

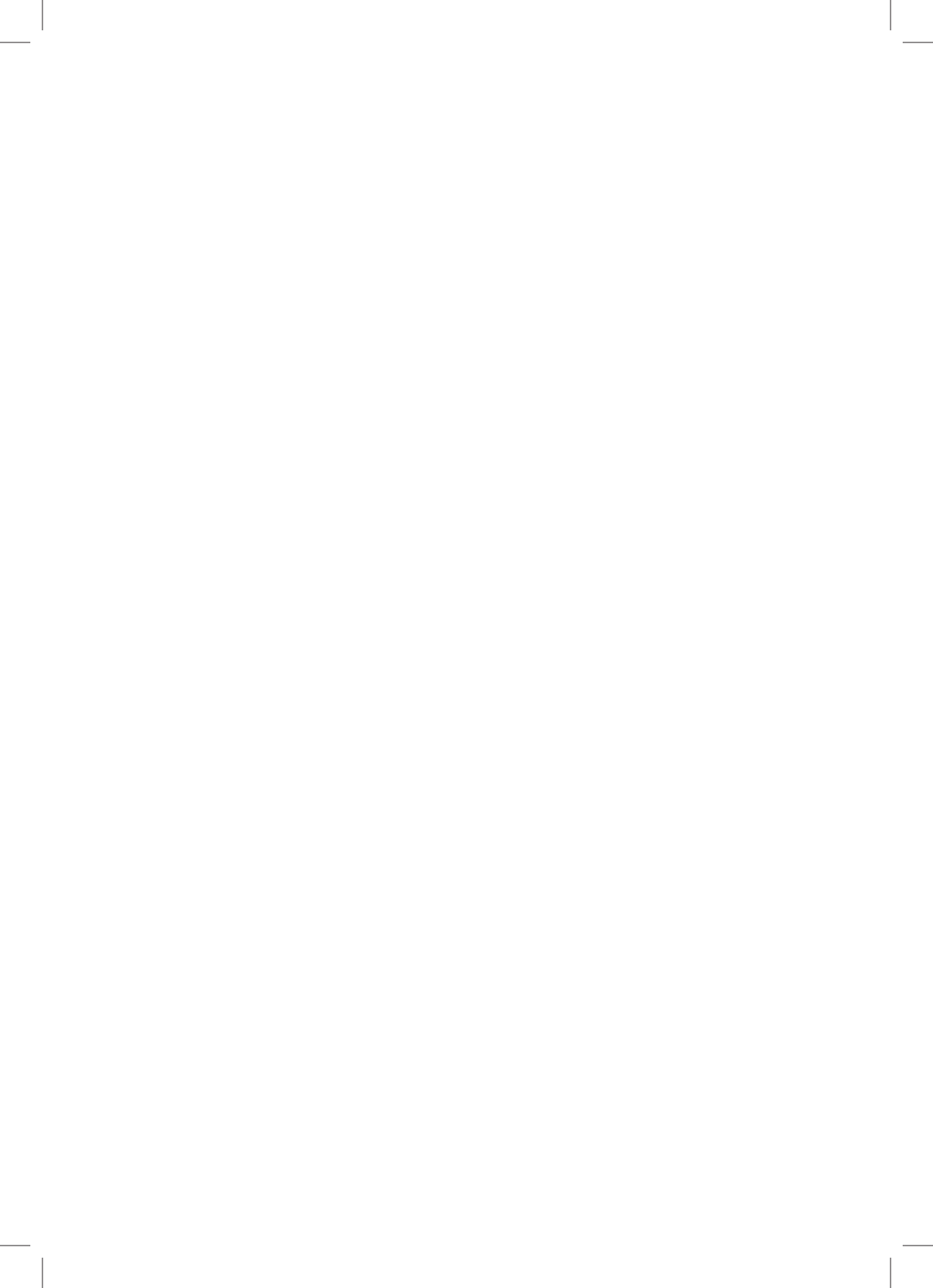
Sorghum

— *Production guideline* —



agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA



Sorghum

— *Production guideline* —

March 2010

Department of Agriculture, Forestry and Fisheries

2010

Printed and published by

Department of Agriculture, Forestry and Fisheries

Compiled by

Directorate Plant Production in collaboration with the ARC

Design and layout by

Directorate Agricultural Information Services

Obtainable from

Resource Centre
Directorate Agricultural Information Services
Private Bag X144
PRETORIA
0001

CONTENT

General..... 1

Cultivation practices 7

Post-harvest handling13

Production schedule15

Utilisation16

Acknowledgement17

Notes19



GENERAL

Classification

Scientific name: *Sorghum bicolor*

Common names: Grain sorghum, Mabele, Amazimba, Amabele

Origin and distribution

Sorghum is the 5th most important grain crop after wheat, maize, rice and barley. It is indigenous to Africa. Globally, it produces approximately 70 million tons of grain from about 50 million ha of land. It is the dietary staple of more than 500 million people in more than 30 countries. "For all that, however, sorghum now receives merely a fraction of attention of what it could. Not only is it inadequately supported for the world's fifth major grain crop, it is undersupported considering its vast untapped potential" (National Research Council, 1996). Sorghum could contribute more to food supplies than at present, especially to those regions and peoples in greatest need.

Production levels in South Africa

The sorghum farming community in South Africa can conveniently be divided into the smallholder and commercial farmers owing to the differences in farm sizes, production and marketing methods. On average, smallholder farmers farm on 3 ha which they do not own. They consume their products and are net buyers of grain. For these reasons, total sorghum production of smallholder farmers is not known. Average sorghum yield on smallholder farms is estimated from that observed for the SADC countries to be 0,8 t/ha. In the Limpopo Province, sorghum is grown on at least 25 342 ha, with Sekhukhune (19 033 ha), Waterberg (3 410 ha) and Capricorn (2 899 ha) the most important districts. From these data it is estimated that the Limpopo Province produces more than 20 000 tons of sorghum. Sorghum is also produced in other provinces such as Mpumalanga, North West, Northern Cape, Eastern Cape, KwaZulu-Natal and Free State. Statistics from these provinces are not available.

South African commercial farmers, located mostly in the Free State, produce on average 300 000 tons on 150 000 ha. Average production per ha is 2 tons (Wenzel, 2003), equal to that obtained in Australia. Nearly all the harvest is marketed. These differences are of importance when considering or planning the future production, consumption, commercialisation and development of the sorghum industry. It is of special importance to plant



breeders who have to initiate breeding programmes with objectives that satisfy the needs of the industry of at least 5 to 10 years in the future. A conventional breeding programme takes at least 10 years to achieve its objectives.

Major production areas in South Africa

Province	District	Town
Free State	Xhariep	Fauresmith, Jacobsdal, Jagersfontein, Koffiefontein, Petrusburg, Rouxville, Trompsburg, Smithfield, Springfontein, Verwoerd Dam, Zastron, Koffiefontein, Luckhoff, Edenburg
	Motheo	Bloemfontein TLC, Botshabelo, Eastern Free State DC, Excelsior, Kopano, Ladybrand, Maluti, Morojaneng / Dewetsdorp, South East Free State, Thaba Nchu TLC & TRC, Wepener, Thaba Nchu
	Lejeweputswa	Allanridge, Boshof, Bothaville, Bultfontein, Dealesville, Goldfields, Ladybrand Tswelopele
Mpumalanga	Gert Sibande	Eastvaal, Badplaas, Carolina Lc & Rc, Ekulindeni, Elukwatini, Empuluzi, Breyten
	Nkangala	Highveld Dc, Delmas Lc & Rc, Kriel Lc & Rc, Ogies, Witbank Lc & Rc, Hendrina, Middelburg Lc & Rc, Belfast
	Ehlanzeni	Lowveld Escarpment Dc, Graskop, Lydenburg Lc & Rc, Sabie, Hazyview, Nelspruit Lc & Rc , White River
North West	Ngaka Modiri Malema	Mafikeng, Delareyville, Lichtenburg, Zeerust, Sannieshof, Mmabatho
	Dr Ruth Segomotsi Mompati	Schweizer-Reneke, Vryburg, Christiana, Bloemhof, Reivilo, Taung
	Dr Kenneth Kaunda	Ventersdorp, Klerksdorp, Potchefstroom, Wolmaransstad, Hartbeesfontein
Limpopo	Waterberg	Modimolle, Thabazimbi, Lephalale, Mookgopong
	Vhembe	Northern Dc, Musina, Nzhelele/Tshipise, Alldays, Elim/Tshitale/Hlanganani/ Thohoyandou, Louis Trichardt
Gauteng	Metsweding	Bronkhorstpruit, Cullinan, Eastern Gauteng, Roodeplaat, Ekangala



Description of the plant

Morphology, growth and development of the sorghum plant

Sorghum belongs to the grass family, Gramineae. It is essential that producers know the crop they are cultivating in order to develop the most effective production practices.

Root system

The roots of the sorghum plant can be divided into a primary and secondary root system. The primary roots are those which appear first from the germinating seed. The primary roots provide the seedling with water and nutrients from the soil. Primary roots have a limited growth and their functions are soon taken over by the secondary roots. Secondary roots develop from nodes below the soil surface. The permanent root system branches freely, both laterally and downwards into the soil. If no soil impediments occur, roots can reach a lateral distribution of 1m and a depth of up to 2 m early in the life of the plant. The roots are finer and branch approximately twice as much as roots from maize plants.

Leaves

Sorghum leaves are typically green, glasslike and flat and not as broad as maize leaves. Sorghum plants have a leaf area smaller than that of maize. The leaf blade is long, narrow and pointed. The leaf blades of young leaves are upright, however, the blades tend to bend downwards as the leaves mature. Stomata occur on both surfaces of the leaf. A unique characteristic of sorghum leaves is the rows of motor cells along the midrib on the upper surface of the leaf. These cells can roll up leaves rapidly during moisture stress. Leaves are covered by a thin wax layer and develop opposite one another on either side of the stem. Environmental conditions determine the number of leaves, which may vary from eight to 22 leaves per plant.

Stem

The stem of the plant is solid and dry, succulent and sweet. Under favourable conditions more internodes develop, together with leaves, producing a longer stem. The stem consists of internodes and nodes. A cross-section



of the stem appears oval or round. The diameter of the stem varies between 5 mm and 30 mm. The internodes are covered by a thick waxy layer, giving it a blue-white colour. The waxy layer reduces transpiration and increases the drought tolerance of the plants. The root band of nodes below or just above the soil surface develops prop roots. The growth bud develops lateral shoots. Sometimes the growth buds higher up the stem may also develop lateral shoots.

Inflorescence (panicle)

The inflorescence of sorghum is a compact panicle. The shape and colour of the panicle varies between cultivars. Heads are carried on a main stem or peduncle with primary and secondary branches on which the florets are borne. The peduncle is usually straight and its length varies from 75 to 500 mm. Each panicle contains from 800 to 3 000 kernels, which are usually partly enclosed by glumes. The colour of the glumes may be black, red, brown or tan. The flowers of sorghum open during the night or early morning. Those at the top of the panicle open first and it takes approximately 6 to 9 days for the entire panicle to flower. Because of the structure of the flower, mainly self-pollination takes place. A small percentage of cross-pollination (approximately 6 %) occurs naturally.

Seed

The ripe seed (grain) of sorghum is usually partially enclosed by glumes, which are removed during threshing and/or harvesting. The shape of the seed is oval to round and the colour may be red, white, yellow, brown or shades thereof. If only the pericarp is coloured, the seed is usually yellow or red. Pigment in both the pericarp and testa results in a dark-brown or red-brown colour. The sorghum grain consists of the testa, embryo and endosperm.

Composition of the sorghum grain as a fraction of total mass

Description	Percentage
Seed coat	7,3–09,3
Embryo	7,8–12,1
Endosperm	81,1–84,6

Seed coat

The seed coat consists of the pericarp and testa.



Pericarp

This is the outermost layer of the seed and consists of the epicarp, hypodermis, mesocarp and endocarp.

Testa

The testa is situated directly below the endocarp and encloses the endosperm. Apart from the role of the testa in the colouring of the seed, it contains a tannin-like substance with a bitter taste. The presence thereof results in less bird damage to sorghum. In the absence of a testa, bird damage significantly increases. The bitter taste of sorghum with a testa however, makes it less acceptable as food for humans and animals.

Embryo

The embryo contains those parts which give rise to the new seedling. The new plant, which is already a complete unit, depends on the right moisture and temperature conditions to start developing.

Endosperm

The endosperm consists of hard and soft endosperm. The endosperm supplies the seedling with nutrients until it can take up its own nutrients.

Cultivars

Cultivar planning aims to reduce risks by avoiding drought periods during the most critical growing stages of the plant growth, such as flowering and seed set. Cultivars differ in their reaction to the environment and the climate, which can be used in planning the seed package. The yield potential of the farm or field should be known as well as the long-term rainfall pattern to be able to make the best cultivar choice. The long-term rainfall data will be a guide for the choice of the correct growing season length of the cultivars suitable for that area. Isolated or small areas of sorghum are prone to bird damage. When selecting bird resistant cultivars for such areas, contracts should be negotiated prior to planting, as this grain is not accepted easily by industry.

Cultivars with a wide adaptability would be a good first choice when starting with sorghum production. Multiseasonal results can be used to select specific cultivars, which can be incorporated into the cultivar package after proper testing onsite. Agronomic characteristics such as disease and in-



sect resistance, lodging and head placement should be kept in mind when compiling a cultivar package.

Climatic requirements

Sorghum is a warm-weather crop, which requires high temperatures for good germination and growth. The minimum temperature for germination varies from 7 to 10 °C. At a temperature of 15 °C, 80 % of seeds germinate within 10 to 12 days. The best time to plant is when there is sufficient water in the soil and the soil temperature is 15 °C or higher at a depth of 10 cm. Temperature plays an important role in growth and development after germination. A temperature of 27 to 30 °C is required for optimum growth and development. The temperature can, however, be as low as 21 °C, without a dramatic effect on growth and yield.

Exceptionally high temperatures cause a decrease in yield. Flower initiation and the development of flower primordia are delayed with increased day and night temperatures. Plants with four to six mature leaves that are exposed to a cold treatment (temperatures less than 18 °C) will form lateral shoots. However, in plants in or beyond the eight-leaf stage, apical dominance will prevent the formation of lateral shoots.



Temperatures below freezing are detrimental to sorghum and may result in dying of the plant. At an age of 1 to 3 weeks, plants may recover if exposed to a temperature of 5 °C below freezing point, however, at 7 °C below freezing, plants die off. Plants older than 3 weeks are less tolerant to low temperatures and may die off at 0 °C.

Soil requirements

Sorghum is mainly grown on low-potential, shallow soils with a high clay content, which usually are not suitable for the production of maize. Sorghum usually grows poorly on sandy soils, except where heavy textured subsoil is present. Sorghum is more tolerant of alkaline salts than other grain crops and can therefore be cultivated successfully on soils with a pH (KCl) between 5,5 and 8,5. Sorghum can better tolerate short periods of waterlogging compared to maize. Soils with a clay percentage of between 10 and 30 % are optimal for sorghum production.

Rainfall requirements

Sorghum is grown mostly in an annual rainfall range of 300 to 750 mm. It is grown in areas which are too dry for maize. Early drought stops growth before floral initiation and the plant remains vegetative; it will resume leaf production and flower when conditions become favourable for growth. Late drought stops leaf development but not floral initiation. The crop has a relatively deep rooting system that can extract water from low sources.

CULTIVATION PRACTICES

Soil preparation

Sorghum is grown on well-prepared seedbed. The seedbed preparation should begin promptly after the previous crop is harvested to allow ample time for weed control, decay of crop residue, infiltration and storage of soil moisture, fertiliser application and soil firming. The following practices are commonly used for seedbed preparation: Stalks of the previous crop are shredded, the land is disced, chiselled, ploughed or bedded by fall or winter. Winter weeds should be controlled with chemicals, rotary hoeing or bed reshaping to avoid disturbing the seedbed. At planting, the seedbed should be firm and moist. If the soil is dry, it would be important to compact it so that the seed comes into contact with the soil to receive the little moisture present and this ensures that the temperature around it does not drop.



Planting

Planting date

The planting date of sorghum is determined by the first spring rain, distribution of the seasonal rainfall, soil temperature, frost-free period and the cultivar to be planted. Normally sorghum is planted in South Africa from mid-October to mid-December. Sorghum is sensitive to low temperatures. The ideal soil temperature for germination is 15 °C at a depth of 10 cm. The crop is also sensitive to frost and planting should be delayed until the last frost has passed. It is important to choose the planting date so that the period of critical moisture need (ear initiation) does not coincide with a drought period.

Planting depth

Sorghum has a small seed and should be planted shallow. A planting depth of 25 mm is satisfactory with sufficient water. Under drier conditions the seed should be planted deeper, but no more than 50 mm. Planting depth is also determined by soil type. On heavy soils, the planting depth should not be more than 25 mm, while on light soils, the depth can be as much as 50 mm. It is important that the soil surrounding the seed is firm to ensure rapid absorption of water and therefore germination.

Row width

Sorghum is planted in areas with a wide range of rainfall and soil conditions. Wide rows are recommended for the low-rainfall areas and on soils with poor water-holding capacity. In areas with good, deep soils and a high rainfall, narrow rows (0,91 m) are recommended. Depending on the long-term rainfall, soil type (potential) and factors already mentioned, sorghum is planted in 0,91 m, 1,5 m or 2,3 m rows. The inclusion of a 2,3 m strip within the narrow rows is important if pest control is to be done with a tractor or sprayer.

Plant population

Poor seedbed preparation, insufficient water, insects and diseases can result in a poor stand. The quantity of seed should therefore be increased to compensate for a poor stand. On the other hand, the population may be too high for the prevailing water and nutrient supply, if germination is good. Recommendations regarding plant population for sorghum are usually expressed in kilogramme seed per hectare. The seed size of



sorghum cultivars varies from 30 000 to 40 000 grains per kilogramme. Recommendations for seed therefore, vary from 3,0 to 7,0 kg/ha.

Plant population and seed requirements for different row widths and in-row spacing

In-row spacing	Plants per hectare (kg seed/per hectare)		
	0,91 m rows	1,5 m rows	2,3 m rows
10	—	—	434700 (12,4)
15	—	444 444 (12,7)	289 800 (8,3)
20	—	333 333 (9,5)	217 350 (6,2)
25	439 560 (12,6)	266 666 (7,6)	173 913 (5,0)
50	219 780 (6,3)	133 333 (3,8)	86 956 (2,5)
75	146 520 (4,2)	88 888 (2,5)	57 971 (1,7)
100	109 890 (3,1)	66 666 (1,9)	43 478 (1,2)
125	87 912 (2,5)	53 333 (1,5)	34 478 (1,0)
150	73 260 (2,1)	44 444 (1,3)	28 985 (0,8)

Planting method

Sorghum is normally planted with maize planters. Adaptations should be made by using the correct planter plates and gear ratios to obtain the correct plant populations.

Fertilisation

To assess the correct quantity of fertiliser to be applied for optimal yield, soil samples should be taken according to the recommendations of an accredited soil laboratory. Fertiliser recommendations made according to the soil analysis should be applied accordingly. Symptoms of deficiencies that may be observed in the field are as follows:

Nitrogen (N) deficiency—young plants are light green or yellow-green; at a more mature stage the older leaves start yellowing first with a characteristic inverted V-shape.

Phosphorus (P) deficiency—under wet, cool conditions, the leaves of young plants may turn dark green with reddish-purple margins and tips.

Potassium (K) deficiency—a deficiency of K is initially noted as yellow or necrotic leaf margins, beginning at the lower leaves and spreading to the upper leaves.





Irrigation

Sorghum is produced in South Africa on a wide range of soils, and under fluctuating rainfall conditions of approximately 400 mm in the drier western parts to about 800 mm in the wetter eastern parts.

Weed control

Weed control during the first 6 to 8 weeks after planting is crucial, as weeds compete vigorously with the crop for nutrients and water during this period. The root parasite *Striga asiatica* (L.) Kuntze or witchweed (rooibloom) can damage the crop and mainly occurs under low-input farming conditions. The parasitic plants are single stemmed with bright red flowers.

Most of the damage is done before the parasite emerges from the soil. The symptoms include leaf wilt, leaf roll, and leaf scorch, even though the soil may have sufficient water. The tiny seeds are disseminated by wind, water and animals, and remain viable in the soil for 15 to 20 years. Rotation with cotton, groundnut, cowpea and pigeon pea will reduce the incidence of *Striga*. Hand pulling the plants before flowering could be used.

Methods of weed control

PHYSICAL METHODS

Weeds can be removed mechanically, using manual labour or implements.

CULTURAL PRACTICES

Ploughing during winter or early spring is an effective method of controlling weeds.

CHEMICAL METHODS

Chemicals formulated as liquids, granules or gasses can be applied to kill germinating, growing weeds or seeds. Control of nut-grass with pre-emergence herbicides is not effective when applied after emergence. It is important to cultivate fields before applying herbicides. Wild sorghum in sorghum fields can only be controlled mechanically or by hand hoeing.

Pest control

Integrated pest management

Integrated pest management is a system whereby various methods are applied to protect the crop by suppressing insect populations and limiting damage. These measures include the following: chemical control, biological control, plant resistance and cultural control.

Preventative control

For both *Chilo* borer and the maize stem borer, the economic threshold level of 10 % infested plants in a sorghum field applies. This value implies that there are sufficient larvae in the field to cause economic damage and that chemical control should therefore be applied. For bollworm on sorghum the economic threshold level is when on average two larvae occur per panicle and only then spraying should take place.

In the case of aphids, timely control is very important, however, spraying at first indication of an infestation is not necessary. An indication that the aphid population is nearing economically important levels, is when virtually all plants are infested. Spraying at this stage will ensure that the crop is free of aphids for the greater part of the most sensitive period, namely grain filling.

Cultural methods

This implies that pest populations are suppressed by cultural practices, which are detrimental to the pest. These practices include soil cultivation during winter, eradicating volunteer plants, cultivar choice and adapting planting times.



Biological control

Natural control of pests occurs continually in fields where natural enemies attack all the life-stages of insect pests. Aphids and diapause larvae of stem borers are particularly vulnerable to natural enemies. The complex of natural enemies can be protected to a certain extent by using insecticides which are more environmentally friendly and which are not highly poisonous to nontarget organisms.

Harvesting

Seeds harvesting

Sorghum for silage should be harvested when seeds are in the milk to dough stage. When used for hay, two to five harvests may be made per season, each with a potential yield of 2Mt/ha or more. Hay products require several days of sunshine. A forage crusher assists in reducing the time.

For seed, the crop is cut by hand or mower, smaller dwarf types can be harvested by a combine harvester. If harvesting is by hand, heads are dried in heaps on the ground or threshing floor. If the entire plant is cut by hand or binder, it should be stocked and left in the field to dry and mature for 10 to 14 days, and then threshed. Seed is stored at 12 to 13 % moisture or less.

Grain sorghum for animal feed

The highest dry-matter yields are obtained at maturity or when the stems are 80 to 120 cm tall; such heights are suitable for hay, silage and green chop and are best grazed at 20 to 30 cm height; best regrowth is when 10 to 15 cm stubble left. Some sorghum cultivars are very productive, yielding more dry matter than maize. Cut sorghum plants when the grain is in the dough stage and feeding value of fodder is at a maximum.

Harvesting methods

Harvesting for green chop or silage is well-suited to mechanical harvesting owing to the bulk and mass involved. Pasturing is the cheapest method of harvesting forage. For seed, the crop is cut by hand or mower, smaller dwarf types are usually harvested by using a combine.



POST-HARVEST HANDLING

Sorting

During harvest the seeds mix with foreign materials, making it difficult for one to package without sorting. There are official standards for grades in South Africa which necessitate a need for sorting in order to compete for a better price in the market. All grades of sorghum should:

- Be free of black discoloration as a result of smut, and should not contain 10 or more smut bodies or portions of smut bodies which are collectively equivalent to 10 or more smut bodies, per 100 g of sorghum. After harvesting the grains should be clearly sorted for removal of foreign material and any undesired seeds
- Be free of a musty, sour or other undesirable odour
- Be free of substances which may render such sorghum unsuitable for human or animal consumption or for processing into or utilisation thereof as a food or feed
- Have a moisture content of not more than 14 %
- Be free of live insects, irrespective of whether such insects occur in or on a bulk container: Provided that a consignment which is rejected owing to insect infestation could be presented for inspection again after fumigation with prescribed remedies and in accordance with acknowledged methods
- Not contain more than three noxious seeds per 10 kg
- Contain no chemical residue which exceed the prescribed maximum residue limit, provided that if the prescribed maximum residue limit of an importing country is lower than is permissible in terms of the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947), the prescribed maximum residue limit of the importing country shall be complied with; and the Executive Officer may grant permission for sorghum with a higher maximum residue limit to be exported to a country

Grading

The grades for the different classes of sorghum are as follows:

Class GM	Grade GM
Class GL	Grade GL1
	Grade GL2

Class GH	Grade GH1 Grade GH2
Class GM	Malt sorghum that does not have a dark testa and is of GM cultivar as determined in the cultivar list.
Class GL	Malt sorghum that does not have a dark testa and is a GM cultivar, that cannot be graded as a grade of Class GM sorghum or is GM cultivar specified in the cultivar list.
Class GH	Malt sorghum that has a dark testa, which is a GH cultivar as determined in the cultivar list and complies with the standards for one of the grades for Class GH sorghum.

Packing

Generally sorghum of different classes and grades should be packed in different containers and bags should be closed properly. Every container or the accompanying sale document of a consignment of sorghum should be marked or endorsed with the class and where applicable, the grade of that sorghum as well as the name and address of the exporter (provided that if the name and address concerned are indicated in a code, such code shall be registered with the Executive Officer). No misleading information should appear on the container.

Storage

Sorghum is therefore best stored as whole grain and most importantly the seed stored at 12 to 13 % moisture or less. The objective of storage is to preserve as much as possible of the value of the grain for its intended future use. This means either retaining as high a proportion of viable seeds as possible for planting at the next harvest or preserving as much as possible of the food value of the grain for as long as possible. Several factors lead to the loss of both viability and nutrients, however, globally the main causes of loss are the depredations of pests (insects, birds and rodents) and mould damage. Germination of the grain (sprouting) also results in losses, although on a smaller scale. Grain is stored by consumers and by processors for future consumption. It is also stored by commercial traders for resale, usually on the home market but occasionally for export. When sorghum is stored in developing countries, it is usually stored in small quantities in traditional containers, often on the farm. Large quantities are seldom accumulated and bulk storage is infrequent. Storage bins are best filled early in the day when the air is cool and the humidity is often at its lowest. The grain should be packed as tightly as possible to allow insects the minimum space around and to breed.



Marketing of sorghum

The South African sorghum grading system

As mentioned above, most smallholder farmers consume their own product while commercial farmers market most of their products. For marketing, sorghum is graded into three classes, namely, Class GM, including cultivars that were approved for malting, Class GL includes cultivars that cannot be malted (both classes are group 1 sorghums: see below) and Class 3 includes cultivars with high tannin content, group 3, grain that can be malted. A fourth class, other sorghum, includes all those that cannot be included in Classes 1 to 3. Sorghum grain is presently graded according to malting quality.

In South Africa or Africa where a large proportion is used for human consumption other than beer, at least one class is required for marketing and pricing grain as food sorghums, including traits such as flour extraction rate, and suitability for porridge and other food products. In contrast to feed and malt sorghums, which are usually red seeded with purple plant colour often causing off-colours and off-flavours when used for food, food sorghums are characterised by white seed and tan plant colour.

PRODUCTION SCHEDULES

Activities	January	February	March	April	May	June	July	August	September	October	November	December
Soil sampling												
Soil preparation												
Planting												
Fertilisation												
Irrigation												
Pest control												
Disease control												
Weed control												
Harvesting												
Marketing												

UTILISATION

Basic uses

Human use

In many parts of the world sorghum has been used traditionally in food products and various food items; porridge, unleavened bread, cookies, cakes, couscous, and malted beverages are made from this versatile grain. Traditional food preparation of sorghum is quite varied. Boiled sorghums are one of the most basic uses and small, corneous grains are normally desired for this type of food product. The whole grain may be ground into flour or decorticated before grinding to produce either a fine particle product or flour, which is then used in various traditional foods. The seed is used as food, in brewing beer, sorghum malt and meal. It is fermented to make “Lleting” (a sour mash), the pith is eaten, and the sweet culm chewed. Porridge and muffins can be made using sorghum meal. Parched seeds are used as coffee substitutes or adulterants. Sorghum, with large juicy stems containing as much as 10 % sucrose, is used in the manufacture of syrup; sugar can be manufactured from sorghum. The stalks are also used for making thatch while broomcorn makes brooms.



Livestock uses

Sorghum is also an important animal feed. Good-quality sorghums are available with a nutritional feeding value that is equivalent to that of maize. Sorghum can be processed to further improve its feed value and techniques such as grinding, crushing, steaming, steam flaking, popping and extruding have all been used to enhance the grain for feeding. The products are then fed to beef and dairy cattle, laying hens and poultry and pigs, and are used in pet foods. Mycotoxins such as aflatoxin and vomitoxin do not readily occur in grain sorghum, whereas they do occur in other grain sources. Sorghum serves as an important summer fodder where tempera-

tures are high and rainfall is insufficient for maize. The most important use is for silage or green siling, or for hay when grown under irrigation in very dry areas.

Industrial uses

Industrial uses for sorghum include wallboard and biodegradable packaging materials and it can also be processed interchangeably with maize for the production of ethanol.

ACKNOWLEDGEMENTS

ARC-Grain Crops Institute Potchefstroom is acknowledged for the contribution made in the development of this production guideline.

Further information can be obtained from:

Directorate Plant Production
Private Bag X250
PRETORIA 0001

Tel: +27 12 319 6072
Fax: +27 12 319 6353
E-mail: DPP@daff.gov.za

NOTES

This image shows a full page of white paper with horizontal dotted lines, typical of primary school writing paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]



