



Sunflower 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 Sunflower 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 Sunflower 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.

M.

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1.0 Introduction

Sunflower (*Helianthus annus L.*) which is a member of the Compositae family is an open pollinated species dependent on insects transferring pollen from one flower to another for fertilization.

In Zambia, sunflower can be grown throughout the country as it is widely adapted. However, it is most suited to be grown in Agro-ecological Regions I and II.

Sunflower seed is rich in oil (28% - 48%) and protein (20%). The seed cake, which is a by-product of oil processing, is rich in protein, fat and vitamins and it makes an excellent feed for chicken, cattle, goats and pigs.

While there are a number of crops that can supply edible cooking oils, sunflower is one of the best sources in Zambia as it is cholesterol free.

It is a crop that can give an economical yield with minimal use of inputs, particularly inorganic fertilizers ,when grown following a good managed cereal like maize. The crop has also been grown for weed control and birdseed. It is suitable for production by all categories of farmers and can be processed right at the farm.

2.0 Climatic and Soil Requirements

2.1. Climate

Sunflower requires moderate rainfall of about 500-600 mm during crop growth, hence can perform well in Agro-ecological Regions I and II. It is considered to be more drought tolerant than most crops and can therefore be grown in drought prone areas. However, the crop should have enough water during its establishment (1st two weeks) and flowering stage (approximately 60-90 days after planting). Adequate moisture aids pollination, seed set and the filling out of firm plump seeds. Excessive rain after crop maturity leads to rotting of the heads. In high rainfall areas, therefore, the crop should be planted late in the season to ensure that it matures after the rain season.

2.2. Soil Types

Sunflower will grow well over a wide range of soil types. Generally soils that are suitable for maize cultivation are also suitable for sunflower. In high rainfall areas, soils that are free draining are preferred as sunflower is particularly sensitive to water logging which causes thin stunted plants. Therefore, areas which frequently become waterlogged should be avoided. In general, acidic soils are not suitable for sunflower.

3.0 Recommended Varieties

There are a number of sunflower varieties that have been developed and are available on the Zambian market. Currently, most of the available varieties are open pollinated varieties. These have the advantage that the seeds can be re-planted for up to 4 years without significant reduction in yields.

Average commercial yields for open pollinated varieties is about 1.6 tonnes/ha, while for hybrids, it is 2 tonnes/ha.

The varieties developed by ZARI and their major characteristics are given in the table below.

Varieties	Oil Content (%)	Day To Maturity	Yield (Tons/ha)	Disease Reaction
Record	40	140	1.5 - 2	Moderate
Saona	37	130	0.8 - 1	Moderate
Milika	38	120	1 – 1.5	Moderate

Please note that there are other varieties available in Zambia which have been developed by seed companies.

4.0 Recommended management practices

4.1. Land Preparation

Normal ploughing and discing should give a suitable seedbed and good control of early weed growth.

4.2. Planting

Care must be taken to ensure proper planting of sunflower as this can have a bearing on plant establishment and subsequently yield.

Spacing

Sunflower should be planted at an inter-row spacing of 75-90cm and within row spacing of 25-30 cm with one seed per station sown at a depth of 2-3 cm. Avoid planting deeper and covering the seeds with big lumps of soil as emergence may be affected. When planting farm saved seed of open-pollinated varieties sow 3 seeds per station and thin to one plant per station after 2 to 3 weeks. Thinning must be done when the soil is moist. Sunflower should not be dry planted.

Seed rate

Plant 5 to 7 Kg of seed per hectare to achieve a plant population of about 40,000 to 45,000 plants. The recommended spacing and plant population is critical in sunflower to avoid competition among plants that may lead to adverse impact on growth and development. The results of crowding are thin and weak stalks which results in the production of numerous small heads, leading to increased lodging. Plant 5 to 7 Kg of seed per hectare to achieve a plant population of about 40,000 to 45,000 plants. The recommended spacing and plant population is critical in sunflower to avoid competition among plants that may lead to adverse impact on growth and development. The results of crowding are thin and weak stalks which results in the production of numerous small heads, leading to increased lodging.

4.3 Weed control

Weed control in sunflower is essential for proper crop growth and development. The first weeding should be done at two weeks after planting, followed by the second weeding six weeks after planting depending on weed pressure.

Weed control in sunflower is also effectively achieved by use of herbicides such as Treflan and Dual applied at planting followed by one weeding before 8 leaf stage. Once sunflower passes the 8 leaf stage, growth is very rapid, and further cultivation increases the risk of plant damage. Alternatively two timely mechanical weedings should provide adequate weed control. Once well-established sunflower plants grow rapidly and vigorously and are well able to

compete with weeds. This is particularly so once the leaves meet between the rows, as the large leaves form a dense canopy and the shade effect is very strong.

4.4. Fertilizer use

It is recommended that fertilizer and lime requirements are based on soil test results. However, the general recommended fertilizer application rates are 200-300 kg/ha D-Compound at planting and 100-150 kg/ha Urea at six weeks after planting.

Nitrogen top dressing is generally recommended in smaller quantities compared to D-Compound as excessive nitrogen may cause harmful effects such as producing very tall plants, which may be prone to lodging, delays in maturity and harvest and reduction in oil content.

4.5 Crop Rotation practices

Sunflower is able to utilize residual fertilizer efficiently. When following a well fertilized maize or wheat crop, sunflower can grow with little additional fertilizer application.

5.0. Crop Protection

Sunflower has relatively few pests of economic importance in Zambia. It is however susceptible to a number of 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 Control Measures

Diseases that affect sunflower include Alternaria Leaf Blight (*Alternaria helianthi*), Septoria Leaf Spot (*Septoria helianthi*), Sunflower rust (*Puccinia helianthi*), Downy mildew (*Plasmopara halsedii*), Powdery mildew (*Erysiphe cichoracearum*) and Sclerotinia Wilt (*Sclerotinia sclerotiorum*).

5.1.1 Alternaria Leaf Blight (*Alternaria helianthi*)

Alternaria is predominant during the later stage of the crop. Spores are carried by the wind and can infect the host after only 12 hours dew period. Symptoms of *A. helianthi* appear as circular, dark brown to black lesions with concentric rings. Lesions will eventually

enlarge in size and join causing blighting of leaves. Some lesions can be identified by distinct yellow halos, particularly on young plants. If the disease is severe, plants may be defoliated prematurely and die or lodge.

Control Measures

Cultural management practices, such as crop rotation, destruction of plant debris and tillage operations that bury and rapidly promote residue decomposition, can be used to minimise disease infection. Crop rotation helps reduce populations of many important sunflower pathogens in the soil. The disease can also be managed by using resistant or tolerant varieties.

Chemical seed treatment with fungicides significantly reduces seed-borne leaf diseases.

5.1.2 Septoria Leaf Spot (*Septoria helianthi*)

Septoria leaf spot develops initially on the lower leaves and spreads to the upper leaves. The spots begin as water-soaked areas, which are angular with tan centres and brown margins. A narrow yellow halo often surrounds young spots. However, mature leaf spots may contain tiny black specks, the fungal fruiting bodies (*pycnidia*). The presence of pycnidia is the best means of distinguishing leaf spots caused by Septoria from those caused by Alternaria. Severe infections can cause defoliation, but if this affects only the lower leaves on mature plants, the yield impact may be minimal.

Control Measures

Cultural management practices, such as crop rotation, destruction of plant debris and tillage operations that bury and rapidly promote residue decomposition, can be used to minimise disease infection. The disease can also be managed by using resistant or tolerant varieties as well as use of clean and disease free seed.

5.1.3 Sunflower rust (*Puccinia helianthi*)

Rust is characterised by cinnamon-coloured spots or uredial pustules, which primarily occur on the leaves, but also on the stems, petioles, bracts and the back of the head under severe infections. Yield losses can be severe when conditions are favourable and infections occur at an early plant growth stage. Rust does not only reduce crop yield, but is also capable of reducing oil, seed size, test weight and kernel-to-hull ratios.

Control Measures

Cultural management practices, such as crop rotation, destruction of plant debris and tillage operations that bury and rapidly promote residue decomposition, can be used to minimise disease infection. The disease can also be managed by using resistant or tolerant varieties as well as use of clean and disease free seed.

5.1.4 Downy mildew (*Plasmopara halstedii*)

The symptoms are characterized by death of seedlings leading to reduced stand in field. If seedlings survive they may be chlorotic with thickened leaves and white cottony growth is present on leaf undersides. Systemic infection causes stunted plant growth and reduced seed production.

Control Measures

Use of tolerant or resistant varieties and application of an appropriate fungicide is recommended.

5.1.5 Powdery mildew (*Erysiphe cichoracearum*)

The disease is characterized by powdery white patches which appear initially on lower leaves but which may spread to all above-ground parts of plants. White patches turn gray in color and black fungal fruiting bodies are visible. Severely infected leaves may turn yellow and dry up.

Control Measures

The following cultural and sanitary practices help to control disease incidence:

- a) Allow adequate spacing between plants to promote good air circulation around foliage.
- b) Plant sunflowers in an area that receives full sun for most of the day.
- c) Remove and destroy all sunflower crop debris after harvest.
- d) Use tolerant or resistant varieties

Applications of appropriate foliar fungicides can help control the disease

5.1.5 Sclerotinia Wilt (*Sclerotinia sclerotiorum*)

The disease infects stems and heads. It can be identified by the blackish sclerotia developing in and on plants towards the end of the crop cycle.

Control Measures

The disease can be controlled by use of clean and disease free seed, planting of tolerant or resistant varieties and removal of crop debris.

5.2. Major Pests and Control Measures

No serious damage by pests has been found in Zambia. Preventive spraying to control leaf pests in sunflower is rarely necessary as it can sustain up to 30% leaf damage before economic yield loss is attained. Insecticides applied after flowering has commenced may also kill the bees which are required for pollination.

The following are some of the insect pests of sunflower:

5.2.1 Cutworm (*Agrotis spp.*)

The caterpillar at maturity is clay coloured and 30 to 40 mm long. The larva cuts off plants after germination at night and larva hide below the soil during day time. Larva feed on the base of young plants.

Control measures

Control by spraying Dursban 4E (chlorpyrifos) at first sign of damage. Other control methods include use of cultural practices and poison baits.

5.2.2 Nysius Bug (*Nysius spp*)

This is a serious pest of sunflower. Feeding during budding can cause the head to wilt, become malformed or die. After flowering adults and nymphs reduce yields and oil content by sucking the developing seed, reducing seed weight, changing oil content and reducing seed germination.

Control measure

This can be controlled by Thiodan (endosulfan) 50%W.P.

5.2.3 Looper Caterpillar (*Xanthodes graellsii*)

The adult moth can be distinguished by its straw coloured fore wings marked with median longitudinal brown stripes and scattered brown spots along the coastal margin. The hind wings are plain, whitish with yellowish margin. The caterpillars are first light green, turning dark green later on, with a pale stripe along the back. Damage is caused by larvae that bore into the kernels.

Control measures

Control may be achieved by application of Thiodan (endosulfan) 50% W.P.

6.0. Harvesting

The seed is mature when the back of the head has turned yellow and the bracts are turning brown. The harvesting should be completed as quickly as possible to reduce losses from bird damage, insects, seed shattering, stalk breaking, seed and head diseases and spoilage from late rains. Harvest by cutting heads. It is highly recommended to spike down (cutting heads with sickle or a knife and placing the heads upside down on their stalks). This reduces losses and ensures uniform drying. After 5 to 6 days from spiking the crop will be ready for threshing. Do not stack the cut heads.

7.0. Post Harvest Handling and Processing

Threshing can be done by beating heads with sticks either in a sack or on a hard floor. After cleaning and drying the sunflower, oil can be extracted from it either at industrial or at farm level. At farm level, the most commonly used method of oil extraction in Zambia is the use of the ram press. The crude oil obtained from this process may be processed by boiling and removal of impurities. The by-product from oil extraction is a highly nutritious cake which may be fed to livestock.

7.1 Storage

Sunflower seed may be safely stored in bags at a moisture content of below 11%. The seed should be stored in a cool dry place.

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