



# Sorghum Production Guide



Researching Soils, Crops and  
Water in Zambia





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## Foreword



Zambia has the potential to produce sufficient food for its citizens and for export.

In order to ensure that good agricultural practices are employed by farmers, crop specific production information should be made available to them.

Due to technological advances and the changing environmental and socio-economic conditions it became necessary to revise the first edition of the Sorghum Production Guide, which was published in 2002. This revised edition is meant to provide farmers and other stakeholders crop specific information in order to promote good agricultural practices and enhance productivity and production..

The information contained in this booklet has been generated over a number of years of research and is appropriate for all categories of farmers. The information is meant for extension officers, agricultural training institutions and other development partners.

It is my sincere hope that this information will go a long way in stimulating Sorghum production in Zambia.

The Zambia Agriculture Research Institute (ZARI) is committed to alleviating poverty and enhancing food security by contributing to increased and sustainable food production.

A handwritten signature in blue ink, consisting of stylized initials and a surname, likely 'M. Mwale'.

M. Mwale  
Director,  
Zambia Agriculture Research Institute,  
Ministry of Agriculture,.

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## Acknowledgements

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## **1.0 Introduction**

Sorghum (*Sorghum bicolor*) is one of the most important traditional cereal crops of the hotter and drier regions of the tropics and subtropics. In areas with insufficient and erratic rainfall, sorghum is a preferred crop. With a policy of crop diversification in place, sorghum can play an important role in achieving food security at household level.

Although sorghum is grown throughout the country its cultivation is concentrated in the drier and hotter valley areas of Southern, Central, Muchinga and Eastern provinces, parts of Northwestern and Copperbelt provinces. It is more suitable to be grown in moisture stress areas as it is more drought tolerant and resilient than maize.

Sorghum is traditionally used as a main staple food crop in areas where it is grown as the main cereal crop. Other uses include brewing.

## **2.0 Climatic and Soil Requirements**

### **2.1 Climate**

This crop does well in semi-arid tropics as it tolerates harsh weather conditions, which include low moisture, high temperature and heat, better than maize and other crops. It grows well at temperatures above 100°C although some sorghum varieties are sensitive to day-length especially the local types.

### **2.2 Soil Types**

Sorghum grows well on both sandy and clay soils with pH not less than 4.5.

## **3.0 Recommended varieties**

Both open pollinated varieties and hybrids are now available in Zambia. Hybrids give higher and more stable yields across seasons, locations and management levels, as they are capable of withstanding adverse growing conditions better than open pollinated varieties.

Local traditional varieties of sorghum require a long growing season, have low yield potential, and are tall and less responsive to improved management, while improved sorghum varieties, are responsive to high input applications, and are high yielding.

Varieties that are available and their major characteristics are given in the table below.

| Variety   | Maturity       | Major Characteristics                                                                         | Recommended areas for cultivation | Average Potential Yield (t/ha) |
|-----------|----------------|-----------------------------------------------------------------------------------------------|-----------------------------------|--------------------------------|
| Kuyuma    | Early          | Short, white grain, excellent milling quality and resistant to most diseases                  | Regions I and II                  | 3-5                            |
| Sima      | Medium to late | Medium tall, white grain and moderate resistant to diseases                                   | All agroecological regions        | 4 –6                           |
| MMSH-375  | Early          | Brown grain, good resistance to most diseases except downy mildew                             | All agroecological regions        | 6 –8                           |
| MMSH-413  | Medium         | Brown grain, high tannin content, excellent malting properties and resistant to most diseases | All agroecological regions        | 6 –8                           |
| ZSV 12    | Medium to late | Pigmented white grain, good resistance to soil acidity and anthracnose disease                | Agroecological regions III        | 3.5                            |
| MMSH-1324 | Early          | Medium height, white grain and resistant to most diseases except anthracnose                  | Agroecological regions I and II   | 4-6                            |
| MMSH-1257 | Medium         | Medium tall, white grain, resistant to most diseases                                          | All Agroecological regions        | 6 –8                           |
| ZSV15     | Early          | White grain and resistant to most diseases                                                    | Agroecological region I           | 3-5                            |
| WP-13     | Late           | Pigmented white and large grain, good resistance to anthracnose and soil acidity              | Agroecological region III         | 3                              |

## 4.0 Recommended Management Practices

### 4.1 Land Preparation

Prepare a fine seedbed for planting, as sorghum seeds are small. Minimum tillage can also be used to prepare fields. These include planting basins and rip-lines.

### 4.2 Planting

In low rainfall areas, Sorghum should be planted in the first to third week of December. While in high rainfall areas, planting can start in the second week of December up to mid January.

Sorghum seed should be planted 3-5 cm deep. Avoid planting deeper as this may lead to poor germination.

#### *Seed Rate*

The recommended seed rate for sorghum is 7-10 kg/ha. When planting is done with precision planters a lower seed rate of 7.0 kg/ha will suffice. When planted by hand-hoe, germination may be poor due to the uneven planting depth. Therefore, a higher seed rate of 10 kg/ha is recommended. The aim is to achieve a plant population of 120,000 to 180,000 plants/ha. For forage sorghums where higher plant population is desirable, a higher seed rate of 15-20 kg/ha should be used.

#### *Planting Method*

Planting should be done in rows, with a row spacing of 75 cm being ideal. In drill planting, seedlings should be thinned to maintain 10-15 cm between plants. When planting in stations, spacing should be 50 cm between stations with 8-10 seeds planted per station, which are later thinned to 3-4 plants. In very dry areas, 2-3 plants per station should be retained.

#### *Thinning*

High plant population can lead to poor plant growth, especially under drought conditions. It is, therefore, advisable to thin out extra plants after 3 weeks of planting to maintain the recommended plant population. Thinned plants should be transplanted on wet days to enhance successful establishment.

### **4.3 Weed Control**

Farmers using hand-hoes are advised to plant sorghum on a weed free seed bed following the first flush of weeds after first effective rains. Keeping fields free from weeds in early growth stages is necessary for plant growth and development.

First weeding should be done 2-3 weeks after planting. In most cases a second at 5-6 weeks after planting is necessary.

Weed control can also be achieved by use of pre-emergence herbicides such as Atrazine just after planting. In fields that have been prepared under minimum tillage, apply a second post-emergence herbicide such as Glyphosate just after planting. Gesaprim, which is a post emergence herbicide can be applied in low doses to control mainly broad leaved weeds during the early growth period.

### **4.4 Fertiliser Use**

For a good crop of sorghum, application of 200 kg/ha of 'D' compound as basal dressing and 100 kg/ha of urea as top dressing is recommended. In general, improved sorghum varieties respond better to fertilizer application than traditional varieties.

### **4.5 Crop Rotation Practices**

Sorghum should not be cultivated in the same field continuously following another cereal. It should be rotated with a legume so that it benefits from residual nitrogen.

### **5.0 Crop Protection**

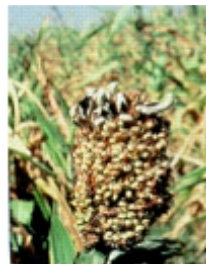
Sorghum is susceptible to a number of insect pests and diseases that reduce the yield and quality of the produce. There are measures that can be taken to minimize the damage.

### **5.1 Major Diseases and their Control Measures**

Although many diseases are known to attack sorghum, very few of them cause economic losses.

### 5.1.1 Smuts (*Spacelotheca sorghi*)

Smuts cause various symptoms affecting the inflorescence and occasionally the foliage. Individual ovules are replaced by a smut sorus which is covered by a persistent peridium. Most sori are conical or oval and resemble an elongated sorghum seed. They vary in colour from white to grey or brown and may be banded grey and brown. Sori may encompass all florets in a sorghum head or may be localized on the top, bottom, or sides of a head.



Smuts

### Control Measures

Use of an appropriate fungicide as seed treatment to provide protection from kernel smut is recommended.

### 5.1.2 Downy Mildew (*Peronosclerospora sorghi*)

This disease occurs either as a systemic or localized infection. The systemic form is induced when the pathogen colonizes the meristematic foliar tissues. Systematically infected seedlings are chlorotic and stunted and may die prematurely. Downy mildew appears like leafy brush in place of a spike.



Downy Mildew

### Control Measures

Control of the disease may be achieved by use of resistant or tolerant varieties, deep ploughing and roguing of diseased plants as well as use an appropriate systemic fungicide as seed dressing to control the pathogen.

### 5.1.3 Anthracnose (*Colletotrichum sublineolum*)

Anthrachnose is the most important leaf spot disease in Region III with losses of up to 67 % recorded. Typical anthracnose symptoms are circular-elliptical dark spots, sometimes with a red pigmentation, which vary in size. The centre of an advanced lesion is straw-coloured and contains numerous acervuli containing black seta.

### Control Measures

To minimise disease incidence, use of resistant varieties

recommended for each agro-ecological region and timely planting is recommended. Control may also be achieved by practicing crop rotation and use of clean disease free seed.

#### 5.1.4 Ergot (*Sphacelia sorghi*)

Individual ovaries between the glumes of some or all sorghum florets are replaced by a soft, white, sub-globose-shaped growth of mycelium (sphacelium) from which sticky, liquid droplets of spore-bearing honey-dew (thin to viscous, orange-brown or superficially white) may exude. Under conditions of high relative humidity, the honeydew is thin and the surface white. The surfaces of the panicle, leaves and soil become smeared by the dripping honey-dew and appear conspicuously white. A white, powdery crust forms wherever such honeydew dries up.



Egrot

#### Control Measures

The disease can be controlled by early planting in late November so that the flowering coincides with the dry spell which normally occurs in January or February, use of seed multiplied under irrigation in the dry season. Seed multiplied under these conditions is likely to be free of the disease. Others cultural and sanitary control measures include removal of infected panicles at harvest and practicing a 3 year crop rotation cycle and deep ploughing of residues.

#### 5.2 Major Insect Pests and Control Measures

The major insect pests of sorghum are Armoured crickets and Stem borers. Birds, like insects, are a major pest of sorghum.

##### 5.2.1 Armoured Crickets (*Acanthopplus discoidalis*)

The incidence of Armoured cricket attack is sporadic causing serious damage to many crops in drier parts of the country, the valleys in particular. The green coloured young crickets (nymphs) start appearing when the sorghum crop is at knee-high stage, and if not controlled, they will damage the heads and grain.

Crickets attack a range of crops and migrate from one crop to another.

### Control Measures

Integrated Pest Management (IPM) strategies such as timely weeding, digging trenches around the field, stripping of leaves up to the flag leaf and the use of “Karate” has been found to be effective in controlling armoured crickets. Poison bait (maize meal and “Karate”) around and inside the field is also effective.



Armoured cricket

### 5.2.2 Stem borers (*Chilo partellus*)

Damage is caused by the larvae which, bores into the central shoot. Symptoms include withering and drying of central shoot “dead heart”, red mining in midrib, visible bore holes on the stem near the nodes, parallel ‘shot holes’ on tender folded leaves and affected parts of the stem may show internal tunneling of the caterpillar.



Adult stem borer

### Control Measures

A prophylactic spray with long lasting broad-spectrum insecticide like 'Fastac' is recommended at knee-high stage to protect the crop from insect pest.

### 5.2.3 Birds

Birds are undoubtedly the most serious pests of sorghum and yield losses due to bird damage can be high.

#### Control Measures

Bird scaring measures from the soft dough stage onwards are considered essential. Bird damage in any one field can be reduced if many farmers plant varieties of similar maturity at the same time.

## **6.0 Harvesting**

Sorghum should be harvested after reaching physiological maturity, which occurs when a black layer appears at the base of the kernel and when moisture content is below 20 %.

Harvesting can be done manually or using a combine harvester. Manual harvesting involves cutting heads off the plant using a sickle or knife. Sometimes entire plants are cut and heads allowed to dry whilst on the plant.

## **7. 0 Post-Harvest Handling and Processing**

Hand harvested heads can be threshed by a stationary combine, hand beating or by using cattle to walk on the layers of sorghum heads.

Threshed grain of sorghum should be stored in granaries in threshed form and not in heads because this way the crop is more at risk to storage insects and rodents. Dried grain must be stored in closed bins treated with appropriate grain protectants such as Shumba Super and Blue Cross.

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