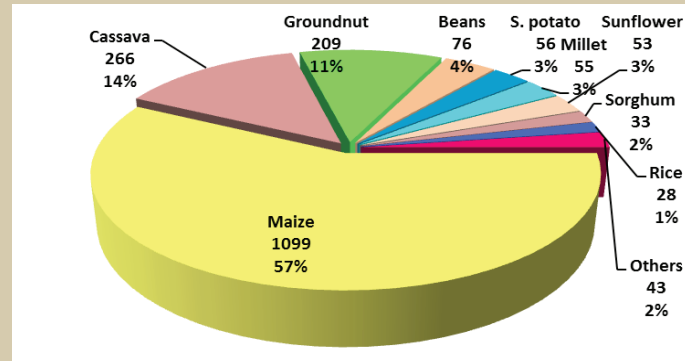


## A Quarterly Bulletin of the Drought Tolerant Maize for Africa Project

### About the Bulletin

**DT Maize** is a quarterly publication of the Drought Tolerant Maize for Africa (DTMA) project, funded by the Bill & Melinda Gates Foundation. Its aim is to inform partners and the general public at large about developments related to drought tolerant maize in Sub-Saharan Africa. It publishes short, general articles, relevant news, and events related to DTMA. Articles and news on all aspects of maize in Africa from sister projects and other partners are also welcome. Any feedback from our readers would be appreciated.



Share of crops grown in Zambia; numbers represent 1000 ha and percentages of the total cultivated area (source: constructed by the authors from Ministry of Agriculture [MOA] data)

## Maize in Zambia: An Example of Good Practice

### Overview

Maize occupies the largest proportion of the land area planted to all crops in Zambia. According to Ministry of Agriculture (MOA) data for 2011/12, maize occupies approximately 1.3 million ha, accounting for 57% of Zambia's total cultivated area (see the pie chart above), with an annual production of more than 2.8 million metric tons (MT). Other staples include cassava, groundnut, common bean, sweet potato, millet, sunflower, sorghum and rice.

Zambia has the highest average maize yield, 2.64 MT/ha<sup>1</sup>, compared to 2.19 MT/ha for Malawi, 1.29 MT/ha for Tanzania, 0.97 MT/ha for Mozambique, 0.93 MT/ha for Zimbabwe, and 0.83 MT/ha for Angola. Maize area, yield and production in Zambia showed average annual growth rates of 6.2%, 4.9%, and 11.4%, respectively, during the period from 2000 to 2013. This translates into a productivity gain of more than 97 kg/ha/yr, which is the highest among the neighboring countries, and is a far cry from the negative or stagnant growth rates reported during the two decades between 1980 and 1999 (Figure 1).

There was faster and relatively more sustained growth in Zambia's maize area, yield and production since the early 2000s, compared to previous years (Figure 1).

According to MOA, smallholders (whose farm sizes range from 2 to 20 ha) account for 85% of Zambia's maize production, whereas emerging commercial farmers (20 to 200 ha) and large commercial farmers (>200 ha) account for 10% and 5%, respectively.

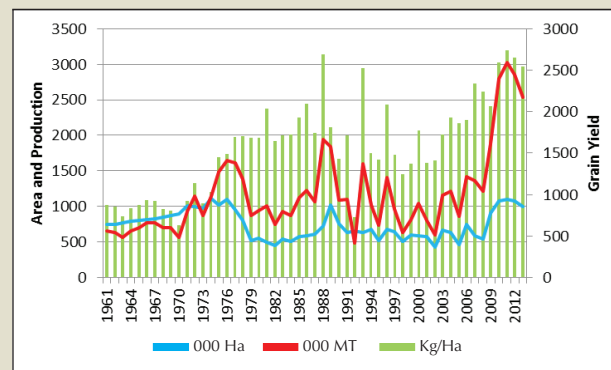


Figure 1: Maize performance in Zambia, 1961-2013 (source: calculated by the authors from FAOSTAT, accessed on 02/05/2015)

Women contribute 44% of labor. Approximately 48% of all maize produced in Zambia is sold commercially<sup>2</sup>. The government of Zambia purchases about 90% of all commercialized maize, even though it does not control the grain market. An average Zambian consumes about 170 kg of maize a year, compared to 30 kg for Angola, 150 kg for Zimbabwe, 300 kg for Malawi, and 315 kg for Mozambique.

### Major Constraints

Drought is the key constraint for maize production in Zambia, as it is in many other countries in Sub-Saharan Africa (SSA). In an adoption monitoring survey carried out by DTMA in 2013, 83% of smallholder households surveyed said they had encountered drought 1-3 years over the previous 10 years. They also pointed out that inadequate awareness, low seed availability, and lack of resources (credit) to purchase

<sup>1</sup> Average large-scale farm yield is estimated at 3.68 MT/ha compared to 2.03 MT/ha for small-scale farmers; similarly, hybrids yield about 4.11 MT/ha, whereas the average yield for OPVs is estimated at 2.31 MT/ha.

<sup>2</sup> Large commercial growers sell about 91% of their grain.

seed were the key constraints to adopting drought tolerant maize in Zambia.

## Major Agroecologies

Zambia has four main agroecological zones (AEZs): AEZ I, AEZ IIA, AEZ IIB, and AEZ III; the last one is by far the largest (Figure 2). Administratively, the country is divided into ten provinces and 78 districts. Maize is grown across all provinces and districts. Southern, Eastern and Central Provinces account for 56% of the total area, and the highest yields per hectare are obtained in Copper Belt, Central and Lusaka Provinces.

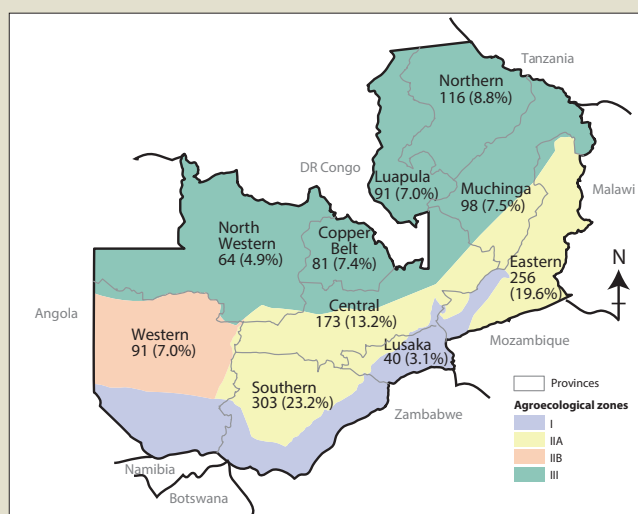


Figure 2: Distribution of maize across different agroecological zones and provinces in Zambia (data are from MOA 2011/12 season); figures indicate 000' ha. (and percent of national total).

## Maize Varieties in Zambia

Maize variety release in Zambia started in 1960, with SR 52, a hybrid; the first OPV (ZCA) was released in 1969. The frequency of maize variety releases increased substantially starting in the mid-1990s (Figure 3). For a long time, hybrids dominated maize varieties in Zambia. For example, 90% of all varieties released between 1960 and 2012 were hybrids. Approximately 90% of the varieties were white, and the rest were yellow/orange maize varieties. Variety releases by private companies in Zambia accounted for about 73% of all varieties released between 1960 and 2012; the rest were released by public institutions and parastatals.

The major players in maize variety release in Zambia are Pannar, ZamSeed, Pioneer, and ZARI (Zambia Agricultural Research Institute). The role of public institutions has increased in recent years. For example, of 22 varieties released under DTMA between 2007 and 2014 (table 1), ZARI was responsible for 12, whereas ZamSeed, Capstone, Kamano, Progene, and SeedCo released 2 each.

Approximately 32% of all varieties released under DTMA in Zambia between 2007 and 2014 were OPVs, compared to 10% for all varieties released between 1960 and 2012. This was because of the demand by farmers and the government of Zambia for OPVs. The increased role in variety release of ZARI, in collaboration with DTMA/CIMMYT, has also contributed significantly to increases in OPV releases. Many of the varieties shown in Table 1 are being scaled under the DTMASS (Drought Tolerant Maize for Africa Seed Scaling) project, funded by USAID in parts of Katete, Chipata, Chadiza, Petauke and Lundazi Districts of Eastern Province, in collaboration with seven private and public seed companies.

Table 1: Drought tolerant maize varieties released in Zambia between 2007 and 2014

Release name	Year of release	Hybrid/OPV	Maturity range	Suitable agroecologies	On-farm yield range (MT/ha)	Additional traits/remarks
PGS53	2007	Hybrid	Intermediate	Drier mid-altitudes	3.0-6.0	MSV resistant
PGS71*	2007	Hybrid	Intermediate	Drier mid-altitudes	3.0-6.0	MSV resistant
KAM601*	2008	Hybrid	Intermediate	Drier mid-altitudes	4.0-6.0	GLS and MSV resistant
KAM602*	2008	Hybrid	Intermediate	Drier mid-altitudes	4.0-6.0	GLS & MSV resistant
SC721	2008	Hybrid	Very late	Drier mid-altitudes	6.0-8.0	GLS and MSV resistant
CAP9001	2010	Hybrid	Intermediate	Drier mid-altitudes	4.0-6.0	MSV & GLS resistant
SC727	2010	Hybrid	Late	Drier mid-altitudes	4.0-6.0	MSV & GLS resistant
ZMS606	2010	Hybrid	Intermediate	Drier mid-altitudes	4.0-6.0	MSV & GLS resistant
ZMS623	2012	Hybrid	Intermediate	Drier mid-altitudes	3.0-5.0	MSV & GLS resistant
GV 635*	2013	Hybrid	Intermediate	Drier mid-altitudes	4.0-6.0	Semi-flint, MSV & GLS resistant
GV 638*	2013	Hybrid	Intermediate	Drier mid-altitudes	4.0-6.0	Semi-flint, MSV & GLS resistant
GV 628*	2013	Hybrid	Early	Drier mid-altitudes	4.0-6.0	Semi-flint, MSV & GLS resistant
GV613*	2014	Hybrid	Intermediate	Drier mid-altitudes	4.0-6.0	Semi-flint, MSV & GLS resistant
GV637*	2014	Hybrid	Intermediate	Drier mid-altitudes	4.0-6.0	Semi-flint, MSV & GLS resistant
GV655*	2014	Hybrid	Intermediate	Drier mid-altitudes	4.0-6.0	Semi-flint, MSV & GLS resistant
ZM423	2007	OPV	Early	Drier mid-altitudes	3.0-4.0	MSV resistant
ZM523	2008	OPV	Early	Drier mid-altitudes	3.0-4.0	MSV resistant
ZM625	2008	OPV	Intermediate	Drier mid-altitudes	3.0-5.0	MSV resistant
ZM721	2008	OPV	Late	Drier mid-altitudes	3.0-5.0	Flint, MSV & GLS resistant
Nelson's Choice	2010	OPV	Intermediate	Drier mid-altitudes	3.0-4.0	GLS, MSV & rust resistant
MMV409	2011	OPV	Very early	Drier mid-altitudes	2.0-3.0	Flint, MSV resistant
MMV607	2014	OPV	Intermediate	Transition & drier mid-altitudes	3.0-4.0	Semi-flint, MSV & GLS resistant

\* = Varieties being scaled under DTMASS

The previously mentioned household survey carried out by DTMA in 2013 revealed that Zambian farmers in the surveyed areas grew a total of 20 varieties during that year. The most widely grown varieties were SC513 (released in 1999), MRI 624 (1998), Gankata (landrace), MRI 614 (1998), and SC601 (1997). These varieties accounted for approximately 57% of all the maize area sown that year. The average age of hybrids was 15 years (range: 11 to 29 years).

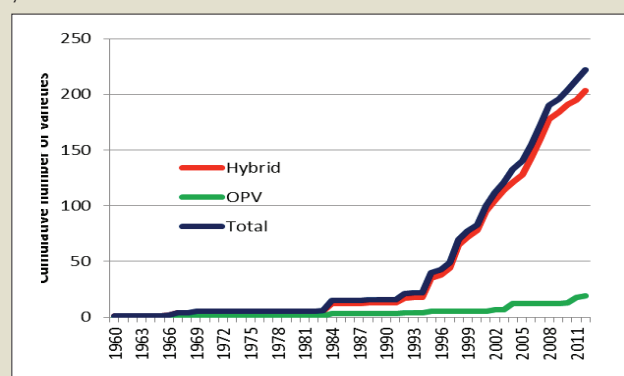


Figure 3: Cumulative numbers of maize varieties released in Zambia between 1960 and 2012 (source: official Variety Register-2013, Seed Control and Certification Institute)<sup>3</sup>

### Seed Systems

Zambia has a well-established, vibrant seed industry. As of 2015, a total of 13 seed companies are actively producing maize seed in Zambia, including national (ZamSeed, Kamano Seed, MRI, Progene Seed, Steward Globe, and Unity Seed), regional (Capstone, Klein Karoo Seed and SeedCo), and multinational (Pioneer, Monsanto, Sygenta and Advanta) companies. With the exception of ZamSeed, all are privately owned. ZamSeed has been providing maize varieties to Zambian farmers since 1960, whereas the smaller national companies were established after 2006. Regional and multinational companies started operations in the early 1990s. For example, Pioneer first released a maize hybrid in 1992, Pannar in 1995, SeedCo in 1997, MRI in 1998, Monsanto in 2002, and Advanta in 2012.

<sup>3</sup> Only varieties for which year of release is given are shown here.

### Trade

Zambia has a checkered history of maize import and export. In particular, it was a heavy net importer of maize grain between the late 1970s and early 2000s (Figure 4). However, in recent years, it has become a net exporter. For example, average annual net exports between 2000 and 2011 totaled more than 56,000 MT valued at more than US\$ 24.4 million.

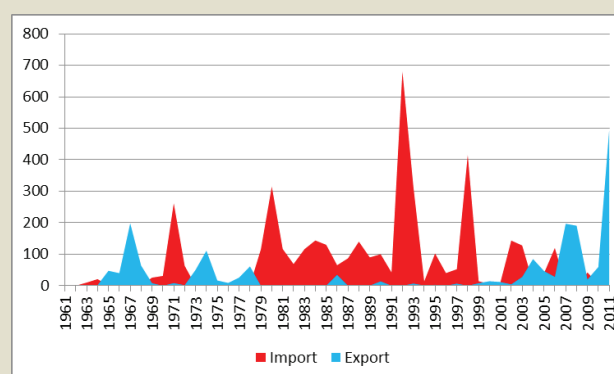


Figure 4: Maize imports and exports in Zambia (source: calculated by the authors from FAOSTAT, accessed on 14/06/2015)

### Fertilizer Use in Maize in Zambia

Data on fertilizer use in maize in 2011 reveal that Zambia has the highest fertilizer (NPK nutrients) application rate in Sub-Saharan Africa<sup>4</sup>. Table 2 presents a comparison of fertilizer application rates on maize for Zambia and its neighboring countries. The 2011 nutrient application rate of 49 kg/ha for Zambia is very close to the minimum fertilizer nutrient recommendation of 50 kg/ha by the Abuja Declaration of African Union.

### Research Capacity

Informal surveys carried out by one of the authors (Abate) revealed that Zambia has 4.0 full time equivalent (FTE) researchers as of 2013. This would mean approximately

<sup>4</sup> Does not include South Africa.

<sup>5</sup> Considering that 40% of all fertilizers used in Africa are applied on maize (from the literature).

Table 2: Fertilizer application rates (kg/ha NPK nutrients) in Zambia and neighboring countries<sup>5</sup>

Country	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Zambia	26	26	30	28	26	32	39	27	27	49
Malawi	30	31	34	30	37	42	35	29	33	30
Zimbabwe	36	40	23	22	33	27	22	27	26	23
Tanzania	4	4	5	6	5	5	5	8	7	9
Mozambique	6	1	2	2	5	3	13	4	9	8
Angola	2	2	5	2	4	3	8	1	2	5
SSA avg.	13	12	16	13	16	17	17	14	16	18

Source: Calculated by the authors from FAOSTAT (27/02/2014)

3.8 FTE for every million ha of maize harvested or 1.4 FTE for every million MT of grain produced. All the FTE researchers had a MSc; there were no PhD and BSc degree holders at the time of the survey. FTE researchers consisted of 1 woman and 3 men.

Zambia's research capacity is low in comparison even to the African average: 5.0 FTEs per million ha harvested. By comparison, Mozambique, Tanzania, Angola, Malawi and Zimbabwe have 5.2, 3.8, 3.2, 1.7, and 1.5 FTEs per million ha of maize harvested.

## Concluding Remarks

Maize occupies the largest area (57%) of all crops in Zambia and its hectareage is still growing. Zambia has made significant progress in maize productivity over the last decade, with an annual productivity gain of 97 kg/ha/yr, one of the highest in SSA. This has been achieved because the government gives very high priority to maize; even though the overall investment in agriculture declined over the last decade, maize is still accorded the highest priority and was little affected by that. Other

contributing factors include: a) Zambia's higher fertilizer use compared with other countries in the region, b) the presence of well-established seed companies that produce seed of modern varieties, and c) effective partnership with CIMMYT, which also provides technical support.

On the other hand, there are areas that need significant improvement. The variety turnover in Zambia is slow and most varieties currently grown by smallholder farmers were released before 2000. This is partly because of the reluctance of big seed companies to invest in the promotion and marketing of recently released high yielding varieties even though they have a clear yield advantage. Current national research capacity is extremely low. The government needs to invest in capacity building – both in quantity and quality – if recent gains are to be maintained and further enhanced. ■

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## News and Events

### West Africa Regional Meeting Held

The Annual DTMA Regional Meeting for West Africa held on 20-23 April 2015 at IITA, Ibadan, Nigeria, was attended by scientists from the four member countries – Benin, Ghana, Mali and Nigeria. Progress made during the 2014 crop season was discussed and work plans for 2015 were reviewed.

A total of 20 new varieties were released across the four countries in 2014, including nine in Benin, five in Mali, four in Ghana and two in Nigeria. One of the varieties registered in Benin was a hybrid – the first of its kind to be released in that country. All of the varieties released in the other countries were hybrids. Seed production showed significant improvement particularly in Nigeria (14,077 MT), Ghana (2,444 MT) and Benin (1,787 MT).

### Sub-Grant Agreements Signed

Sub-grant agreements on DTMA Seed Scaling (DTMASS), funded by USAID, were signed between CIMMYT and seed companies in Ethiopia, Kenya, Mozambique, Tanzania, Uganda and Zambia. The grants are being used by key partners (including seed companies, research organizations and ministries of agriculture) to improve facilities, promote new drought tolerant maize varieties,

and produce early generation seed (breeder seed, pre-basic seed and foundation seed).

### Workshop on Proposal Writing Held

Senior researchers from CIMMYT and IITA held a workshop on project proposal writing for STMA (Stress Tolerant Maize for Africa), the project that will succeed DTMA and IMAS (Improved Maize for African Soils), in Nairobi on 6-8 May 2015. Subsequently, draft proposals have been prepared and are being reviewed before being submitted to donors.



Participants of STMA Writeshop meeting

### Upcoming Events

The joint DTMA and IMAS annual meeting has been scheduled for 14-18 September 2015 in Addis Ababa. This is the conclusion of both projects, which will soon operate under one umbrella: STMA. The meeting will review progress made since the launching of both projects.