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# Crop Product Profile

Vitamin A Maize Zimbabwe

### 02. Popular hybrids and varieties in Zimbabwe



## 01. Executive Summary

In Zimbabwe, vitamin A maize varieties are developed by CIMMYT and DR&SS for licensing to seed companies who in turn multiply and market the certified seed to farmers through agro-dealers, which are provided with training on biofortification to enable them to act as ambassadors of the program.

The maize seed is available to farmers –which are also trained on biofortification- through urban and rural agro-dealer outlets and promotional marketing that includes packs, POS branding, IEC materials, radio, and TV programs and message blasts on social media.

Many of their daily diets contain maize either directly or indirectly. Cooked, roasted, fried, ground pounded or crushed to prepare various food items like pap. Preparations and uses of maize grains varied from group to group, though at time with some similarities. Besides food, maize is also useful as medicines and as raw materials for industries.

Traditional methods of preparations use of maize are restricted to definite localities or ethnic groups.

Line	Туре	Developed by	Year of release	Main characteristics	Yield (ton/ha)
Heckory King	OPV	Introduction from USA	1905	Large kernels, and tolerance to poor soils	3
SC 525	Hybrid	CIMMYT & Seed Co	2000	White, good yield potential, drought and heat tolerant, tolerance to GLS.	8
ZM 521	OPV	Zimbabwe Super Seeds	2002	White, good yield potential, drought and heat tolerant, tolerance to GLS.	5
Z5242A*	Hybrid (Three way)	СІММҮТ	2015	Orange, good yield potential Intermediate level of pro- vitamin A content (9.8 ug/g), Tolerance to MSV, GLS and TLB	5,6
Z5244A*	Hybrid (Three way)	СІММҮТ	2016	Orange, good yield potential Intermediate level of pro- vitamin A content (I2 ug/g), Resistance to weevils	5,6
ZS246A*	Hybrid (Three way)	СІММҮТ	2016	Orange, good yield potential Intermediate level of pro- vitamin A content (8.7ug/g)	5,2
Z5248A*	Hybrid (Three way)	СІММҮТ	2016	Orange, good yield potential Intermediate level of pro- vitamin A content (7.8 ug/g)	5,2
SC 501	Hybrid	CIMMYT & Seed Co	N/A	White, good yield potential, drought and heat tolerant.	5

## 03. Productive regions:



#### Figure 1

Traditional maize production across the country

Region of the country	Percentage of contribution to total crop production
Mashonaland West (A)	25%
Mashonaland Central (B)	19%
Midlands (C)	15%
Manicaland (D)	14%
Mashonaland East (E)	13%
Masvingo (F)	7%
Metebeleland North (G)	4%
Metebeleland South (H)	3%

Figure 1: Maize production in Zimbabwe across different regions.

Data source: Production data from federal ministry of agriculture and livestock 2018 and 2018 Crop Forecast Survey. Percentage values indicates percent regional production of total average production from 2017 – 2018.



04. Preferred planting and harvesting seasons for the crop in the country

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### **Semester A**

Sowing season: November-December

### Semester B

Sowing season: April-May

Harvesting season: April-May Harvesting season: September - October

### Top agronomic traits for biofortified maize in Zimbabwe





**Early maturity** 

#### Relevance for adoption on farmers and producers

Reduction in the number of days to harvest will represent a greater income in a shorter period compared to other materials with late maturity and permits better chances to sell the production with a better price. Early maturity will let varieties enter the market when prices are still high and increase crop profitability.

### Trait indicators commonly used for crop improvement:

Days to anthesis (Phenotypic) Days to maturity (Phenotypic) Heading seeding interval (Phenotypic)



#### **Drought tolerance**

## Relevance for adoption on farmers and producers

Drought-tolerant varieties will develop acceptable grain yield even under stress conditions. This characteristic will allow incomes based on the commercialization of the production achieved in challenging environments.

### Trait indicators commonly used for crop improvement:

Segregating populations under drought environment to evaluate: a) Nutrient acquisition/Uptake efficiency (Analytic) b) Water use efficiency Photosynthesis (Analytic) c) Radiation use efficiency (Analytic) d) Deep Root development (Phenotypic) e) Grain number maintenance (Phenotypic) f) Grain fill duration and rate. (Phenotypic)



#### Tolerance to low soil nitrogen (N)

### Relevance for adoption on farmers and producers

Low soil nitrogen (N) tolerant varieties will develop acceptable grain yield even under deficient N soils. This characteristic will allow incomes based in the commercialization of the production achieved in nutrient deficient soils.

## Trait indicators commonly used for crop improvement:

Segregating populations under deficient N soils to evaluate: a) No. kernels/ear (Phenotypic) b) Dry matter yield of stems and roots (Phenotypic) c) Grain yield (Phenotypic) d) N-uptake efficiency (Analytic) e) Utilization efficiency of N (Analytic)

### Top agronomic traits for biofortified maize in Zimbabwe

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#### Grey leaf spot (GLS)

#### Relevance for adoption on farmers and producers

GLS tolerant varieties will be capable of surviving in the sustained presence of the weed. This characteristic will allow an acceptable arain production under the infestated weed.

#### Relevance for adoption on farmers and producers

Ear and Stalk rot

Ear and stalk tolerant varieties will be capable of surviving even with the sustained presence of the disease lowering the risk of molds in grains which may develop production of toxic aflatoxins.

### Trait indicators commonly used for crop improvement:

Selection pressure in segregating populations under infestation of Cercospora zeae-maydis

### Trait indicators commonly used for crop improvement:

Selection pressure in segregating populations under infestation of Fusarium sp, Diplodia sp, Penicilum sp, and Aspergilus sp to evaluate tolerance and resistance to the disease.

### Top agronomic traits for biofortified maize in Zimbabwe

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Maize streak virus tolerance (MSV)

#### Relevance for adoption on farmers and producers

MSV tolerant varieties will be capable of surviving the productive cycle even with the sustained presence of the disease. This characteristic will allow an acceptable production of the crop. In general, virus diseases are capable of severely affect any crop. Tolerance to this two of issues are mandatory.

# Trait indicators commonly used for crop improvement:

Selection pressure in segregating populations under infestation of green leafhoppers (C. mbila Naudé and C. storeyi), feed with infested plants with the virus MSC in controlled environments to evaluate tolerance and resistance to the disease.



Army worm tolerance (Spodoptera frugiperda)

#### Relevance for adoption on farmers and producers

Pest management with different products is recommended to control this type of issue. However army worm tolerant varieties will be capable of surviving the completely productive cycle even with the sustained presence of the insect. This characteristic makes the plants less attractive for the insect feeding and helps to prevent a consequent death of the plant.

# Trait indicators commonly used for crop improvement:

Selection pressure in segregating populations under infestation of Spodoptera frugiperda in controlled environments to evaluate tolerance and resistance to the disease

# Top post harvest and marketing traits for biofortified maize in Zimbabwe





#### Kernel length/Kernel shape

### Relevance for adoption on farmers and producers

The flour industry for bread and snacks requires medium to small sized maize, which hydrates more easily than the large ones; favoring the performance of the products made with flour. However, larger seeds are often preferred for fresh consumption of cob.

Dent com is often used as livestock feed, industrial products, or processed food preparations. Flint corn is used for similar purposes as dent corn, however has hard outer shell, which make it more attractive for millers and retailers. Popcorn, a type of flint corn, has a soft starchy center surrounded by a very hard exterior shell.

# Trait indicators commonly used for crop improvement:

The physical appearance of the kernels defines its price in the market, which is define by length and shape. Variations in size and shape are mainly genetic. Kernel length - Phenotypic: 33-38gr = Madium 33-38gr = Madium 33-38gr = Madium 33-8gr = Large Kernel shape (Phenotypic) Visual Rank (Phenotypic) Filmt(Phenotypic) SemiFilmt (Phenotypic) Semifilmt (Phenotypic) Dent (Phenotypic)



**Hardness of the Kernel** 

### Relevance for adoption on farmers and producers

Determines the capacity of the grain to absorb and retain water during the different stages of the cooking process. For boiled consumption, usually soft or very soft grains are required. The dry milling industry requires hard or very hard kernels, to obtain good milling performance. The popcorn industry requires hard kernels. The flour industry prefers intermediate and soft grains, which is related to adequate cooking time of kernels at the time of making flour.

### Trait indicators commonly used for crop improvement:

Flotation index of Kernels in sodium nitrate or sugar solution (Analytic):

Ranks: Very hard (0-12 FG), Hard (13-37 FG), Intermediate (38-62 FG), Soft (63 - 87 FG) and very soft (88-100 FG)

Hectolitic weight in 1 liter of H2O (Analytic): Hard (>75 kg), Intermediate (74-75 kg), soft (<74 kg)

### Trait indicators commonly used for crop improvement:

Scale using the Minolta colorimeter (Lxaxb) or Smartphon app Techkon Color Catcher™ (Analytic)

L: Low intensity (black colors> Values closer to zero), High Intensity (White colors > Values closer to 100).

a: Negative values, green color (Low intensity closer to 0, high intensity closer to -100), Positive values, red color (Low intensity closer to 0, high intensity closer to 100).

b: Negative values, blue color (Low intensity closer to 0, high intensity closer to -100), Positive values, yellow colors (Low intensity closer to 0, high intensity closer to 100).



#### **Color of the Kernel**

#### Relevance for adoption on farmers and producers

The consumer's first approach to raw materials and processed foods based upon maize is because of its color, since it relates to acceptance or rejection. For maize, the most appreciate colors in the country are white which is related to flour industry which is associated with fresh consumption, animal feed and some minor cases of flour industry.

# Top post harvest and marketing traits for biofortified maize in Zimbabwe





Milling performance ratio

#### Relevance for adoption on farmers and producers

It is a Key characteristic that contributes to give maize mechanical resistance during the post-harvest activities, which determines the integrity of the kernel during the harvesting, pre-cleaning and milling of the seed maize. For retailers, processors and flour industry, it's the most relevant trait for commercialization.

#### Scale of measurements

#### A) Ratio of milled dry maize (Analytics)

Pre cleaning of dry maize and moisture content below 14% are needed for this test. Milled dry maize remove the pericarp and part of endosperm layers. Weight of entire kernel, which remains after the milling and compare against the weight before milling expressed in milling ratio (%).

Weight of kernel after milling / weight before milling (Analytics) Ranks: High milling performance ratio (>70%), Intermediate (70% - 60%), Low (<60%)



#### Aflatoxins

#### Relevance for adoption on farmers and producers

Aflatoxins (mycotoxins) awareness in maize has grown due to their high influence in massive food; they are produced by fungi species (Fusarium sp, Diplodia sp, Penicilium sp, and Aspergilus sp). On the field they have more incidence in tropical climate with closer ranges of 80 to 90% relative humidity and temperatures of 30 to 35°C. To reduce its incidence under storage, the raw material needs to be stored in dry and cold places to have longer shefl life. This issue can generate epidemiological effects in a short time (acute), as well as it could manifest in months or years (chronic).

#### Scale of measurements Ranks:

High > 5 ug/kg for dry maize

### **Quick reference guide**

Characteristic	Fresh consumption Flour industry	Popcorn industry
Kernel lenght	Large Medium - Small	Small
Kernel shape	Flint Semiflint - Dent	Flint
Hardness	Soft - intermediate Very hard - Hard	Hard
Color	White - yellow - orange   White - yellow - orange	White - yellow - orange
Miling performance ratio	Not relevant High - Intermediate	High - Intermediate
Aflaxotins	X < 5 X < 5	X < 5

#### **Contact us:**

If you have any questions or want to access to our germplasm, please contact our breeders:

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