Production guidelines for amadumbe
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Directorate: Plant Production

DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES
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Part 1: General aspects

Classification
Scientific name: *Colocasia esculenta*
Family: Aracea
Common names: Amadumbe, Amadumbi, Amadombie, Amadombi, Mufhongwe

Origin and distribution
This “potato of the tropics” or amadumbe (*Colocasia esculenta*) is found worldwide in subtropical regions and is cooked much like a yam. Edible aroids (family Araceae) comprise many underground food crops grown in several tropical and subtropical countries. Amadumbe and tannia (*Xanthosoma sagittifolium*) are the most important species. Together they are also called amadumbs in many parts of the world, especially in Africa. Amadumbe originated from Oceania and South East Asia and the tannia from the American tropics. It is believed that amadumbe has been cultivated for more than 6 000 years. From America, the tannia or yautia reached West Africa, which is now the major producer. There, it has been displacing the amadumbe because of its better yield. Amadumbe is superficially similar to other large-leaved arums such as the true elephant ears (*Xanthosoma sagittifolium*) and the arrow arums (*Peltrandra* spp.), but amadumbe is the only one with peltate leaves.

Production levels

South Africa
The level of production of amadumbe in South Africa is not known because it is mostly produced by rural farming communities for subsistence and not for trading.

International
Data on world production and trade of amadumbe are difficult to estimate because of their very limited significance in terms of total production of root and tuber crops. Production of amadumbe in Africa is largely confined to the "yam zone", comprising Cameroon, Nigeria, Benin, Togo, Ghana, and Côte d’Ivoire, where approximately 90% of the world’s production takes place.

According to the FAO (Food and Agriculture Organisation) statistics, the total world production area of amadumbe alone was estimated to be about 993 x 10³ ha in 1983, with 80% in Africa. During this period, global production of amadumbe was 5,607 million tons, with about 61,33% in Africa and 38,67% in Asia. Thirty seven and half a million (37,5 million) tons of amadumbe were produced worldwide in 2000, 96% of this in Africa. The leading producer was Nigeria with 26 million tons, followed by Ghana with more than 3 million tons, and Côte d’Ivoire with 2,9 million tons. In 2000 nearly 4 million ha of land was planted with
amadumbe throughout the world. More than 69% of this total area was located in Nigeria. The average yield was nearly 10 t/ha.

**Major production areas in South Africa**

The amadumbe has been cultivated by villagers in KwaZulu-Natal for so long that it is regarded as indigenous food crop. The other producing areas are Mpumalanga and Eastern Cape.

**Varieties**

There are no cultivars developed in South Africa yet.

**Description of the plant**

The amadumbe is a wetland herbaceous, perennial plant of up to 2 m in height.

**Mature plant**

**Roots**: Amadumbe is a tubular root or corm (also called a "mammy"). The corm is shaped like a top with rough ridges, lumps and spindly roots and usually weighs around 0,5 kg to 0,9 kg, but occasionally as much as 3,6 kg. The skin is brown and the flesh is white or pink. Certain kinds of amadumbes produce smaller tubers called eddos, which grow off the sides of the main corm. The eddos are usually around 2 g to 4 g.

**Stem**: The stem consists mainly of leaves, which arise in a whorl from the apex of the stem. The terminal bud remains very close to the apex.

**Leaves**: Amadumbe produces heart-shaped leaves which are 0,6 m to 0,9 m long and 0,6 m to 0,9 m petiole that all emanate from an upright tuberous rootstock, technically a corm. The petiole is thick, succulent and purplish.

**Flower**: Inflorescences sprout between the leaves in a spadix, with a white 12 cm to 15 cm spathe which closes at its base in the form of a spherical chamber and opens at the top into a concave lamina; the spadix is cylindrical, slightly longer than the spathe, with female flowers on the lower portion, male flowers on the upper portion and sterile flowers in the middle portion. The spadices are rarely fertile and produce few viable seeds.
Amadumbe is grown for its edible corms as a staple throughout subtropical and tropic regions of the world.

**Climatic requirements**

*Temperature*

Amadumbe does best in partial shade, but tolerates full sun if it gets plenty of water. Optimum temperature for growth is 24°C. Amadumbe prefers warm conditions because it does not withstand freezing. It grows at 1 500 m above sea level, especially in the tropics.

*Water*

Amadumbe can be cultivated under both wetland and dry land conditions and some varieties do well under both types of culture. Amadumbe can tolerate high-rainfall areas, provided there is good drainage, but does not tolerate water logging.

Optimum rainfall is 1 400 mm—2 000 mm for the growing season.

**Soil requirements**

It grows best in moist, heavy, well-aerated soils with good moisture holding capacity. A pH of 5,5 to 7,8 is required. High yields can be obtained with a pH as low as 4,8. Amadumbe grows in a slightly acidic, moist or wet soil, rich in organic material.
Part II: Cultivation practices

Propagation
Amadumbe is propagated from whole tubers or cuttings from corms.

Soil preparation
After the land is cleared, the field is ploughed, followed by harrowing or rotovation at 5 day to 7 day intervals. Heaps or ridges can be made at 1 m x 1 m apart.

Field layout and design
The planting distance in commercial cultivation is 1,3 m between rows and 40 cm to 50 cm between plants. In small plantations, planting can be done in mounds spaced at 1 m x 1 m or 1,3 m x 1,3 m. Plant on the crest of the heaps or ridges at 1 m apart on rows.

Planting
Planting is either done by hand labour or from a tractor-pulled planter. Plant 15 cm to 20 cm deep. The cut surface of the set should face upwards in a slanting position. The best planting time is between December and April, but plantings can be made any time during the year if moisture is adequate. Plant population is about 15 000 plants per hectare. The tubers have a large sink capacity and continue to grow and store food reserves throughout the year as long as conditions remain favourable. It is a fast-growing plant with a tendency to spread if conditions are favourable.

Fertilisation
Fertiliser applications should supplement the nutrient levels already found in the soil at planting time. Fertile soil may not need any fertiliser, but fertiliser may be needed if the soil has been depleted. Apply N.P.K. 15:15:15 at 5 to 6 Coke bottle capfuls in a ring about 10 cm around the plant. The applications are made at 2, 5 and 7 months after planting. The initial fertiliser application should include 1,5% Mg, 1% Mn, and 0,1% Zn.

Irrigation
Irrigation can be done at least 15 mm three times with an overhead sprinkler. Drip irrigation can work as well.

Weed control
Weeds should be controlled for the first three months after planting. Soil is moved up around the plant to control weeds and to enhance underground storage organ size. Weed
at least three times per season. Weeding is done by cultivation with tractors and by hand. During the first four months of growth weeds are a particular problem. Weed competition during this period may reduce yields by as much as 43%.

**Pest control**

Amadumbe is affected by many pests such as white ants. The pests are responsible for suboptimal yields as well as deterioration of the quality of the tuber in storage.

White ants: White ants cause damage to the tubers at any stage of development and also during storage. Other pests include rodents that eat the corms and cormels on the field.

**Disease control**

Make sure that you start with disease-free propagating material by closely inspecting each cutting, washing with potable water, soaking hulis in a 10% bleach solution for 30 seconds. Store the hulis in a dry, cool, and well-ventilated area for three to five days before planting to allow for old wounds to heal.

Root rot or "leaf-burning disease" is the most serious disease believed to be caused by a complex of pathogens involving *Pythium myriotylum*. Corm and root rots can be avoided by planting in well-drained soils.

Tannia (dynastid beetle, *Ligrus ebenus*): Control with Malathion.

Dasheen mosaic virus: Use virus-free seed stock.

Fungal attack: Amadumbe plant leaves turn yellow prematurely, and the entire plant wilts. In the case of a severe attack, uproot the affected plant and bury or burn it.

**Harvesting**

**Harvest maturity**

Most amadumbe varieties mature in about eight to ten months from planting. The growth cycle lasts from nine to eleven months: during the first six months the corms and leaves develop; in the last four months, the foliage remains stable and, when it begins to dry, the plants are ready for the cormels to be harvested.

**Harvesting methods**

Harvesting is done by uprooting when the leaves have turned yellow and are beginning to dry. The crop can be harvested by hand or by a semi-mechanised method. In small plantations, harvesting of the cormels begins four to six months after planting and is done without uprooting the plant.

In the latter case, the tractor has an iron plate as wide as itself attached to it and has a central point which digs into the row of plants. It turns them over, and leaves the central stem and cormels free, which are subsequently collected by hand. Cormels that remain in the soil are dug out.
Before harvest the foliage is cut with a rotary mower, and disc cultivation brakes down the furrow. A modified potato harvester is then used to lift the corms and cormels from the soil. The one-row potato digger brings the cormels to the surface where they are selected, cleaned and packed into 22,5 kg wooden boxes, all without the aid of machinery. The boxes are later hauled to the packing shed. The planting material is selected by hand and cut with a machete. It is then thrown into a box or piled for curing until the cut surface has suberised.
Part III: Post-harvest handling

Sorting

Sorting is done to derive maximum benefits from crop production outputs by reducing losses and maintaining product quality and nutritional value. This process is achieved by removing soil from corms, washing the corms and selecting in terms of size. Finally, the corms are dried and disinfected carefully before being placed in boxes in cold-storage rooms.

Packing

Extra care should be taken to avoid damage to the corms because this may lead to rapid deterioration during subsequent handling and storage. Crates are preferred because they are firm, and reduce the incidence of mechanical damage to the corms. Corms destined for storage are cleaned but not through washing, and may also be cured to enhance repair of any physical injury present. Under ambient conditions of high temperature and high relative humidity (common in most tropical regions), wet tissue provides a conducive environment for microbial growth and spreading to healthy produce. In commercial packing sheds the corms are conveyed to a machine with circular brushes which clean and sort before the corms are packed by hand labour. The product may be shipped to a buyer for placement in a cold room. Corms yields will be reduced if more than three leaves are picked per plant.

Storage

The storage life of amadumbe is limited to its dormancy period after which sprouting starts and dietary value is quickly lost. The high moisture content of amadumbe (70% to 80%) makes it susceptible to attacks by microorganisms while in storage. The corms are then arranged on a raised platform where they may remain in good condition for up to three to four months. Other storage techniques include packing in heaps and dusting with wood ash, or leaving it in the ground unharvested for two to three months, but sprouting should not be allowed. Amadumbe stores better and it can be available throughout the year, ensuring regular food and income for the resource-poor farmers. The recommended temperature for prolonged storage is 7,22 °C to 10 °C with a relative humidity of 85%. Corms that are bruised do not last in storage.

Transport

After packaging the corms are graded and packed into crates for transportation. During transport, especially on long voyages, deterioration caused by moulding, heating and sweating may be a problem but crates are preferred because they are firm and reduce the incidence of mechanical damage to corms.
Marketing

The tannia has traditionally been a subsistence crop and any produce, which is not consumed, goes to the market. In the past, it was regarded as a crop cultivated and consumed by low-income farmers.
## Part IV: Production schedules

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Part V: Utilisation

Notwithstanding its high starch content, edible amadumbe has a higher content of protein and amino acids than many other tropical root crops. Nutritionally the root crop is rich in fibre, calcium, potassium, iron, vitamin A, vitamin B1, vitamin B2, and vitamin C. For some decades the quality of the diet of indigenous people has generally decreased when the consumption of amadumbe is being replaced with other sources of carbohydrates such as white bread.

The mature corms and young shoots of amadumbe are mostly used as boiled vegetables, but the corms are also roasted, baked, or fried. Roasted or boiled corms can be eaten alone or with stew. The boiled corms are mashed and used as weaning diet. Mature, edible aroids are also processed into flour, which is used to prepare "fufu" that is commonly eaten in Nigeria with stew. Tannia is used in small quantity as soup thickener after boiling and pounding to obtain a consistent paste. Young amadumbe leaves are used with coconut cream to prepare a dish, which is then used to eat the boiled or roasted amadumbe, breadfruit and banana. The leaves and sometimes stems are eaten as spinach and provide a supplement to maize.

Secondary and derived products

Despite their considerable potential as animal feed, renewable energy source and industrial raw material, the development of agro-industries based on aroids as major inputs remains a theoretical concept despite several positive indicators from research and development. Amadumbe chips are other important secondary products.

Warning: Never eat amabumbe raw, as it can cause serious inflammation of the mouth and throat. The high content of calcium oxalate crystals, about 780 mg per 100 g in some species of amadumbe, Colocasia and Xanthosoma, has been implicated in the acridity or irritation caused by amadumbe. Oxalate also tends to precipitate calcium and makes it unavailable for use by the body. Oke (1967) has given an extensive review of the role of oxalate in nutrition, including the possibility of oxalaurea and kidney stones. The acidity of high oxalate cultivars of amadumbe can be reduced by peeling, grating, soaking and fermenting during processing.

Acknowledgement

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References

www.arc.agric.za/home.asp?pid=6425
www.fao.org/docrep/005/ac450e/ac450e04