries: the application of pesticides is carried out exclusively by men and seed storage is done largely by women. In most African societies, processing (milling) is

almost exclusively women's responsibility. In most societies, both men and women are involved in selling maize, though it sometimes differs by point of sale and quantities of sale (Adam and Quinhentos, 2018). In Mozambique, both men and women are involved in the marketing of maize and legumes. However, cultural norms restrict women's mobility, thus reducing their access to distant and more profitable markets. Women sell their products at the farm gate and local markets occasionally and in small amounts, whenever they need money for household expenses. Specifically, in Macate district, respondents revealed that most women sell mainly in local markets. When the markets are far away, men take charge of transporting the products to the market, because women are expected to

take care of the children and the house.

Studies show that the involvement of women, children and hired labor in maize production may differ in female- and male-headed households (Adam et al., 2018a; Adam et al., 2018b). In female-headed households In Tanzania, a higher percentage of women and children were involved in a number of maize production tasks. Female-headed households in Mozambique used hired labor more than male-headed households for some tasks, to make up for the slack caused by the lower involvement of male-household members in field tasks. Labor and other constraints are therefore likely to influence varietal trait preferences by female producers in female-headed households.

Table 1. Gender division of labor in maize production in male-headed households in Tanzania and Mozambique (percentage)

Production activities	Tanzania (N=473)	Mozambique (N=255)
Land preparation and planting		
Men	35%	45%
Women	33%	31%
Children	13%	8%
Weeding		
Men	28%	35%
Women	37%	36%
Children	11%	12
Harvesting		
Men	29%	31%
Women	29%	39%
Children	12%	13%
Threshing		
Men	33%	32%
Women	33%	40%
Children	17%	15%

Note: this table does not report on hired labor used for various tasks
Source: Adam et al., (2018a) and Adam et al., (2018b)



Gender in relation to plot ownership, intrahousehold variety decision-making and control over income

Varietal choices are often made within the context of intrahousehold decision making. There is ample empirical evidence that supports the notion that one cannot treat multi-adult households as single decision-making units, or that the household behaves as if it is a single agent; there are differences in the decisions reached by husbands and by wives in agriculture-related matters, and it is not necessarily a fact that husbands and their wives will have the same opinions or reach the same decisions. In many rural areas of sub-Saharan Africa, these intrahousehold differences are relevant not least because individual members of a household often engage in managing separate agricultural plots. The distribution and allocation of agricultural resources (land) or inputs (fertilizer) among economically-active members of the household, and the allocation of the proceeds of farm production within the household, are often determined by intrahousehold bargaining.

A study that was done in three countries, namely Ethiopia, Tanzania and Uganda by Marenya (2017), shows well how decisions are made within the household with respect to variety choices, and also shows figures

of who owns the plots. The study was done using household surveys from Uganda (1000 households), Tanzania (1020 households) and Ethiopia (928 households).

The headship structure in the data was such that 85-91% of the households were male-headed (Figure 1).

The results below show how decisions are reportedly made within the household with respect to variety choices. The data suggests that roughly half the time it was the household head in all three countries who was responsible for making the decision as to which variety to plant. Very few spouses were responsible for making this decision: 0.3% in Ethiopia, 10% in Uganda and 2% in Tanzania (Figure 2). It appears that whenever spouses (mostly women) were involved in the decision as to which variety to plant, it was made jointly with the household head. A joint decision as to which variety to plant was made 46% of the time in Ethiopia, 35% in Uganda and 42% in Tanzania. In terms of controlling the income from maize, the data also showed that in most cases in Ethiopia (67%), the decision as to how to use the income was made jointly by the spouses. This decision was made jointly 34% of the

time in Uganda and 47% of the time in Tanzania. The household head controlled the harvest and income from maize 28% of the time in Ethiopia, 54% in Uganda and 46% in Tanzania. Overall, the fact that women were involved in making decisions concerning choices of varieties only as joint decision makers, reveals both an opportunity as well as a gap in variety-targeting in terms of breeding, extension and marketing.

In terms of plot ownership, more than 70% of the plots were owned by household heads in all the countries, with Uganda being the highest at 92%, followed by Ethiopia, 79%, and Tanzania, 72%. Spouses hardly owned any plots (1%-3% ownership level) (Figure

3). Plots owned jointly by both household head and spouse were also very few: 21% in Tanzania, 14% in Ethiopia and 1% in Uganda. The number of plots owned by other household members was highest in Uganda (66%), with only 5% in Ethiopia and 1% in Tanzania (Figure 3).

Whoever is involved in making decisions about the allocation of the maize harvest is important for ensuring household food security. While women often have more responsibility for providing food for their households, men may play a dominant role in deciding how much maize to keep for household consumption; this is a situation which sometimes leads to conflict.

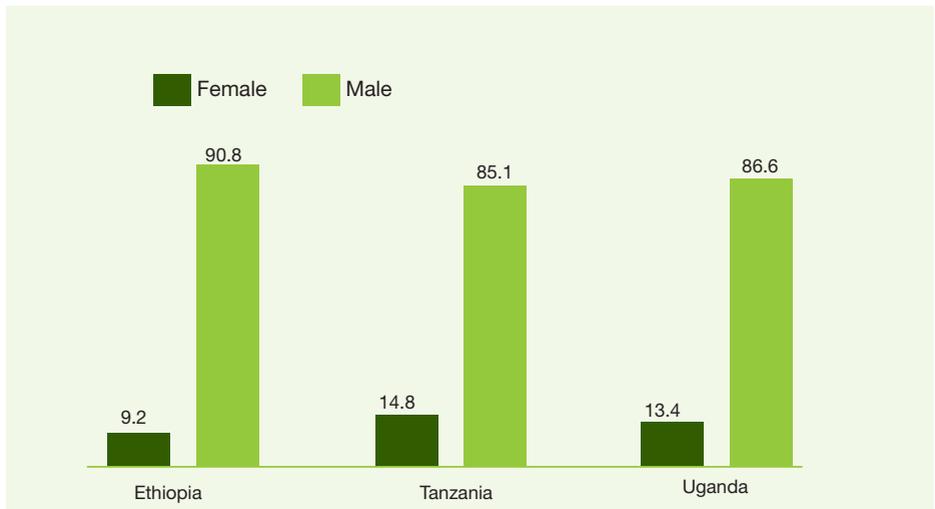
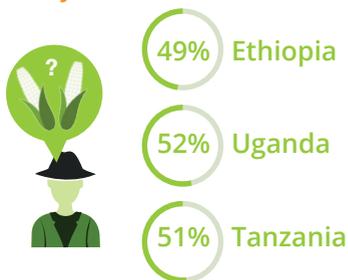
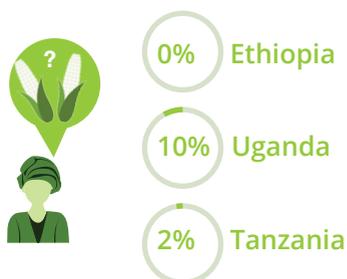


Figure 1. Gender of the household head in Ethiopia, Tanzania and Uganda, represented in percentages. Source: Marennya (2017).

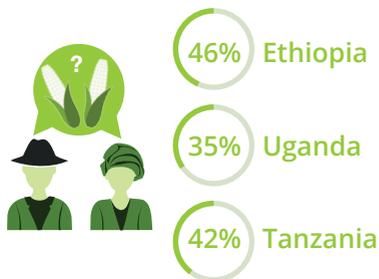
Variety choice decisions were made by household head



Variety choice decisions were made by spouse



Variety choice decisions were jointly made by both spouses



The household head controlled the harvest and income from maize



The spouse controlled the harvest and income from maize

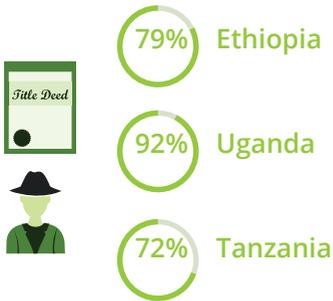


Both spouses jointly controlled income from maize



Figure 2. (i) Percentages of household heads that made decision on the choice of variety of maize to plant, followed by the percentages of spouses that made decision on the same and lastly percentages of both spouses that jointly made decision on the choice of variety of maize to plant and (ii) Percentages of household heads that controlled the harvest and income from maize, followed by the percentages of spouses that also controlled the harvest and income from maize, and lastly the percentages of both spouses that jointly controlled income from maize. Source: Marenja (2017).

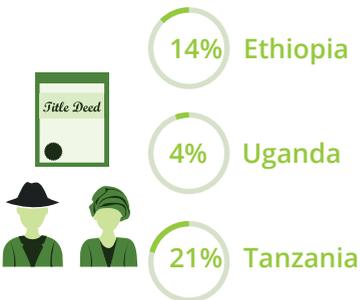
Plot owned by household head



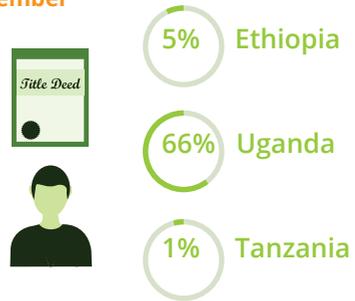
Plot owned by spouse



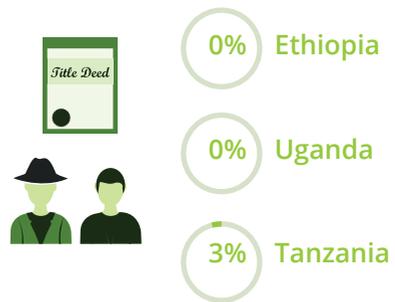
Plot owned by household head and spouse



Plot owned by other household member



Plot owned by household head and other household member



Plot owned by spouse and other household member

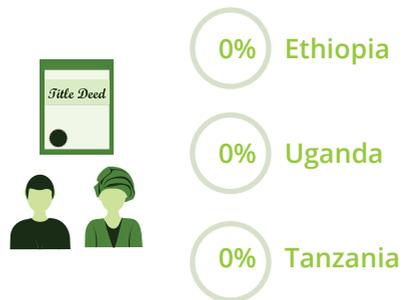


Figure 3. Percentages of plots that are owned by the following: household head alone, spouse alone, household head and spouse, other household member alone, household head and another household member and finally, spouse and another household member. Source: Marenja (2017).

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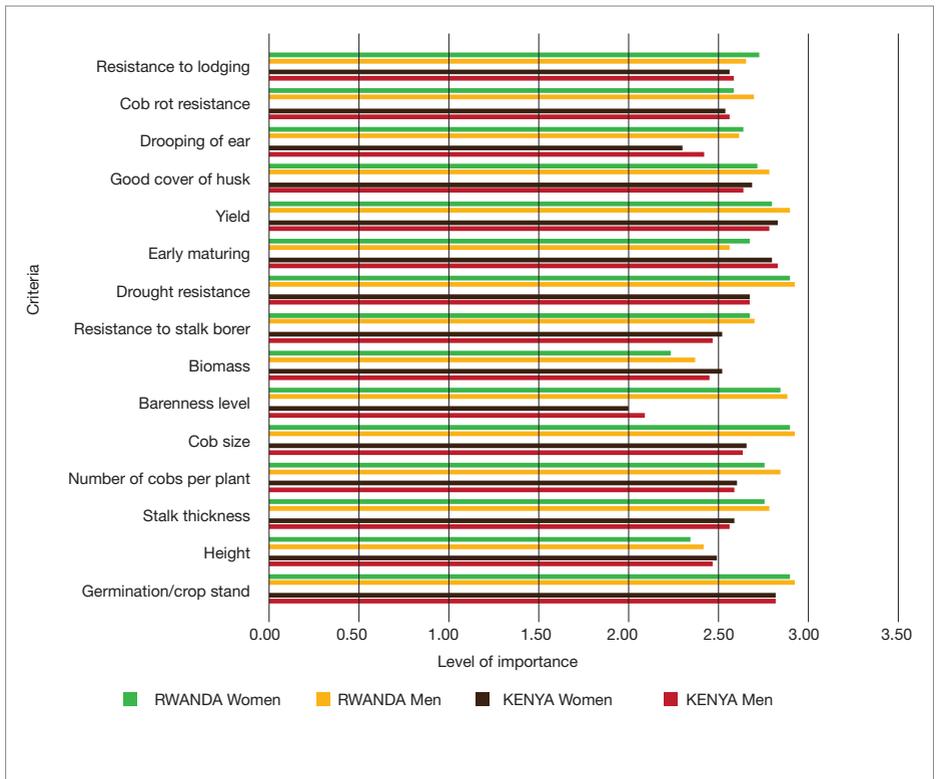


Gender and maize trait preferences

Studies show that both men and women maize farmers may value the same varietal traits, but often rate maize characteristics differently and prefer different combinations of traits. Some studies have found that both men and women value some of the same traits, such as high yield potential, but a common trend across countries is a stronger interest by women in consumption-related traits such as starch content and length of post-harvested conservation, while men tend to focus more on productivity and marketability. For example, Ethiopian women identified four important characteristics: taste for consumption in the fresh state, earliness of maturity, size of ears and high flour yield, whereas men were more concerned with the long-term availability of food (Mulatu and Zelleke, 2002). Marenya (2017), also found that women farmers in Ethiopia valued early maturity more than men and showed a slightly stronger preference than men for covered tips and rust resistance. Male farmers in Benin tended to seek market-oriented varieties: those with attributes such

as yield, color and grain size (Baco et al., 2015).

Other studies highlight the importance of other traits for men and women (see Figure 4, from Adam and Osanya, 2018). A study in Kenya (used 2016 and 2017 datasets) found that men ranked early maturing as the most important criterion and barrenness level as the least important, while women ranked yield as the most important and barrenness level as the least important. In Rwanda (used 2016 and 2017 datasets), germination was the most important criterion for men and biomass as the least important, while women ranked drought resistance as the most important criterion and biomass as the least important (Figure 4). It is important to note, however, that statistically the data show that there is no significant difference in trait preferences between men and women in Rwanda, while in Kenya, there is only one statistically-significant difference in trait preferences between men and women: namely drooping of ear.



Levels of importance: 0-Not important, 1-Low importance, 2-Medium importance, 3-High importance

Figure 4. Men and women’s preferences for the maize seed traits, datasets from Kenya and Rwanda. Source: Adam and Osanya (2018).



Production and marketing constraints:

Because men and women maize farmers do not have the same access to productive resources, they often face different production constraints. Women are more likely to have difficulty accessing land, labor, improved seed, fertilizer and credit. They may also be less likely to sell their agricultural produce in markets some distance from their homes due to cultural restrictions on their physical mobility or due to their busy work schedule.

Based on the different roles and responsibilities, varietal trait preferences, and

production constraints of farmers that have been documented by research on gender and maize production in sub-Saharan Africa, three broad categories of maize producers can be identified, while controlling for other socio-economic characteristics (wealth, age, education etc.):

- Male farmers
- Female farmers in male-headed households
- Female farmers in female-headed households



3.

Gender-responsive participatory varietal selection

Breeders face the challenging tasks of breeding to meet the needs of a diverse population of smallholder producers, and of deciding when it is useful to consider the different preferences, needs, and objectives of men and women end-users. This section describes how to carry out participatory varietal selection (PVS), an approach used by many maize breeding programs in Africa, in a gender-responsive manner. Participatory varietal selection is an approach whereby farmers and other end-users participate in selecting finished or near-finished varieties (lines) or clones (Ceccarelli, 2012). PVS is considered part of the participatory plant breeding process and is often the final stage. However, PVS does not have to be used as part of a participatory breeding program, but

can be used on its own during either of the following stages and locations:

- On station researcher-managed trials
- On farm researcher-managed trials

As PVS is an approach used in plant breeding, it is useful for breeders to have a good understanding of gender-responsive breeding. Although it is beyond the scope of this manual to go into details of the specific steps required for gender-responsive breeding, we encourage readers to become familiar with the guidelines developed by the CGIAR Gender and Breeding Initiative (Box 2) and to visit the Initiative's website (<http://www.rtb.cgiar.org/gender-breeding-initiative>) for more details.

Box 2: Guidelines for gender-responsive breeding

The CGIAR Gender and Breeding Initiative proposes the following guidelines for gender responsive breeding:

Know when, where, and why women are an important beneficiary group. Take into account important differences in constraints faced by women and men farmers that breeding can influence.

Anticipate how design decisions (e.g., defining plant ideotype, prioritizing of traits, targeting and testing varieties with farmers) may impact and be influenced by women's labor, available resources and opportunities.

Design breeding objectives specifically to benefit women farmers when they are an important beneficiary group who require a special approach, and consider their needs, constraints and knowledge more generally in the breeding program.

Be accountable, making sure the success of the breeding program is measured in ways that include positive impacts for women, as well as for households or farmers in general.

Source: CGIAR Gender and Breeding Initiative (2018).



Steps in gender-responsive participatory varietal selection

Gender-responsive PVS seeks to incorporate the experiences, knowledge, and preferences of men and women into the breeding process, in order to produce a 'basket' of improved varieties that meet the needs of diverse groups of men and women farmers, thereby encouraging more widespread adoption. PVS helps breeders to

identify the traits/varieties that are important for both men and women producers, the trait preferences that differ by gender, and the reasons for the similarities and differences in trait preferences. PVS also exposes farmers to new germplasm before varieties are released.

Box 3: Steps involved in PVS

-  **1 Set up the research team**
-  **2 Collect baseline data**
-  **3 Select locations and farmers**
-  **4 Organize PVS evaluations**
-  **5 Collect data for the three critical stages for doing PVS, which are: the vegetative/grain filling stage, just before or at harvest time and post-harvest.**
-  **6 Analyze and interpret the data**
-  **7 Use the data**

It is important to integrate gender at each step when conducting a PVS.



The research team: The research team should include a social scientist and/or a gender expert in addition to breeders, agronomists and technicians. Both men and women should be represented on the team and all members should have undergone gender training. At least some team members should speak the local language, as women farmers are less likely than men to speak the official language.



Baseline data collection: Collecting baseline data is important for obtaining information on the production and marketing of maize in the target areas. Such information includes the cropping system, the area planted to maize, the varieties, production constraints, marketing systems, the role of maize in the diet and the socio-economic characteristics of households in the target area. Baseline studies should also collect information on gender aspects such as the gender division of labor, decision-making and control generally in agriculture and specifically in relation to maize. Baseline data can be collected using formal and informal surveys and/or participatory rural appraisal methods such as group- and key- informant interviews.



Farmer selection: Farmers have to be selected both to host and to evaluate trials. Who is involved in the selection process and how the selection is done, are important to avoid selecting mainly men, better-off farmers, lead farmers and community leaders. Involve local extension/advisory staff in the selection process and be as participatory as possible.

Select an equal number of men and women, where possible. For example, if there are ten trials plots, five should be managed by women and five by men. Include female-headed households as well as women farmers in male-headed households. Include a diversity of farmers, that is men and women from different wealth, ethnic, religious and age groups. For example, of the five trials managed by women, one could be an older married woman, another a younger woman, another a female head of household and a fourth and a fifth, women from poor and wealth groups.

Remember that farmers also benefit from participating in PVS in terms of being exposed to new materials and agronomic practices, receiving free inputs and the prestige and status they get from interacting with researchers and seed company representatives.



Organizing PVS evaluation events: To ensure that both men and women participate equally in the evaluation exercise, it is important to address women's specific needs. Ensure that the timing of the exercise is convenient for all community members, especially women. Inform community members/participants well in advance of the activity through various communication channels, including those used most by women. Evaluations should not last more than three to four hours, bearing in mind women's busy work schedules. Specifically, evaluation can be done during the growing season and during harvest. During the growing season it takes about two hours and during the harvest about three to four hours.

Make arrangements for child care so that women with babies and small children can participate in the evaluations undisturbed. Avoid assigning to women participants roles that are not related to the evaluation such as cooking; select non-participants for these tasks. It is important to create an atmosphere where all participants feel free to express and exchange ideas. This means that facilitators will need skills on how to manage dominant characters such as local leaders and extension workers and how to encourage women to speak.



Collecting and analyzing data: Start by explaining to participants the objective of the on-farm trials and the purpose of ranking varieties/trait preferences.

- Allow men and women farmers to view all the plots before making their choices
- Give each farmer a set of 'I like cards' with a smiley (☺) to assign for best varieties. Consider using other symbols that work better for non-literate participants
- Give each farmer a set of 'I don't like cards' with a frown (☹) to assign for worst varieties
- Use different colored cards for men and women
- Separate the men and women farmers and ask the women first to walk through the plot(s) and vote for the best and worst varieties using the cards. Repeat the same process with the men
- Count and record the number of like and don't like cards by gender
- Select the two most-preferred varieties for men and for women
- Go to the relevant plot with a group of men and a group of women separately and ask the farmers to give their reasons for liking these two most-preferred varieties
- Make a summary of the reasons for the selection of these two most-preferred varieties by gender and by plot
- Repeat this process with the two least-preferred varieties
- Summarize the information
- Thank the farmers for their participation

For evaluations after harvesting the crop, arrange the cobs in a place and manner where farmers can easily access them. Follow the process outlined above.

A gender-responsive PVS provides information on traits/varieties preferred and disliked by men and women, and the reasons for their preferences.

A good example of how to carry out a gender-disaggregated analysis of PVS data can be found from a study that was done by Setimela et al., (2017), which shows how well PVS was

done on farm regional variety trials in Zimbabwe. In this study, there were 29 trial sites and a number of varieties, which included the following: elite drought-tolerant hybrid varieties, new drought-tolerant open-pollinated varieties, checked open-pollinated varieties, checked hybrids and farmer varieties. A total of 311 farmers participated in the study, 150 men and 161 women.

In order to carry out gender-disaggregated analysis of PVS data, Setimela et al., (2017) used the voting and calculated Preference Index (PI) from the 29 trial sites in Zimbabwe. PI is calculated using voting for the varieties. A PI can be calculated using the following formula:

$$PI = \frac{\text{Number of positive votes} - \text{Number of negative votes}}{\text{Total number of positive and negative votes}}$$

Using the voting and calculated PI from the 29 trial sites in Zimbabwe, farmers preferred Pan53, CZH095, CZH0616, AND CZH1021 (Figure 5). The trend was similar for both men and women.

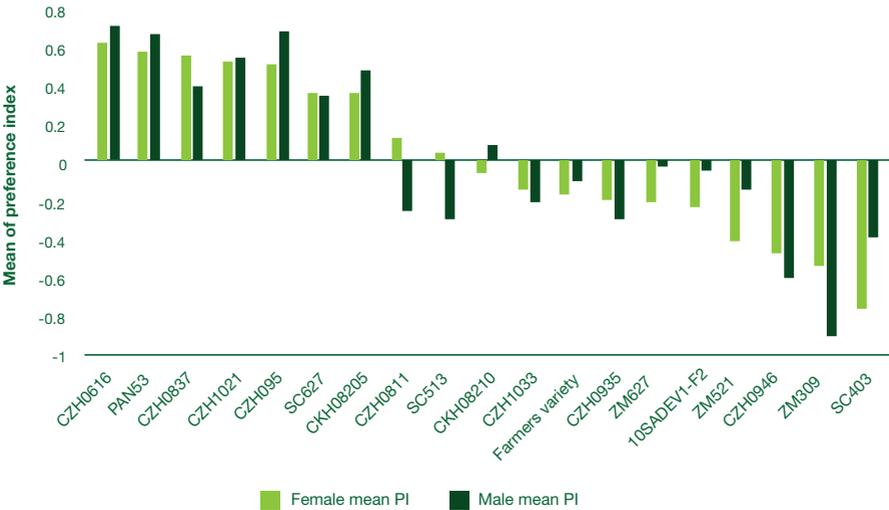


Figure 5. Preference index from voting by men and women on the different varieties in the trials. Source: Setimela et al., (2017).

The reasons given by farmers for liking the varieties CZH0616, CZH095, and PAN53 were big cob sizes, good vegetative standing, drought resistance, good tip cover, and good grain quality (Table 2). Furthermore, the PI shows that farmers disliked ZM309, SC403, and CZH0946. The reasons given were small cobs, poor vegetative standing, susceptibility to lodging, and inability to withstand drought (Table 2).

Table 2. Varietal traits that the farmers liked and disliked by gender in some selected drought-tolerant varieties (percentage)

Trait	Liked traits in varieties CZH0616, CZH095, and PAN53		Trait	Disliked traits in varieties CZH0946, ZM309, and SC403	
	Women (% , n=161)	Men (% , n=150)		Women (% , n=161)	Men (% , n=150)
Large cob size	30.19	31.51	Small cobs	28.81	25.76
Good standing ability	30.19	19.18	Poor standing	20.34	27.27
Drought tolerance	18.87	10.96	Susceptibility to lodging	18.64	16.67
Resistance to lodging	9.43	15.07	Small grain	11.86	4.55
Grain quality	5.66	-	Susceptibility to drought	6.78	16.67
Good tip cover	-	12.33			

Source: Setimela et al., (2017)

Integrating gender into PVS and plant breeding programs more broadly will ultimately depend on whether breeders and other scientists believe that these efforts will make a difference in their work by increasing adoption and impact.

4.

Gender-responsive approaches to promoting and disseminating new maize varieties

Once a new maize variety is released, efforts are usually made to multiply, promote and disseminate it widely. Breeders play a role in these areas by working with contract growers, seed companies and agro-dealers. This section discusses how to ensure that gender is addressed in promotion and dissemination.

4.1 Gender considerations in contract seed production

Research organizations and seed companies hire contract growers to cultivate maize seed based on criteria such as access to land and labor. Involving an equal number of men and women in contract seed production is

seldom a goal, and as a result, maize seed contract growers are predominantly men. This situation is not unique to maize. In Kenya less than 10 percent of smallholder contract growers in the fresh fruit and vegetable sector were women farmers (Chan, 2010) and studies in Kenya, Uganda, Malawi and Senegal found little or no involvement of women in contract farming schemes (Action Aid, 2015). Yet in many cases, women provide a significant amount of labor in maize seed plots that are registered in their husbands' names. Supporting more women to be maize seed contract growers in their own right or recognizing their 'invisible' roles on male-controlled seed plots can provide financial benefits to seed companies in terms of:



Improved crop quality: Because women farmers often provide better quality agricultural products than men (Chan, 2010), increasing the number of women involved in contract seed production could help improve seed quality.



Increasing productivity through improving incentives for women producers: Providing seed production training to both husbands and wives, where the latter provide labor on seed plots, can improve productivity.



Growing the supply base: Studies show that involving more women in contract farming can increase the number of growers, as women are effective as recruiters (Chan, 2010). Growing male migration and off-farm employment in many countries means that increasing the number of women contract growers is a way to ensure future seed supply.

Box 4: Self reflection: Is gender important in contract seed production?

To assess whether gender has been a consideration in contract seed production, ask the following questions:

What factors do you consider when you select producers?

Who are your current producers (in terms of gender, age, wealth etc)?

Who might be your future producers?

Why are certain groups (e.g. women) not represented?

Are women excluded because of factors associated with being female (gender-based constraints)? What can be done to address these factors and overcome these constraints?

Would my business benefit from including these groups? How?



To encourage a greater involvement of women in contract seed production, consider establishing a quota for the number of women contract seed growers. For example, you may decide to recruit women as a third of seed growers. It is important to make sure that the criteria used to select contract growers do not discriminate against women. For example, rather than land ownership, consider using control over land as a requirement. Consider establishing contracts with women's groups, as it is often

easier for women to operate and access land and labor in groups rather than working as individuals. One way to involve women more directly in contract seed production is to establish contracts with households, both men and women, rather than with individuals (who are generally men). Where married women provide labor on seed plots, provide technical training to both husbands and wives, and encourage male seed growers to share some of their earnings with their wives or to allocate a portion of land to them.

4.2 Gender-responsive awareness creation and promotion of maize varieties

Creating awareness about and disseminating new maize varieties involves multiple partners, including researchers, private seed companies, agro-dealers, extension agents, community-based organizations (CBOs) and non-governmental organizations (NGOs), working together. These actors often use multiple promotional approaches to create awareness of improved maize varieties among farmers. Common approaches include:

Box 5: Considerations for making promotional approaches more gender-responsive



Source: Kandiwa et al., 2018

However, very often, seed companies, extension/advisory services and other organizations do not recognize that different approaches and strategies are needed to reach men and women producers and end-users. The outcome of a 'one-size fits all' approach is often that women are less aware of modern maize varieties than men, as mentioned earlier.

Multiple reasons related to women's disadvantaged position in society account for their lower awareness of new maize varieties compared to men: women tend to be less literate and less likely to speak official languages; they have less access to means of communication (radio, television, mobile phones, the internet etc.); they have less time to use means of communication and engage in social interactions; women are less physically mobile than men and have less interaction with extension/advisory services. It is important to note that many of these constraints also apply to poor men and other disadvantaged groups. Promotional efforts therefore need to be gender-responsive by taking these constraints into account.

Collect information on women's and men's information and seed channels

The first step in designing a gender-responsive promotional approach is to carry out a general situation analysis of farmers' information and seed channels. The purpose of this analysis is to identify target areas for product promotion; to obtain information on the role of men and women in maize production and on the information and seed channels that they each use; to recognize the constraints they face in accessing information about agriculture and new varieties in general; to evaluate the best mix of promotional approaches for reaching men and women; to identify potential partners for promotional activities and to evaluate their experience with promotional activities and their strengths and weaknesses. Methods that can be used for a general situation analysis include key informant interviews, group interviews, participatory rural appraisal and formal surveys.

Two useful approaches for awareness creation and promotion

Promotional approaches fall into two broad categories: those that create awareness and provide information (radio, TV announcements, messaging, road shows, agricultural fairs, printed materials) and those that demonstrate the performance of new maize varieties (demonstrations, field days, small seed packets). Ideally, it is best to use a combination of methods both to promote awareness and to demonstrate performance. The following describes how to address gender issues in conducting demonstrations/field days and in distributing small seed packets.



Demonstrations and field days:

These two approaches are highly effective in increasing awareness of new maize varieties for two main reasons. Firstly, demonstrations and field days demonstrate the actual performance of a variety from planting to harvesting, which can be understood by all farmers regardless of educational level. Secondly, demos can also be used to promote good agronomic practices (e.g. timing of planting, weeding, harvesting, correct spacing etc.). Distributing small packets of maize seed during demonstrations and field days is an excellent way to encourage farmers to adopt new varieties. To ensure that demos are gender-responsive, it is important to pay attention to who hosts demos and field days, to where they are located, to what information is provided about the demos (signage) and to how these events are organized.

The selection of farmers to host demonstrations and field days is often biased toward men and people of high status. Ensure that other categories of farmers, including individual women and youths from different socio-economic groups and women's groups, have the opportunity

to host demonstrations and field days. Efforts should be made to ensure that 50% of demonstrations are hosted by women and 50% by men. Rather than leaving the task of selecting farmers to extension or seed company representatives, a more participatory process led by communities should be considered.

Typically, organizers prefer to locate demos in central places such as on roadsides. However, such demos are less likely to be seen by women in particular due to their limited physical mobility. Guided by information from the situation analysis, it is preferable to disperse demos in a number of areas frequented by different groups e.g. women, youth, etc. The design of signs used at demonstration plots also needs to be gender-responsive. As women tend to be less literate than men especially in official languages, signs need to be in the local language and use simple language and illustrations. Demos and field days need to be planned well in advance based on input from both men and women in the community, and widely publicized locally through multiple channels in order to reach both men and women. The day and time for

such events should take into consideration women's schedules. Organizers should also provide child care to encourage the participation of women with babies and small children. Efforts should be made to ensure that women feel comfortable expressing their views.

Demonstrations and field days provide an

opportunity to get information on the varietal preferences of men and women producers. Managing data from these events is therefore important for effective feedback loops. Data bases on demonstrations should include gender-disaggregated data on farmers who host demonstrations/field days, participants and geo-reference locations.

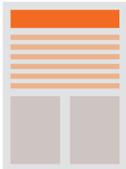


Small seed packets:

Providing small packets of seed of new varieties to farmers free of charge or at minimal cost encourages farmers to try new varieties with little or no risk. Small packets provide between 100g to 2kg for maize and may cost the same as a cup of tea. Anecdotal evidence suggests that women are just as likely as men to purchase small seed packets (Sperling and Boettiger, 2013) but attention needs to be paid to where packets are made available and how they are advertised to ensure that women can easily access them. Small seed packets can be distributed during demos/field days, agricultural fairs, through health clinics,

schools and women's groups, or sold through agro-dealers, small shops or local markets. Information from the analysis of the communications situation can be used to identify the most appropriate channels for reaching women with small seed packets. Distributing small seed packets through various channels, particularly through women's groups, health clinics and local markets, and setting a quota for the number of women receiving packets are effective ways to target women. Table 3 below points out some considerations for making other promotional approaches more gender-responsive.

Table 3. Considerations for making promotional approaches more gender-responsive

PROMOTIONAL APPROACH	 <p style="text-align: center;">Branded clothing</p>	 <p style="text-align: center;">Radio advertisements, TV programs, videos etc.</p>
GENDER CONSIDERATIONS	<p>Common branded clothing such as t-shirts and caps are usually worn by men and may not be appropriate for women. Find out what women prefer. Items of interest to women include branded wrap cloths (kitenge, chitenje, lappa, wrappers), head gear/ties and cloth shopping bags</p>	<p>Women have less time than men to listen to radio or watch television and may not even have access to these communication channels. Messaging through mass media should be in the local language and aired during times that are convenient to both male and female audiences</p>
PROMOTIONAL APPROACH	 <p style="text-align: center;">Printed materials</p>	 <p style="text-align: center;">Road shows and agricultural fairs/shows</p>
GENDER CONSIDERATIONS	<p>Women tend to be less literate than men. Printed materials should be written in the local language where possible and use simple wording with plenty of illustrations</p>	<p>Consider the time and location of these events to ensure that both men and women can attend. If necessary, provide transportation to enable farmers to get to the event</p>

Seed companies distribute certified maize seed through formal, commercial channels, including their own retail shops and mobile marketing teams, agro-dealers, supermarkets and other outlets. This formal seed supply system co-exists with informal seed systems that small-scale farmers rely on to access non-certified maize seed.

While it is widely assumed that formal seed markets are gender-neutral (do not favor either men or women), evidence showing a lower rate of adoption of modern maize varieties by women farmers in sub-Saharan Africa suggests otherwise. There are several reasons why women are less likely than men to obtain maize seed from formal sources.



Location:

Agro-dealers and seed company retail shops are not located in every rural community and farmers may have to travel to reach the nearest shop. Women have less time to go to these sources due to their heavy domestic and work responsibilities, cultural restrictions on moving outside of their homesteads and lack of funds to pay for transportation. In such situations, it is easier and more convenient for women to get maize seed from informal sources closer to home.

Seed companies and agro-dealers may

consider involving local seed sellers such as cooperatives, village stockists and traders in distributing your products. Working with agro-dealers as well as other types of seed merchants provides many opportunities, as they can host demonstrations, provide information and advice to farmers in addition to seed, and offer local credit arrangements. However, local seed merchants need to be trained and monitored to prevent the sale of poor quality or fake seeds.



Packaging size and cost:

Maize seed is often packaged in large quantities of interest to medium or large-scale farmers, whereas women, especially if they grow maize on their own plots, typically plant a smaller area compared to men. Large packaging quantities also sell at a higher cost, which may not be affordable for women and poorer farmers in general. Women may also face difficulties in transporting large bags of seed.

Providing several packaging sizes for seed helps to make seed affordable for women and men who do not have a lot of cash to spend and who cultivate smaller plots. Other ideas for making certified seed more affordable for women include:

- Bulk sales to women's groups
- Setting up a system of loyalty points and discounts
- Allowing clients to pay in installments
- Allowing clients to pay in kind e.g. grain buy back by agro-dealers
- Working with local-level micro-finance programs such as rotating savings and credit
- Setting up credit guarantee schemes managed by cooperatives, non-governmental organizations and community-based organizations.

5.

Creating a gender-responsive organizational culture for breeders

Gender-responsive breeding is not simply a matter of individual breeders wanting to ‘do the right thing’ but also reflects the commitment of the research organization that houses the breeding program, to achieving gender equity at all levels including among its own staff. In short, gender-responsive breeding should be part of a greater effort to promote gender-responsive agricultural research.

A 2014 study found that women accounted for only 24% of agricultural researchers in a sample of sub-Saharan African countries (Beintema, 2014). Furthermore, it is estimated that only a tiny proportion of the small number of plant breeders in Africa are

women. Increasing women’s representation as plant breeders and agricultural scientists ensures a diversity of insights, perspectives and working styles. It is also a strategy for addressing agriculture research capacity shortages in the continent.

Women face huge challenges in training to become and work as plant breeders in African research organizations. These challenges include going against cultural perceptions about what girls should study, and facing challenges such as a lack of mentors, limited opportunities for mobility, lower pay compared to men and organizational policies that discriminate against women in the workplace (Table 4).

“

Women accounted for only **24%** of **agricultural researchers** in a sample of sub-Saharan African countries

”

Table 4. Constraints faced by women breeders and other agricultural scientists

Constraints	How this affects women
Cultural perceptions	<ul style="list-style-type: none"> • Science and agriculture are perceived as male domains; girls are not encouraged to study these fields
Representation and mentoring	<ul style="list-style-type: none"> • Agricultural research tends to be heavily male-dominated, which means fewer opportunities for training and mentoring for women • Women tend to be highly represented in entry-level positions, under-represented in management
Equitable workplaces	<ul style="list-style-type: none"> • Recruitment: few women on search committees, male bias in advertising and hiring procedures • Salaries: pay gap (men paid more than women for doing the same job) • Mobility: due to limited networking opportunities and mentoring, women may lack skills at different career stages e.g. conflict management and conflict resolution skills, styles of interpersonal interactions and leadership skills, grant writing etc. • Gender-unresponsive organizational policies: inadequate parental leave, lack of childcare facilities and flexible hours, frequent travel away from home etc.

Research organizations can support greater gender equity at various levels, including research programming and human resource management. Priority actions include developing and implementing comprehensive gender policies and gender-responsive human resource policies that cover the following aspects, among others:

Gender-responsive research agendas and programs:



To encourage scientists to integrate gender in all aspects of research, organizations should provide guidelines, indicators and monitoring systems as well as providing incentives for gender responsiveness.

Recruitment:



Gender-equality principles that apply to the recruitment stages include using gender-neutral language in job descriptions, advertising positions through channels used by both women and men, ensuring that both men and women are represented in the recruitment team and interview panels and that the interview and selection process is non-discriminatory. Establishing quotas for key positions, and appointing gender-equity advisors and male champions for gender inclusion are some approaches that can be used to encourage gender equality.

Mentoring opportunities for women scientists:



As a vital part of encouraging career mobility and advancement, research organizations should support the formal and informal mentoring of women scientists through local or international programs.

Creating and fostering a gender-equitable workplace:



Research organizations have a duty to ensure that both women and men have equal opportunities, including equal pay for the same work, the removal of barriers to the full and equal participation of women in the workforce, and the elimination of discrimination on the basis of gender, particularly in relation to family and caring responsibilities. Parental leave for both female and male employees, child care facilities and/or child care allowances are some benefits that research organizations should provide. Research organizations are also responsible for ensuring that women and men do not experience sexual harassment in the workplace and for taking strong action against such cases.

References

- Action Aid. (2015). *Contract farming and out-grower schemes: Appropriate development models to tackle poverty and hunger?* Policy discussion paper, Action Aid. Johannesburg, South Africa.
- Adam, R., Ubwe, R., Mmbando, F., Lupindu, O. and Muindi, P. (2018a). *Beyond crop production: Gender and value chain analysis of maize in Tanzania*. Working paper. Mexico, CIMMYT.
- Adam, R. and Quinhentos, M. (2018). *Findings and Lessons Learned from Gender Analysis of Maize and Legume Value Chains in Mozambique: A summary brief*. Mexico, D. F.: CIMMYT.
- Adam, R., Quinhentos, M., Muindi, P., and Osanya, J. (2018b). *Beyond crop production: Gender relations along the maize value chain in Mozambique*. Working paper. Mexico, CIMMYT.
- Adam, R., and Osanya, J. (2018). *Data Analysis for 2016 and 2017 Stress Tolerant Maize for Africa (STMA) Mid-Season Participatory Farmer Evaluations of Kenya and Rwanda On-Farm Trials*. Mexico, CIMMYT.
- Ayinde, O.E.O., Abdoulaye, T., Takim, F.O., Oloyede, A.O., Bankole, F.A. (2016). Economic analysis of on-farm trial of drought tolerant maize in Kwara State, Nigeria: a gender approach. *Trakia Journal of Sciences*, 3: 287–293.
- Baco M. N., Affoukouk, T., Moumouni I., and Abdoulaye, T. (2015). Is taking gender into account for development and diffusion of agricultural innovations justified? The case of drought tolerant maize in Northern Benin. *Journal of Agricultural Extension and Rural Development*. Vol.7 (10): 290–297.
- Beintema, N. (2014). Enhancing Female Participation in Agricultural Research and Development: Rationale and Evidence. In: Quisumbing, A., Meinzen-Dick, R., Raney, T.L., Croppenstedt, J.A., Behrman, J and Peterman, A (eds). *Gender in Agriculture: closing the gender gap*. Netherlands: Springer.
- Ceccarelli, S. (2012). *Plant breeding with farmers – a technical manual*. ICARDA: Aleppo, Syria.
- CGIAR Gender and Breeding Initiative. www.rtb.cgiar.org/gender-breeding-initiative. (Accessed on 2nd of February 2019).
- Chan, M.K. (2010). *Improving Opportunities for Women in Smallholder-based Supply Chains Business case and practical guidance for international food companies*. Prepared for the Bill and Melinda Gates Foundation.
- Fisher, M. and Kandiwa, V. (2014). Can agricultural input subsidies reduce the gender gap in modern maize adoption? Evidence from Malawi. *Food Policy*, 45: 101–111.
- Food and Agriculture Organization (FAO) of the United Nations. (2011). *The state of food and agriculture: women in agriculture; closing the gender gap for development*. Rome: FAO.
- FAO. (2019). FAO STAT. Available online at <http://faostat.fao.org/>. (Accessed: 2nd of February 2019).
- Langyintuo, A.S., Mwangi, W., Diallo, A.O., MacRobert, J., Dixon, J. and Bänziger, M. (2010). Challenges of the maize seed industry in eastern and southern Africa: A compelling case for private-public intervention to promote growth. *Food Policy*, 35: 323–331.
- Marenya, P. (2017). *Which traits do farmers prefer in maize varieties in Eastern Africa?* CIMMYT.
- Mulatu, E. and Zelleke, H. (2002). Farmers' highland maize (*Zea mays* L.) selection criteria: Implication for maize breeding for the Hararge highlands of eastern Ethiopia. *Euphytica*, 127(1): 11–30
- Palacios-Lopez, A., Christiaensen, L. and Kilic, T. (2017). How much of the labor in African agriculture is provided by women? *Food Policy*, 67: 52–63.
- Setimela, P., Magorokosho, C., Lunduka, R., Gasura, E., Makumbi, D., Tarekegne, A., Cairns, J., Ndhlela, T., Erenstein, O., and Mwangi, W. (2017). On-Farm Yield Gains with Stress-Tolerant Maize in Eastern and Southern Africa. *Agronomic Application of Genetic Resources*, 109: 1–12
- Sperling, L. and Boettiger, S. (2013). Impacts of selling seed in small packets: evidence from legumes sales. AgPartnerXChange.



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