



SMALLHOLDER LIVELIHOOD RISKS AND BARRIERS TO ADOPTION OF DROUGHT TOLERANT MAIZE VARIETIES IN UGANDA

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The Integrated Seed Sector Development project (ISSD) in Uganda in collaboration with the Development Economics Group at Wageningen University, International Research Institute for Climate and Society (IRI), United States and The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) conducted a study on male and female risks and barriers to adoption of drought tolerant maize (DTM) varieties in Uganda. The study also assessed gendered risk reduction and mitigation measures. This brief summarizes the findings from the study on smallholder livelihood risks for the maize growers in Uganda.

Key messages

1) Agricultural decisions, and thus uptake of DROUGHT TOLERANT MAIZE (DTM) VARIETIES, are not only determined by production risk, but also health risk, output price risks and financial constraints, with men giving a higher priority to financial concerns and women to production related risks.

2) Without access to financial markets households need buffers to self-insure against financial emergencies. Particularly, due to health risks, farmers must choose between investing in seed (and fertilizer)

or keeping a buffer for sickness. Sickness in the family reduces available labor required during the agricultural season resulting in a risk of losing the monetary investment in seed (and fertilizer) if good agronomic practices cannot be applied. As a result, smallholders invest in low input-low output systems using home-saved seed and other low-cost alternatives.

3) Agricultural insurance products cover only production risk and do not include health and market risks; yet smallholders perceive health risk and output price risk equally important in adoption decisions. Therefore, a single focus insurance is not enough for scaling uptake of drought tolerant maize varieties.

Introduction

Improving agricultural production and productivity is vital given that agriculture is the main source of income for most of Ugandans. Productivity advancements in agriculture require the use of improved innovative technologies, including DTM varieties are those varieties that are bred to withstand dry spells during the cropping seasons.

Currently, several improved drought tolerant maize varieties have been released by breeders, yet adoption remains low (Mastenbroek et al., 2021). In Uganda, approximately 13% of farmers are using certified seed accessed through agro-dealers, seed companies and through NGO/Government handouts (ISSD, 2014).

This reluctance of farmers to adopt improved maize varieties may in part be attributed to agricultural and social risks.

The agricultural decision-making by farmers involves various climate and macro-economic factors, as well as seed and farming choices, facing a time span from planting until harvest, storage and marketing. The gendered drivers and barriers to adoption of high yielding drought tolerant maize varieties, AS WELL AS ways local communities are responding/adapting to observed changes and risks are important considerations in strategies to scale up agricultural technologies.

We aimed to enhance our understanding of why farmers are not adopting drought tolerant maize varieties, but instead of relying on home-saved seed and re-plant grain from the local market. We conducted a study of male and female farmers'

perceived risks spectrum, as well as their risk reduction, mitigation and coping strategies and elicited drivers and barriers to adoption of drought tolerant maize varieties. These barriers have implications for scaling up agricultural technologies.

Methodology

The study was conducted in four villages in Dokolo, Iganga and Masindi districts in March 2019. In each village we interviewed one men's group and one women's group, using exploratory qualitative research methods, including Participatory Rural Appraisal tools (PRA) such as village resource mapping and focus group discussions. We looked at 5 sources of agricultural risks. They are presented in table 1.

Table 1: Definition of risk categories in the agricultural sector

Risk category	Sub category	Description
Production risks – uncertain natural growth processes	Input risks	Access to seed and other inputs, information, management decisions pertaining crops, seed and other inputs, and agronomic practices.
	Weather, biological and environmental related risks	Periodic deficit and/or excess rainfall or temperature, (hail) storms, changes in cropping patterns, crop and livestock pests and diseases, and contamination and degradation of natural resources.
Market risks – price, costs, market access	Logistical and infrastructural risks	Changes in access (physical or economic) to transport, communication, energy, degraded transport, or energy infrastructure.
	Price risks	Fluctuations in prices of inputs and/or outputs due to different causes.
Personal risks – human health and personal relationships	Health risks	Health risks for farming households and farm workers, production failure due to health reasons.
	Social risks and cultural norms	Risk related to needs for social support, safety nets and welfare services.
Financial risks - risks associated with how the farm is financed & additional variability of cash flow	Risks associated to levels of poverty	Risk related to general poverty, generic lack of money in households and/or food insecurity, low levels of cash-flow within semi-subsistent households as the production unit making agricultural investment choices.
	Access to credit and other financial products	Risk related to access, costs, collateral and/or grace period of financial products, availability of financial products, and suitability of financial products to the agricultural sector.
Institutional risks – unpredictable changes in policies and regulations	Public policy and institutional risks	Macroeconomic shocks and downturns. Changing or uncertain policies and weak enforcement; conflicts and political disputes, corruption, weak institutions.

Results & discussion

Risk prioritization

Based on the focus group discussions in the different districts and the responses that the groups provided to the risk and concerns ranking, we graded the perceived risks from high to low (Table 2). Broadly speaking we noticed that the ranking was similar across districts and gender, with some gender differences as presented in figure 1.

Weather-related production risks, health risks, price risks and risks related to general poverty are all ranked as high or very high. Input risks and risks related to social and cultural norms ranked as intermediate.

Logistical and infrastructural risks, credit risks, and public policy and institutional risks were ranked lowest.

Table 2: Risk ranking for both men and women groups

Risk-category	Sub-category	Grading
Production risk	Weather, biological, environment related	(Very) high
	Agric inputs	Medium
Market risks	Logistical & infrastructural	Low
	Market price	(Very) high
Personal risks (human health and personal relationships)	Health	(Very) high
	Social risks and cultural norms	Medium
Financial risks	Risks associated with poverty (no/low cashflow)	(Very) high
	Access to credit /other financial products	Low
Institutional risks – unpredictable changes in policies & regulation	Public policy and institutional risks	Low

Women and men recognized personal and financial risks as a priority, with men giving financial concerns a higher rank than women (Figure 1). In comparison, women reported production related problems as a higher priority more frequently than men did. Institutional and market risks were generally considered to be of less concern, which is partly due to the absence of organized markets and limited logistical infrastructure to move and process produce (Mastenbroek et al., 2020)

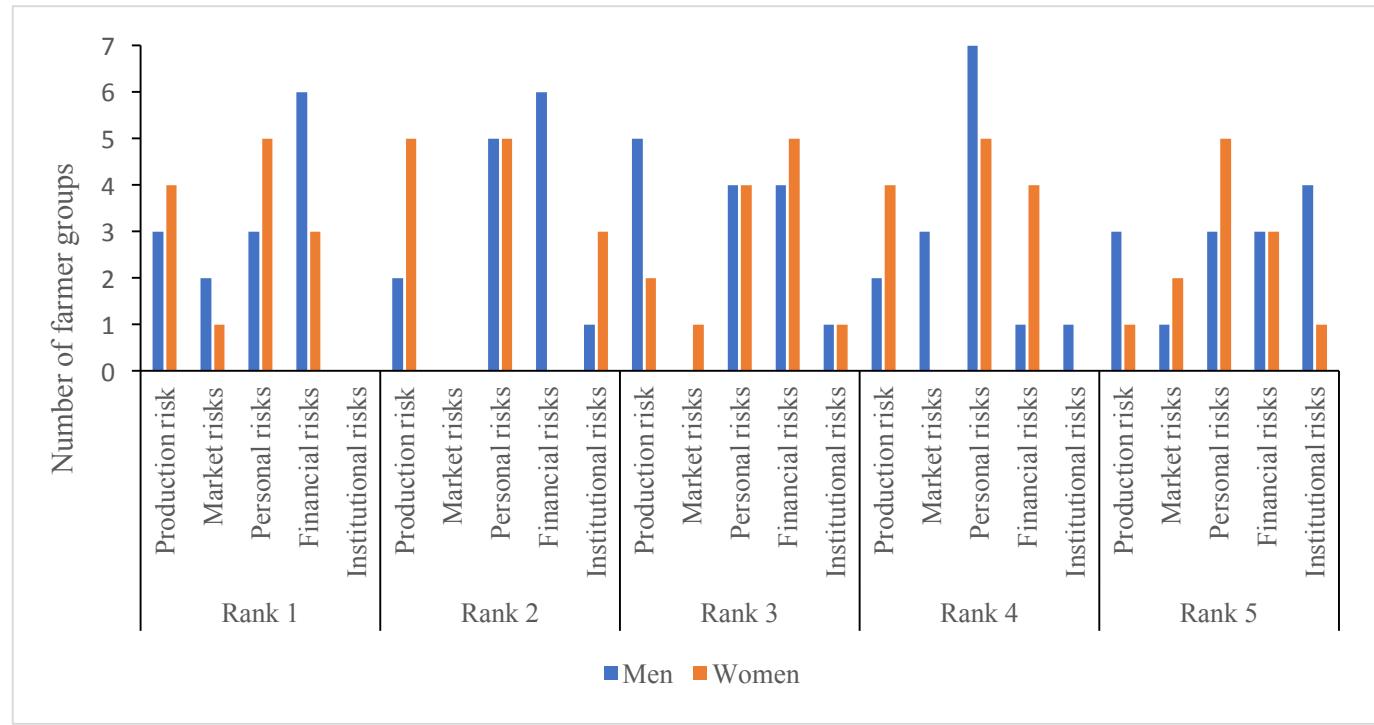


Figure 1: Risks and concerns according to priority rank, by men's and women's groups

Risk reduction and mitigation strategies

Our analysis makes a distinction between household strategies (Mastenbroek et al., 2020) to (i) reduce exposure to risk, (ii) mitigate the effects of this risk, and finally (iii) to cope with these effects. Strategies that reduce exposure are applied before a negative event (risk) occurs. Strategies that mitigate the effect of a negative event (risk) are applied after the risk has occurred and there is still chance to reduce the effects. Strategies to cope with the effect of a negative event (risk) are applied after the event has happened and nothing can be done to reduce the effects.

Risk reduction

Risk reduction strategies were similar for men and women. Strategies reported by male and female groups to reduce production risks include: (i) good agronomic practices such as planting early maturing crops, using drought/pest/disease resistant varieties and choosing food security crops to prevent famine; (ii) addressing water scarcity and lack of clean water, through timely planting, irrigation, farmers training, harvesting rain water and making more shallow wells; (iii) use of home-saved seed, as this does not need to be purchased, provides a low but reasonably stable and reliable yield, and is less dependent on available labor compared to hybrid maize seed.

For reducing **financial risk**, house-holds (i) diversify crops and income streams (such as basket weaving, daily income from sale of milk, boda-boda driving, crop production) to spread risk and generate small daily incomes, while most crops generate seasonal food supply and income; (ii) farmers refrain from growing expensive crops (such as onion and cotton in Dokolo, sugarcane and water melon in Iganga).

Risk mitigation

Strategies for mitigating the effects of production risks include spraying crops and using kitchen droppings to control for pests and diseases. Drought-related mitigation measures include lining up for water, buying water, looking for water in other villages, and boiling and treating drinking water. Women in particular mentioned storing food and hiring out labor in sugarcane plantations.

For mitigating **financial risks**, women and men identified borrowing money, engaging in casual labor, engaging in non-agricultural enterprises, obtaining loans and participating in Village Savings and Loan Associations (VSLAs) and prioritizing saving for school fees, medical treatment, buying food and agricultural inputs.

To mitigate health-related risks, both men and women identified going to health centers, and obtaining immunizations and vaccinations. Women in particular mentioned visiting the Village Health Team (VHT), which are low barriers community health services, mainly ran by women.

From the identified risks and risk management strategies, labor is perceived as the most flexible resource to be optimized. Financial resources (through formal institutions) are hardly available and land availability is fixed in most cases, though some groups mentioned renting additional land as an option. Scarcity of labor was mentioned as a factor hampering investment in particular crops. We can infer that households optimize family labor. This is an important observation for agricultural risk management strategies and gender considerations. In Dokolo and Iganga and to a lesser extent in Masindi, women are solely responsible for most of the household work, such as cooking, sweeping, cleaning and laundry.

Coping

In circumstances where risk reduction and mitigation strategies cannot be applied, maize farming communities adopt coping strategies to deal with difficult conditions. As a result, resources are used for household consumption rather than investing in quality maize seed.

Coping strategies to deal with **financial risks** include buying food, providing casual labor for food, borrowing money for buying food, obtaining food from neighbors, serving smaller portions of food, or refraining from wasting food as strategies to cope with famine. In addition, selling of property to buy food was also mentioned as a measure of last resort. Some groups mentioned that food insecurity and hunger can lead to temporal male migration and school dropouts.

Both women and men mentioned coping strategies for **financial risks** that may have negative effects on longer term productivity, such as limiting investments in maintaining soil fertility, resulting in reduced in soil fertility over time. Some examples of these practices are mono-cropping, over-cultivation (i.e. no longer using fallow periods), and deforestation.

Without access to financial markets households need buffers to self-insure against financial emergencies. Particularly, due to health risks, famers must choose between investing in seed (and fertilizer) or keeping a buffer for sickness. Sickness in the family reduces available labor required during the agricultural season resulting in a risk of losing the monetary investment in seed (and fertilizer) if good agronomic practices cannot be applied. As a result, smallholders invest in low input-low output systems using home-saved seed and other low-cost alternatives.

Maize varieties used by farmers in Uganda

Looking at the implications of the perceived agricultural risks and risk management strategies on the choices of maize varieties, we observe the use of a wide range of maize varieties (Figure 2). Generally, older hybrids, particularly Longe 10H, and open pollinated varieties (OPVs) particularly Longe 5, were mentioned by both men and women in all the study districts apart from women in Iganga who did not mention OPVs. Longe 5 and Longe 10H have been commonly distributed as free hand-outs from the government and NGOs. OPVs and local varieties are generally recycled over several seasons as home-saved seed (Mastenbroek et al., 2020)

The so-called newer hybrid varieties were released from 2012 onwards and are characterized as drought tolerant maize varieties. We noted that the newly introduced drought tolerant varieties were not commonly mentioned by the groups. Bazooka, a newer hybrid variety was mentioned most frequently (4 women's groups in Iganga and 3 men's groups in Masindi). Other newer hybrids mentioned were Ph5052, FH 5150, and UH5053. Groups mentioned seed price and the need for fertilizer as deterrents for using them.

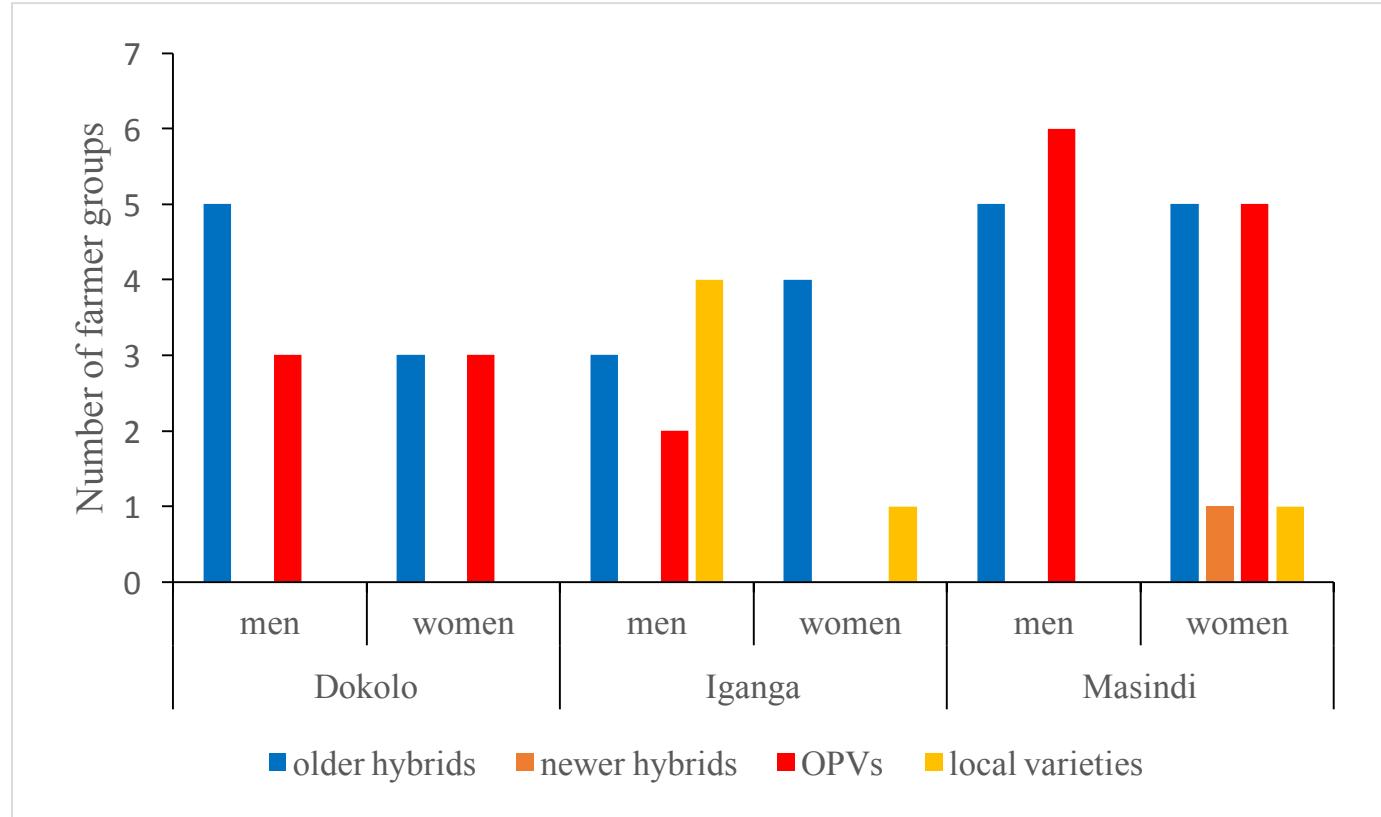


Figure 2: Variety types most commonly grown in villages, by district and men's and women's groups

Older hybrids are less drought tolerant compared to the newly introduced drought tolerant maize varieties and therefore contribute less to production risk reduction. Across districts, knowledge of drought tolerant maize varieties was low. The main sources of information were NGOs, radio, fellow farmers and personal experience, with women's groups in particular reporting the latter. Across districts reasons for not buying DTM were high seed price and not enough knowledge.

The use of home-saved seed and free hand-out seed links directly with the production and financial risks described above. Free seed reduces the financial risks as production is done with 'free' inputs (seed, family labor and family land), however it does not necessarily reduce production risks as DTM are more adapted to the climate and give more stable yields according to research (Hansen et al, 2019).

Seed sources as rated by farmers in Uganda

The most and the least trusted seed sources as perceived by the groups vary across districts and gender. The main source of seed for women in Masindi is the agro-input dealer and for women in Dokolo and Iganga home saved seed.

The main sources of seed for men in Iganga and Masindi were formal sources (agro-input dealer and seed companies) and in Dokolo informal sources (local market, homes saved and neighbors). We can link back the reasons for whether a seed source is trusted or not to either production risks or financial risks. For all seed sources the risk perceptions were formed based on prior experience and hearsay and information from fellow farmers, extension workers and radio. We can see that apart from seed distributed by Government and NGOs reasons to trust the seed source are related to production risks.

Home-saved seed

When home-saved seed is mentioned as most trusted it is because, amongst other reasons, the farmers know the germination potential, it is not mixed, and it is well stored. When home saved seed was mentioned as least trusted it was because the grains are small, it is low yielding and easily attacked by weevils during storage.

Agro input dealers

Agro-input dealers are trusted because the seed is treated, high yielding and not easily affected by pests and diseases. When agro-input dealers are least trusted it is because of counterfeit seed, the crop is affected by fall army worm, or germination is unreliable.

Local government & projects

When local government/projects/NGOs were mentioned as most trusted it was because the farmers receive training (only in Iganga), the varieties are high yielding and because they are either free or sold on credit (Iganga). Local government was mentioned as least trusted because the seed comes late and is susceptible to pests and diseases.

Local markets, middlemen & traders

When local markets were mentioned as most trusted it was because seed is always available and cheap. Local markets, middlemen and local traders were mentioned only in Dokolo.

Reasons groups gave for not trusting local markets, middlemen and local traders include; poor storage conditions leading to low germination rates, mixed seed/fake seed, high cost of seed and no business connection when mentioning local markets, middlemen and traders.

Barriers and drivers to adoption of DTM varieties

The results of the study show that major barriers include inadequate information and knowledge on available varieties and their yield potential, use of home-saved seed, the need to use fertilizers with hybrids, gender inequalities in land ownership, access to extension services, and income control. In addition, maize is a crop grown for both food and income, it has a low and unstable grain market prices and it is susceptible to pests and diseases and droughts. The reducing soil fertility as observed by almost all groups, suggest that without applying fertilizer potential yields will be hard to meet.

On the other hand, major drivers to adoption of drought tolerant maize varieties include seed from agro-dealers being high yielding, participation of women in decision making on seed sourcing, access to agro-dealers and the availability of DROUGHT TOLERANT MAIZE VARIETIES.

Conclusion

Our study found that production risks, financial risks, health risks and output market price risks were rated as most severe by men and women; whereby financial risks were rated as most challenging by men, whereas women reported production related problems as a highest priority followed by health risks. Production risks are mainly managed by using low cost inputs and applying good agronomic practices.

Financial risks are mainly managed through diversification income sources, while health risks limit availability of farm labor and are mainly addressed using preventive and self-medication.

The most common varieties reported by both men and women are Longe5 (OPV) and Longe 10H. Knowledge about newly released drought tolerant varieties was lowest in Dokolo and not widespread in Iganga and Masindi.

Seed companies and agro input dealers are trusted seed sources. In addition, local government and NGOs/projects are also trusted because they provide seed and training to farmers. The least trusted seed sources include local markets, middlemen, local traders and fellow farmers.

Farmers do appear to be informed on the benefits of good quality seeds, but nevertheless remain reluctant to adopt these. This is mainly due to the price of seed and farmers' financial constraints. Although farmers are aware of the benefits of good quality seed, they face an information gap about the benefits of drought tolerant maize varieties.

In addition, missing markets limited farmers to community and personal risk management strategies, rather than institutional risk management strategies. As long as these markets are missing, farmers have to optimize their labor and avoid loss of financial investments.

Crop- and index insurance are many times suggested as an institutional (financial) risk management strategy. Yet, as this study shows, farmers do not only consider production and climate risks when making agricultural decisions, including adoption of drought tolerant maize varieties, but also consider health risks and output market price risks. Yet agricultural insurance products cover only production risk and do not include health and market risks. Therefore, a single focus insurance is not sufficient for scaling uptake of drought tolerant maize varieties.

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