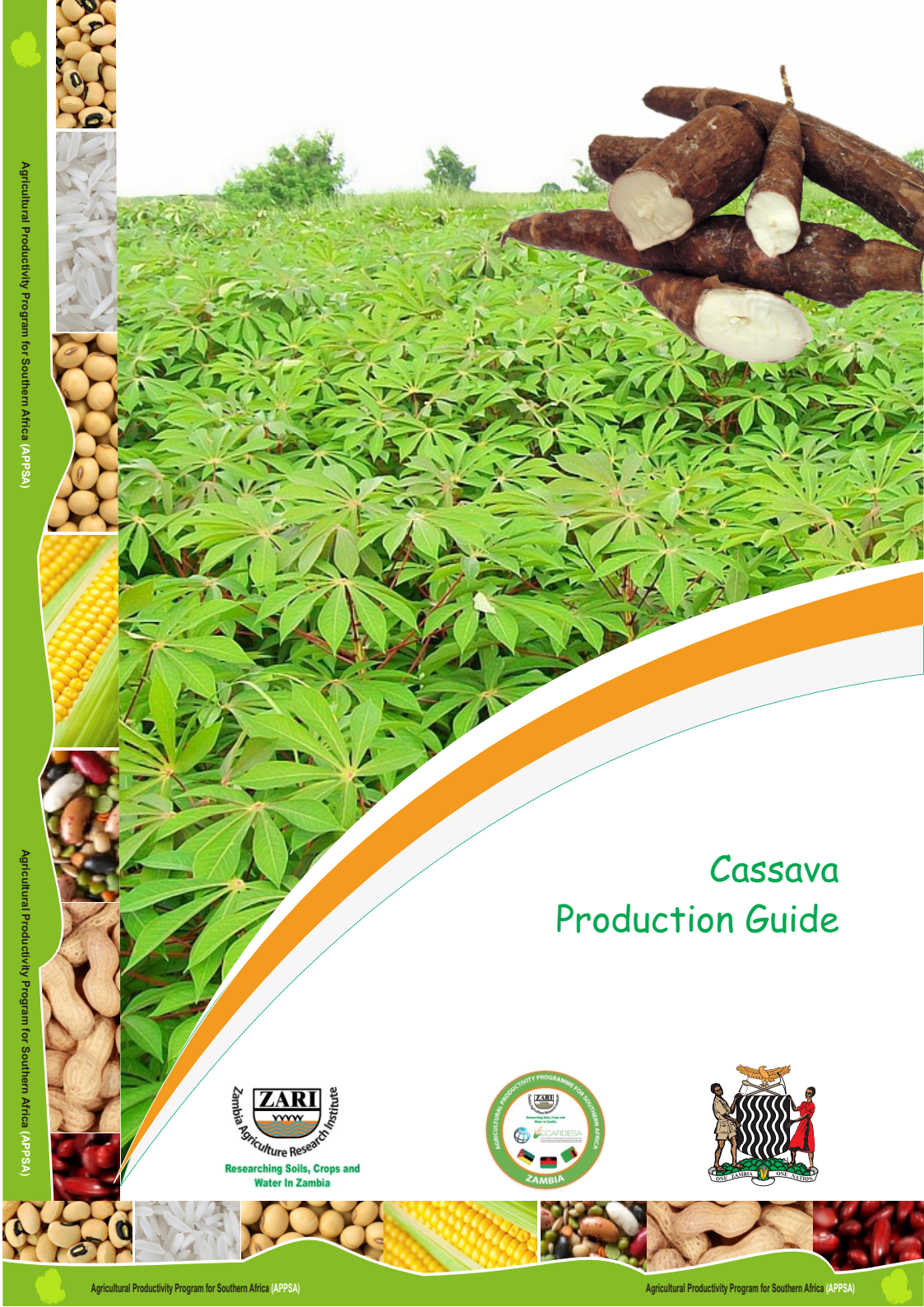

Cassava Production Guide

Zambia Agriculture Research Institute
ZARI
Researching Soils, Crops and Water In Zambia

ZAMBIA

ONE ZAMBIA ONE NATION

Agricultural Productivity Program for Southern Africa (APPSA)

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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 Cassava 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 Cassava 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.

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1.0 Introduction

Cassava (*Manihot esculenta*) is one of the most common food crops grown and consumed in many parts of Africa. In Zambia it is the second most important staple crop after maize. The crop grows well in various soil types and ecologies and can be planted alone or in association with many other crops, like maize, beans, groundnuts and cowpea.

The main cassava growing areas in Zambia are Northern, Muchinga, Luapula, North-western and Western Provinces. Because of its ability to produce reasonable yields under low fertility soils and adverse climatic conditions (erratic and low rainfall) and with limited inputs, the crop is now an important food security crop and source of income among farmers in the country.

However, the country's current average yield of 4.5 t/ha and annual production of 1 million tons compared, for example, with other countries in the region like Mozambique whose annual production is above 10 million tons is very low. This is due to a number of factors such as pests and diseases, limited or lack of availability of improved and appropriate resistant varieties, and low soil fertility status.

Presently the country is threatened severely by the Cassava Mosaic Disease (CMD) pandemic, that is advancing southwards through neighboring Democratic Republic of Congo (DRC); and by the Cassava Brown Streak Disease (CBSD), a virus disease that already occurs in neighbouring countries; Malawi, DRC, and Tanzania.

Increasing the number and availability of improved disease-resistant varieties coupled with the systematic application of phytosanitary measures and good agronomic practices, offer great assurance for improving cassava production in the country.

2. Climate and Soil Requirements

2.1 Climate

Cassava is a plant of tropical lowlands. Its cultivation is restricted to regions between the latitudes of 30° north and 30° south. It is most widespread near the equator between 15° north and south. Since cassava is a short-day plant, the highest yield of roots is in this region. Cassava finds the most favourable growing conditions in humid-warm climates at temperatures of between 25 - 29°C and precipitations of between 1000 - 1500 mm which ideally should be evenly distributed (ONWUEME, 1978).

In Zambia cassava is grown mostly in Agro-ecological regions II and III. Region II include Western and Central Provinces and experiences rainfall between 800 to 1000 mm per year while Region III covers Muchinga, Northern, Luapula and North-Western provinces and receives rainfall above 1000 mm per year.

Though cassava is grown throughout the country, its growth tends to be accelerated by increased relative humidity in the valleys where the maturity periods are shortened to less than 12 months. In view of the climate, cassava has an enormous ability to adapt to varied environments. There are locations in the Andes where cassava is cultivated at an altitude of 2000 metres. Cassava can even survive slight frosts although the plant then loses its leaves which grow again when temperatures rise. Where there are high temperatures fluctuations, the annual average temperature must amount to 20°C. With low fluctuations in temperature, 17°C is also sufficient for successful cultivation (COCK, 1985). Cassava is able to survive longer arid periods. During this period, the plant loses all its leaves and suspends growth even of the thick roots. When precipitation resumes, the plant regenerates without any great loss in yield. This ability to recover is what makes it particularly suitable for locations with indefinite and irregular precipitation.

2.2 Soil Types

Cassava grows well in sandy loam soils with moderate soil fertility and with good drainage. Saline, strongly alkaline and stony soils and

soils with stagnant water are unsuitable for the cultivation of cassava. Stony soils inhibit the formation of the tuberous root while poor drainage results in increased incidence of roots rots. Where soil fertility is concerned, cassava easily grows well on poor and acidic soils which are totally unsuitable for the cultivation of other plants; cassava will still provide a relatively good crop. Traditionally, the cassava crop is often the last crop in a rotation.

3. Recommended Varieties

Presently, 7 varieties are recommended to farmers for growing besides their own local varieties. These clones are high yielding, have high starch and dry matter content, are relatively early maturing, resistant to pests and diseases. These and their major agronomic attributes are given in the table below.

Variety Name	Maturity Period (months)	Potential Yield (t/ha)	Other major characteristics
Bangweulu	16	31	Moderately resistant to cassava mosaic disease (CMD) and cassava mealy bug (CMB)
Nalumino	24	29	Resistant to CMB and CMB
Kapumba	24	22	Moderately resistant to CMB and CMB
Mweru	16	41	good architecture and has wide adaptability
Chila	16	35	leaves are preferred for vegetables
Tanganyika	16	36	susceptible to scale insects
Kampolombo	16	38	Sweet, highly branched

4. Recommended Management Practices

Traditional farmers seldom follow recommended cultural practices for cassava, and may be unaware of the existence of improved varieties. The use of unimproved varieties, together with inadequate length and age of planting material and incorrect plant population, depth and time of planting, are among the reasons why yields under most traditional systems are low. The selection of good planting material is one of the most important aspects of cassava production. The material must be fresh and taken from healthy and mature stem portions if high yields are to be realized.

Cassava can be grown alone or mixed with other crops like maize, beans, millets etc. Mixed cropping is most preferred by small scale farmers. When cassava is mixed with groundnuts or other root crops, care should be taken in spacing them. The harvesting of other crops may disturb cassava root growth thereby affecting the yield. Cassava is a heavy feeder of nutrients, hence continuous cultivation on the same piece of land might lead to depletion of soil fertility. Increased incidence of pests and diseases might also result if crop rotation is not practiced.

4.1 Site Selection

Site selected for cassava production should be an area with good soil texture, fertile soil, flat and gentle sloping land, and should not have had cassava planted in previous season.

4.2 Land Preparation

A fine seed bed is necessary to allow good seedling emergence and root establishment. Prepare early to allow early planting. Cassava can either be planted on mounds, flat or ridges.

Mounds

Planting cassava on mounds gives the advantage of easy root penetration. Plant material buried in the mounds improves soil fertility upon decomposition. Mounds have a better drainage than ridges and on the flat. However, mounds, compared to ridges and flat, give a lower plant population per unit area and require more labour to prepare.

Ridges

Where the soil is not too sandy, ridging is considered the best land preparation method for cassava. If the slope or nature of the land permits, ridges should be constructed in the east to west direction for maximum light reception. A good ridge should be at least 30cm high and the distance between the centres of ridges varying from 80 to 100cm. The advantages of using ridges are that :they are relatively easy to prepare either manually using a hand hoe or mechanically using an ox-drawn or tractor drawn implement. Further, less land is wasted compared to mounds, spacing is regular leading to better light interception, helps in equal distribution of plant nutrients and planting and harvesting is easier.

Flat

In areas where the soils are sandy, cassava may be planted on the flat. In this method land is prepared either in a conventional way or following minimum tillage practices. The disadvantages, especially in high rainfall areas include risk of water logging in poorly drained soils.

4.3 Planting

The following should be considered when preparing stem cuttings for planting:

i) Cutting size: the length of a cutting should be 20-25 cm long, with at least 5-8 nodes. Cut only clean disease free stems close to planting time using sharp knife or secateurs.
Avoid bruises and damage to nodes when transporting to the field. This can be done by packaging them on cushion or dry leaves.

ii) Hot water treatment: dip cuttings in warm water for 5 - 10 minutes before planting. To determine the correct temperature of water to use, add equal volume of boiling water and cold water in a basin or bucket. Treating cuttings with warm water before planting will kill pests such as green mites and scales.

November to December is the best planting time for the high rainfall areas. Mature planting material, which should not be less than 10 months old, should be used. The middle part of the cassava cutting is the most suitable because it sprouts better and gives better yields per unit area. A single cutting for planting should be 20 to 25cm long with 5- 7 nodes.

Cassava cuttings can be planted vertically i.e. standing straight or slanting at an angle of 45o. Though not commonly practiced by farmers, vertical planting is considered the best because it results in uniform rooting system, stronger plant establishment, fewer unproductive branches and gives better yields. The slanting method leads to higher numbers of unproductive branches. The flat system (cuttings buried in a horizontal position), which is the burying of the cutting in the soil, used by some farmers is not recommended for cassava production.

Spacing

Spacing for cassava depends on the branching ability of the clone or variety being grown. The branching type cassava should be spaced at 100 cm x 100 cm while the non-branching type could be spaced at 100cmx75cm.

4.3 Weed Control

Time and frequency of weeding depends on plant population and the type of weeds. However, three weedings at 45 days interval from planting date are recommended. Care should be taken not to injure the roots during weeding as this could result in roots rotting, weeding together with earthing up results in better plant growth and root development.

Appropriate herbicides may be used in the control of weeds in cassava production.

4.4 Fertiliser use

It has been established that the use of fertilizer in cassava production improves yields. However, the amount of fertilizer applied depends on the soil fertility status. Under poor soil conditions

400-700kg/ha compound D is required, while under fertile conditions 150-300 kg/ha compound D would suffice. Fertiliser can be applied between 2 to 6 weeks after planting, when the root system has developed. Application could be at once or split 2 times (first at 2 weeks and second at 6 weeks).

The best method of applying fertilizer is to place it (dibble) at about 10-35cm from the base at about 10cm deep. Fertiliser should not be applied when the soil is dry or when the rains have stopped. More studies are being conducted to generate more information on fertilisers use in cassava production.

4.5 Crop Rotation Practices

Farmers are encouraged to practice crop rotation with crops that would leave a lot of organic matter in the soil after harvesting. Cassava can also make maximal use of residual fertilizer after a crop which was previously well fertilized.

5.0 Crop Protection

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

The major pests and diseases that attack cassava in Zambia are cassava mealy-bugs, cassava green mites, cassava red mites, African cassava mosaic virus (ACMV) and cassava bacterial blight (CBB).

5.1 Major Diseases and Control Measures

5.1.1 Cassava Mosaic Disease (CMD)

CMD is a disease of cassava caused by several species of the Geminiviridae family and genus Begomovirus. There are currently at least eight virus species known to affect cassava in Africa, i.e. 1) the African cassava mosaic virus (ACMV), 2) East Africa Cassava Mosaic virus (EACMV), 3) South African cassava mosaic virus (SACMV), 4) East African cassava mosaic Cameroon virus

(EACMCV), 5) East Africa cassava mosaic Zanzibar virus (EACMZV), 6) East Africa mosaic Cameroon virus (EACMCV)), 7) East African cassava mosaic Kenya virus (EACMKV), and 8) East African cassava mosaic Malawi virus (EACMMV). CMD symptoms are variable according to virus type infecting cassava, season and variety, but always include a chlorotic mosaic on infected leaves (Figure 1). The colour of the chlorosis varies from pale green to whitish yellow and the extent could range from less than 5% to almost 100% of the leaf surface area.

Figure 1: Cassava plant showing symptoms of CMD

The Gemini viruses are spread from one plant to the other by white flies called *Bemisia tabaci.* The disease is also spread through use of infected cuttings.

5.1.2 Cassava Brown Streak Disease (CBSD)

CBSD is a disease of cassava crop caused by Cassava brown streak virus (CBSV. There are two species causing CBSD, cassava brown streak virus (CBSV) and Uganda cassava brown streak virus (UCBSV).

Figure 2: Major CBSD symptoms characteristics on leaves and storage roots

CBSD is characterized by severe chlorosis and necrosis on infected leaves, giving them a yellowish, mottled appearance. Chlorosis may

be associated with the veins, spanning from the mid vein, secondary and tertiary veins, or rather in blotches unconnected to veins. Leaf symptoms vary greatly depending on a variety of factors. The growing conditions (i.e. altitude, rainfall quantity), plant age, and the virus species account for these differences. Brown streaks may appear on the stems of the cassava plant. Also, a dry brown-black necrotic rot of the cassava tuber may occur, which may progress from a small lesion to the whole root. Finally, the roots can become constricted due to the tuber rot, stunting growth. Typically the affected plants do not possess all of these characteristics, but those that are severely affected may do so.

Control Measures

The disease can be controlled by using resistant varieties, planting cuttings from disease free plants and by destroying diseased plants.

5.1.3 Cassava Bacterial Blight (Xanthomonas campestris)

The disease is characterized by localized, angular, water-soaked areas of discoloured, diseased leaf tissue, leaf blighting, wilting, defoliation, vascular discolouration, exudation and die-back.

Control Measures

Control lies in the use of resistant varieties.

5.2 Major Insect Pests and Control Measures

5.2.1 Cassava Mealybug

Cassava mealy bugs cause strong growth disturbance of the terminal shoot, which becomes stunted and deformed. Internode length is reduced causing twisted stems. When the attack is severe, plants die starting at the plant tips where the pest population is highest.

Cassava mealy bug

Control Measures

The pest can be controlled biologically by using natural enemies against the pest. Control can also be achieved by use of resistant varieties. Cultural practices such as early rain season planting is recommended to allow the crop to gain vigour before the dry season. Planting materials suspected to be infested should be treated with hot water at 52oC for 10 minutes. This reduces the possibility of transferring the pest to new fields. Affected plants may be uprooted and burnt.

5.2.2 Cassava green mite

Cassava green mites damage initially appears yellow on the surface of developing and newly formed leaves. Symptoms vary from few yellowish spots to complete yellowing. Heavily attacked leaves are stunted and become deformed. Severe attacks cause the terminal leaves to die and drop.

Control Measures

The only available control measures are the use of natural enemies and resistant varieties, if available. Cultural practices such as early planting is recommended to allow the crop to gain vigor before the dry season. The other cultural practice is use of crop rotation.

5.2.3 Rodents and other wildlife damage

In some cassava growing areas damage by rodents and other wild animals such as pigs cause serious damage to cassava.

Control Measures

There are traditional methods that have been employed to minimize the damage such as use of traps and fencing in the case of wild pigs.

6. Harvesting

Harvesting of cassava can be done throughout the year when the roots reach maturity. Cassava planted at the onset of rains should be ready for harvesting at 12 to 36 months from planting depending on variety. However, the optimum time to harvest is 16 months after planting. The root yield may still increase after 16 months but the

quality will decline, as the roots become more and more fibrous beyond 16 months.

7. Post-harvest Handling and Processing

7.1 Processing

There are many forms of processing cassava in Zambia. However, all methods aim at making cassava palatable and store longer. In general the aim of processing is to reduce cyanide (poisonous substance) in the cassava roots.

Cassava can be harvested, peeled, soaked in water and sundried. The resulting cassava may be roasted and eaten with groundnuts or pounded into flour for nshima preparation.

Another method involves harvesting, peeling, slicing, sun drying, soaking and sun drying. This method of processing is usually done during the dry season and stored for rainy season use. Because of its hardiness, weevil attack during storage is very minimal.

The soaking or fermentation period varies from season to season. In the hot season, It takes 3-4 days while during cold season it can take 4-7days.

Traditional chips normally dry slowly. However, chipping and grating machines have now been developed which slice tubers into small chips which dry faster.

7.2 Storage

Fresh cassava roots may not be stored for long because they deteriorate within 3-4 days after harvest. Due to problems of rain season processing, abundant quantities should be processed during the dry season and stored in bags. Cassava flour can be stored for an average period of 4 to 6 months, after which mould and weevil problems arise

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