Drought-tolerant maize varieties in Uganda

Source	FAO, Le Groupe-Conseil Baastel, Global Climate Change Alliance
Keywords	Drought, maize, disaster risk reduction
Country of first practice	Uganda
ID and publishing year	8920 and 2017
Sustainbale Development Goals	No poverty, no hunger, decent work and economic growth and life on land

Summary

This technology describes the cultivation of drought-tolerant maize varieties in the central cattle corridor of Uganda, a region, particularly exposed to dry spells. The benefits and constraints compared to local varieties are shown in a cost-benefit analysis.

Description

1. Maize varieties

1.1 Local varieties

In visited sites, the average yields for local maize varieties varies between 300 and 600 kg per acre depending on the area. These yields are obtained without the application of any type of fertilizers. Local varieties are usually saved from one campaign to the other, which doesn't cost anything to farmers. These varieties are quite vulnerable to an increase in variability of rainfall patterns and droughts as they are not fast maturing varieties.

1.2 Improved varieties

The most common improved maize varieties in Uganda are listed below. Some of these varieties are more tolerant to drought and one of them (MM3) is a fast maturing variety, presenting a good potential to adapt to a potential decrease in rainfall and an increase in variability of rainfall patterns.

In particular, the following varieties were introduced by the GCCA project:

1.2.1 MM3

Caracterised by:

- Open pollination, fast maturity, drought-tolerance and a maturity of 90 days.

1.2.2 Longe 4

Caracterised by:

- Open pollination, drought-tolerance and a maturity of 100 days.

1.2.3 Longe 5

Caracterised by:

- Drought-tolerance, quality protein maize and a maturity of 115 days.

1.2.4 Longe 7 H

Caracterised by:

- Hybridity, drought-tolerance, resistance to the maize streak virus (MSV), the grey leaf spot (GLS), the northern corn leaf blight (NLB) and Turcicum and a maturity of 120 days.

1.2.5 Longe 10 H

Caracterised by:

- Hybridity, drought-tolerance, resistance to MSV, GLS, NLB and Turcicum; and a maturity of 120 days.

2. Major costs and resources needed to cultivate improved maize varieties

2.1 See purchase price

The improved seeds mentioned in Table 1 are easily available in the local market

2.2 Labour and input costs for maize production

- slashing/acre: four mornings for two workers
- ploughing/acre:
  - manually: 8 h/day for 6 days
  - ox plough: 2 days
- seeds/acre: 10 kg
- planting/ acre: 4 days
- weeding (x2)/ acre: 12 days
- fertilizers: 35 000 UGX/acre
- harvesting/acre: 8 days

3. Cost-Benefit analysis of the practice

The performance of improved maize varieties was assessed at farm-level in Uganda. The net benefits obtained from improved maize varieties were measured through a cost-benefit analysis (CBA), and compared to the net benefits of the local maize variety.

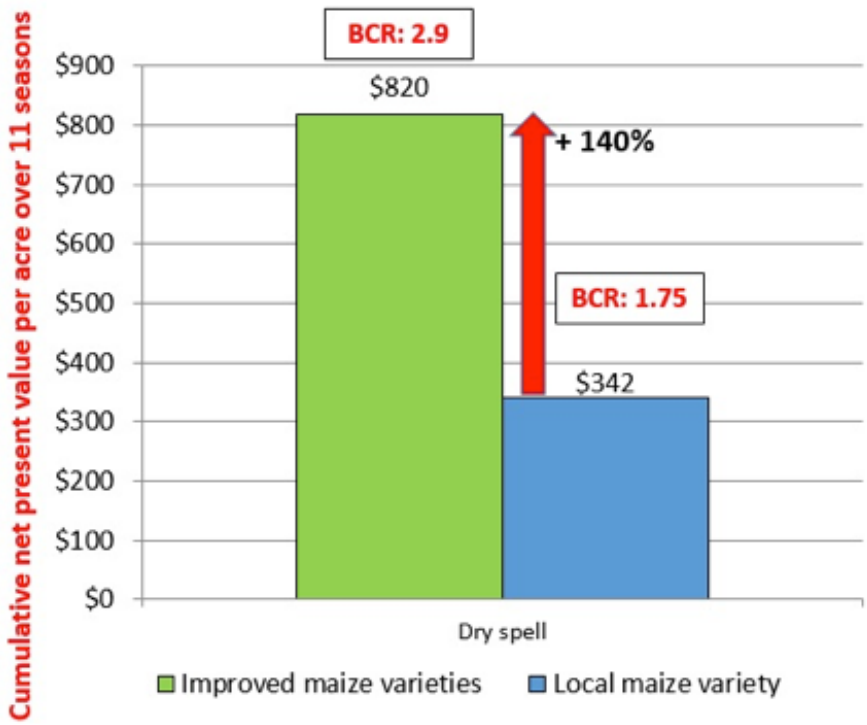
The CBA calculates the cumulative net benefits obtained from 1 acre of maize over

Table 1: Costs of different maize varieties

Variety	Local	Longe5	L7H	L10H	MM3	L4
Price (UGX/kg)	0	2 500	4 000 - 6 000	4 000 - 6 000	3 000	2 750

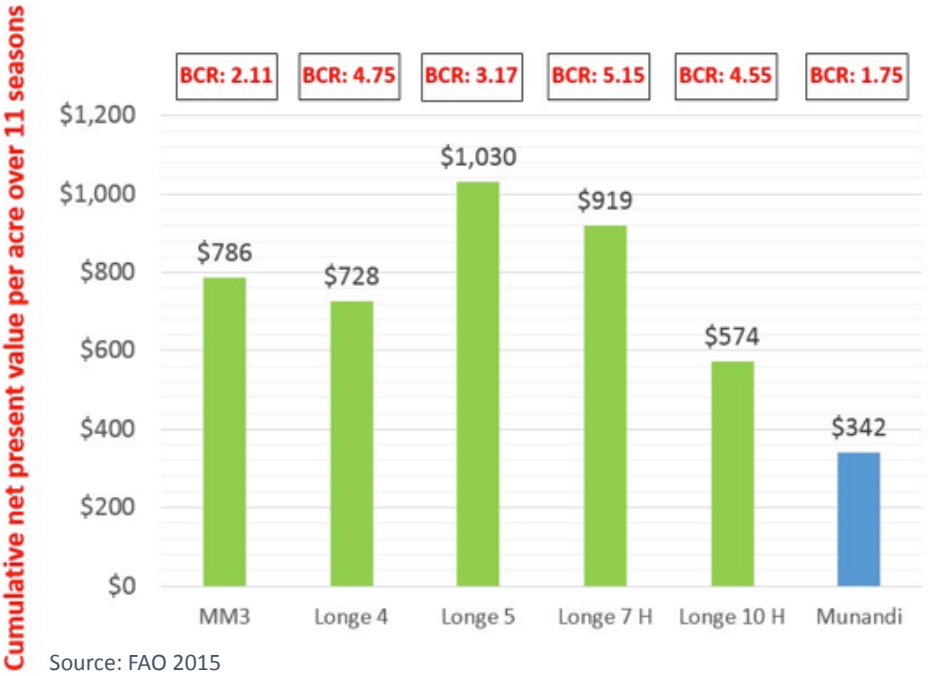
Source: FAO 2015

Figure 1: Cumulative Net Benefits and Benefit Cost Ratios (BCR) of maize varieties, by variety (USD per acre per season)



Source: FAO 2015

Figure 2: Cumulative Net Benefits and Benefit Cost Ratios (BCR) of maize varieties, by variety (USD per acre per season)



Source: FAO 2015

a period of 11 years (10 percent discount rate), as well as the benefit-cost ratio (BCR), which is the ratio between total discounted benefits and total discounted costs over the appraisal period.

Figure 1 provides an overview of the outcome of the CBA. In particular, it shows that:

- In farms affected by dry spells, the cumulative net benefits of improved varieties are more than two times higher than those of the local variety.
- The BCR of the good practice (i.e. use of improved maize variety) (2.9) is higher than the BCR of the local practice (1.75), meaning that improved varieties bring greater benefits relative to costs, as compared to the local variety.

The assessment was conducted in farms that were affected by dry spell during the monitoring period.

Local maize varieties required higher labour costs than improved varieties, probably due to the higher resistance of improved varieties to weeds, pests and diseases. The higher seed and fertilizer costs associated with the cultivation of improved maize were more than compensated by the increase in yields.

Figure 2 shows that, in the analysed dry spell scenario, Longe 5 and Longe 7 H are the varieties that bring higher net returns, followed by MM3, Longe 4 and Longe 10 H. The local variety Munandi brings the lowest net benefits. The best performing variety (Longe 5) brings net returns almost three times higher than the local variety.

3.1 Co-benefits

The improved maize varieties mature faster than the local variety. Therefore, water use is lower under the good practice.

3.2 Maize sale price

In 2015, average maize prices on the local market fluctuated between UGX 400 and UGX 1 000 for 1 kg.

4. Effectiveness and benefits

4.1 Climate change adaptation

In a context of climate change, improved short cycle varieties present a good potential to adapt to a decrease in rainfall and an increase in variability of rainfall patterns.

4.2 Socio-economic and ecological benefits

- Improved tolerance to droughts. Increased yield: while local variety yields are on average 400 – 600 kg/acre, with an improved variety like L10H and under good management, it can go up to 3 600 kg/acre.
- Increased resistance to pests and diseases.

4.3 Side effects

If not properly managed, the cultivation of maize, with or without improved seeds, can alter land fertility and quality, especially when it comes to inadequate soil management and chemical inputs such as herbicides and pesticides.

5. General recommendations

Not all farmers have the financial means to buy improved seeds, but they have a good potential to increase maize productivity in Uganda if grown under good management. Aside from making the seeds accessible or providing them to farmers, it is as important to provide training on how to properly manage their soil and water resources to get the highest yields possible in a sustainable manner and according to the change in climate conditions and patterns. In the majority of the visited districts, communities were growing maize, which shows a high potential for the adoption of improved maize varieties in Uganda.

6. Validation of the practice

6.1 Hazard context during monitoring period

During the 2016 dry season (June to August), the performance of the improved maize varieties was monitored in 19 farms in Kiboga (2) Mubende (3) and Nakasongola (14) districts. All the farms were affected by dry spell during the monitoring period. In particular, rainfall was between 50-100 percent below normal in August, and land surface temperatures were 3 - 7 °C above average, causing a reduction in water availability.

6.2 Farmers' perception

Five farmers were interviewed for the evaluation of the good practice. All of them said they would like to continue planting improved maize varieties in the next seasons as they brought higher yields and strengthened food security at the household level. All farmers said the good practice helped increase maize production, and they assigned a score of 4.4 out of 5 to the resistance of improved varieties to climate constraints. According to one farmer, water scarcity still remains an issue during the dry season. Cost-Benefit Analyses were conducted based on quantitative data collected during the monitoring period in the 2016 dry season (Jun-Aug).

7. Minimum requirements for the successful implementation of the practice

7.1 Major costs

- Price of different maize varieties are mentioned in Table 1; and
- Labour and input costs are listed in

section 2.2.

7.2 Major barriers

Some farmers do not have the means to buy improved seeds and rather grow local varieties that they can save from one campaign to another which does not cost them anything. To significantly increase the maize yields with improved varieties, farmers need to grow them under good management, which includes the use of organic fertilizers, water and soil conservation measures, etc. However, some farmers do not have the technical knowledge to implement such practices which affects their productivity, even with improved varieties.

8. Agro-ecological zones

- Tropics, warm

9. Related/Associated Technologies

Other adaptation options that would create the most synergies with improved varieties are:

- Cover crops;
- Minimum Tillage;
- Organic fertilizers; and
- Mulching.

10. Objectives fulfilled by the project

- Labour saving technology; and
- Pro-poor technology.