

DRAFT KENYA STANDARD

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Production and handling of fresh arrowroots (Taro) – Code of practice

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PUBLIC REVIEW DRAFT

DRAFT KENYA STANDARD

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Production and handling of fresh arrowroots(Taro) – Code of practice

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Foreword

This code of practice was prepared by the national Technical Committee for tubers and tuber products under the guidance of the Standards Project Committee, and it is in accordance with the procedures of the Kenya Bureau of Standards.

Arrowroot utilization in Kenya has been on the rise due to its appreciable nutritional value, however the production and post-harvest handling have not been properly structured through appropriate standards. In order to assure quality and consumer safety, it was necessary to develop a national code of practice for arrowroot

This code of practice intends to safeguard the interests of the stakeholders in the entire value chain from production at farm level to the final product, at the market to guarantee product quality and enhance safety of the consumers.

In the preparation of this standard, reference was made to:

KS EAS 776:2012 Production and handling of fresh cassava— Code of practice

Acknowledgement is hereby made for the assistance derived from these sources.

Production and handling of fresh arrowroots (taro)— Code of practice

1 Scope

This Kenya Code of practice provides recommended Good Agricultural Practices for the production, storage, packaging and transportation of fresh arrowroots (taro) (*Colocasia esculenta* (L.) Schott of the Araceae family, intended for human consumption.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies:

EAS 38, *General standard for labelling of pre-packaged foods*

EAS 39, *Hygiene in the food and drink manufacturing industry — Code of practice*

CAC/RCP 53, *Code of hygienic practice for fresh fruits and vegetables*

CAC/RCP 44, *Code of Practice for Packaging and Transport of Fresh Fruits and Vegetables*

KS ISO 874, *Fresh fruits and vegetables - Sampling*

3 Terms and definitions

For the purposes of this Code of practice, the following terms and definitions shall apply:

3.1

fresh arrowroots

unpeeled roots from varieties of arrowroots [*Colocasia esculenta* (L.) Schott of the Araceae family which contain stored carbohydrates mainly as starch

3.2

agricultural inputs

any incoming material (e.g. water, agricultural chemicals and planting material) used for the primary production of fresh arrowroots

3.3

biological control

use of competing biological agents (such as insects, micro-organisms and/or microbial metabolites) for the control of pests, plant pathogens and spoilage organisms

3.4

primary deterioration

reduction in quality as a result of physiological changes characterized by vascular streaking or vascular

DKS 2843:2018

discoloration

3.5

secondary deterioration

reduction in quality induced by micro-organisms that cause rotting under aerobic and anaerobic conditions

3.6

curing

operation of self-healing of wounds, cuts and bruises

3.7

Corm

a short, vertical, swollen underground plant stem that serves as a storage organ ..

3.8

cormel

a new small corm arising from the base of a fully developed one.

3.9

Lignification

To become woody through the formation and deposit of lignin in cell walls.

3.10

Practically free-

almost free of the concerned items

3.11

Competent authority

any person or organization that has the legally delegated or invested mandate, capacity, or power to perform a designated function.

3.12

Food grade packaging materials

material which will safeguard the hygienic, nutritional, technological, and organoleptic qualities of the product

3.13

Lot

a batch or consignment of arrowroots meeting similar characteristics

4 Requirements for primary production and handling of fresh arrowroots

4.1 General requirements

Arrowroots are grown under a wide range of agro-ecological conditions. Various agricultural inputs and technologies and correct agricultural practices are applied for safe fresh arrowroot production.

Significant primary and secondary deterioration caused by biological, chemical and physical hazards may occur during arrowroot production and post-harvest handling. However, arrowroot production and post-harvest handling should be conducted under good hygienic conditions to minimize potential health hazards in accordance with EAS 39 and CAC/RCP 53.

4.2 Site selection

Site selected for planting shall be suitable for production of arrowroots.

4.2.1 The producer shall demonstrate that the site is located in an area where cultivation is allowed or not restricted by a regulatory authority as per relevant laws

4.2.2 Land that has been used as a land fill or industrial dumping shall not be used for cultivation.

4.2.3. The planting area shall not contain any residue or contamination of hazardous substances such as pesticides likely to be of environmental concern or posing health and safety risk to consumers of resultant crop.

4.2.4 In case the planting area is located near or in the vicinity of industry, or in any high risk area, a risk assessment for suitability of production sites shall be conducted by Regulatory Authorities prior to their approval

4.3 Agro-ecological requirements

Arrowroot should be grown in accordance to the following recommended ecological requirements:

4.3.1 Climate

Warm climate with plenty of moisture is recommended. Under dryland production where rainfall is not enough, supplementary irrigation should be provided to retain soil moisture to field capacity.

4.3.2 Soil:

Deep well drained and friable soils is recommended. Proper land preparation should be done to achieve fine tilth and right planting depth for growth and development of the arrowroots.

4.4 Agronomic practices

Arrowroots should be cultivated in accordance with recommended agronomic practices below in order to achieve high yield and quality .

4.4.1 Plant population

Use plant spacing to achieve a planting densities of 10 000-50 000 plants/ha.

4.4.2 Planting material:

Both mother corm and cormel can be used as planting materials. If corms are used, they shall be cut to small sets of 150-200 grams and for cormels, whole tubers of 50-80 grams size are ideal.

4.5 Other production inputs requirements

DKS 2843:2018

4.5.1 Inputs used for the production of fresh arrowroots shall conform to the relevant Kenya standards.

4.5.2 Agricultural inputs shall be practically free from microbial or chemical contaminants at levels that may adversely affect the safety and quality of fresh arrowroots.

4.5.3 Growers shall use only agricultural inputs which are approved by the competent Authority for the cultivation of arrowroots and shall use them according to the product label for the intended purpose.

4.5.4 The disposal of surplus chemical and used containers shall be in accordance to the national environment regulatory agency guidelines.

4.5.6 Agricultural workers who apply agricultural chemicals shall be trained in proper application procedures.

4.5.7 Untreated Sewage and industrial waste shall not be used in arrowroots production.

4.5.8 Proper records shall be kept for agricultural chemical applications that capture information on the date of application, the chemical used, the crop sprayed, the pest or disease against which it was used, the concentration, method and frequency of application, and records on harvesting to verify that the time between applications and harvesting is appropriate

4.5.9 Agricultural chemicals should be kept in their original containers, labelled with the name of the chemical and the instructions for application and use.

4.6 Weeding and earthing up

a) Dry land production

It is recommended that weeding and earthing up should be done twice; first after 45 days of planting and second one after one month after the first weeding. Inorganic and organic fertilizers should be applied according to the recommended rates.

b) Wet/Fallow production

weeding may not be necessary as the flood system smothers the weeds but the few that withstand the condition can be pulled out by hand.

4.7 Harvesting

Arrowroot is ready for harvesting when most of the leaves begin to turn yellow. Maturity of the crop varies with varieties and methods of cultivation but harvest time may start after 5 months after planting. Arrowroots can be harvested at any time of the year. The food quality of the roots, particularly the starch content, increases with time up to an optimum after which there is a loss of quality mainly due to increased lignification.

Excessive harvesting of the leaves can have a negative effect on the yield of roots.

4.7.1 Handling during harvesting

Care should be taken during the harvesting process to minimize damage such as bruising, scrapping or breaking of the roots, as this greatly reduces shelf life. The corms should not be thrown or dropped down as this may accelerate deterioration.

4.7.1.1 Harvesting tools

The digging tools include wooden sticks, machetes, hoes or forks. The tools should be clean and properly used to avoid injuring the roots during harvesting.

4.7.1.2 Method of harvesting

Harvesting arrowroots may either be done by hand where the soils are loose or by digging using appropriate tools to lift the corm while preventing injury or damage.

4.8 Post-harvest handling of fresh arrowroots

Effective measures shall be taken to prevent contamination of fresh arrowroots from agricultural inputs or personnel who come directly or indirectly into contact with fresh arrowroots. The growers, harvesters and handlers shall adhere to the following:

4.8.1 Fresh arrowroots unfit for human consumption and unsafe for further processing shall be segregated and disposed off properly

4.8.3 harvesting containers used shall be cleaned and sanitized.

4.8.4 Care shall be taken when packing fresh arrowroots in the field to avoid exposure to contamination with animal/human filth.

5 Storage and preservation

5.1 General

Arrowroots generally deteriorate very quickly soon after harvest and this is because of the fact that the root of arrowroots as a storage organ has no dormancy function in propagation and possesses no bud primordial from which re-growth can occur.

Arrowroots are still living organisms after they have been harvested and losses that occur during storage arise mainly from their physical and physiological condition.

The main causes of loss are associated with mechanical damage, physiological condition (maturity, respiration, water loss), diseases and pests. To ensure effective storage of root and tuber crops, these major causative factors need to be properly understood and, where appropriate, be properly controlled, taking into account the socio-economic factors which prevail in the areas of production and marketing.

Successful storage of arrowroots requires:

- a) the use of sound and healthy corms;
- b) proper curing, if possible combined with fungicide treatment;
- c) adequate ventilation to remove the heat generated by respiring corms
- d) regular inspection during storage and removal of rotting corms and any sprouts that develop and;
- e) protection from direct sunlight and rain.

DKS 2843:2018

5.2 Handling during storage

Arrowroots shall be harvested and handled with extreme care if they are to be kept for more than a week.

There are a number of different practices which, if used in combination, will assist in delaying deterioration:

- a) cutting off the stems, leaving only a short part above ground. This operation should be done about three weeks prior to harvesting;
- b) as arrowroots usually start rotting from the neck, (i.e. the point of attachment of the root to the parent plant), harvesting the roots with part of the stem (2 cm - 5 cm) still attached may prevent a rapid spread of decay into the root;
- c) minimize damage at lifting by harvesting while the soil is wet, for example after a rain;
- d) retain only those roots that do not show signs of injury. Roots that are to be kept for more than one week or more should be carefully selected since curing will not be effective on roots with extensive damage; and
- e) establish curing of the roots after harvest as a routine operation with, as far as possible, the minimum of handling.

Severely damaged roots should not be stored because of the following reasons:

- a) lower quality;
- b) increased risk of subsequent pathogenic losses; and
- c) risk of introducing disease organisms into sound produce.

5.3 Control of damage

Arrowroots should be handled so as to minimize abrasion and breaking of the skin because of its relatively soft texture. Most mechanical damage occurs as a result of careless handling at harvest and during transport to and within a store.

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5.4 Temperature control

Temperature has a great influence on many factors that cause loss during storage such as the development of rotting micro-organisms and insect infestation. At 10 °C, the rate of rotting and respiration are shown to be moderate and below 4 °C the rate of respiration is significantly reduced although chilling injury may occur.

5.5 Curing of arrowroots

Arrowroots have the ability to heal their skin wounds when held at relatively high temperatures and humidity for few days after harvest while at the same time there is a general strengthening of the skin. The crop may undergo the operation of curing immediately after harvest.

The process may be carried out for 2 to 7 days at temperatures of 32° to 40°C and a relative humidity of 85% to 95%

5.6 Storage methods

5.6.1 Storage in the soil before harvest

Arrowroot corms may be stored by leaving them un-harvested after the optimum harvest stage depending on the variety and ecological conditions, however, arrowroots will become fibrous and woody and their starch content and palatability decreases. It may also be attacked by pests and pathogens; and become more susceptible to deterioration while still in the ground.

5.6.2 Storage pits/heaps

Arrowroot corms may be kept in pits/heaps for a short period (2 days - 3 days) by:

- a) re-burying in trenches covered with dry plant material and soil;
- b) piling in heaps and kept moist by watering them daily; and
- c) covering by applying a thick coating of soft clay or mud.

5.6.3 Storing fresh arrowroots in crates/ baskets/boxes

Freshly harvested arrowroots can be stored in wooden crates or baskets. The crates are lined with a layer of sawdust, wood shavings, peat or any other suitable adsorbent materials. The spaces between the roots are also filled with sawdust. Finally, the roots are then covered with sawdust.

The sawdust should be damp but must not be wet. If the sawdust is too dry the roots will deteriorate quickly. Sawdust which is too moist promotes the formation of mould and rot. To prevent the roots drying out too early, the crate should be lined with plastic foil.

The crates or baskets can simultaneously be used as containers during transport (also several times) which saves on handling costs and also reduces injury to the roots during transport.

5.6.4 Storing fresh arrowroots in a dip

Fresh arrowroots may be stored in potable water in various sized containers. The containers are filled with potable water and the roots are completely submerged. This process may also be used simultaneously for detoxifying the roots which contain Acrid factor

The effectiveness of this method depends greatly on the degree of freshness of the roots when they are stored.

5.6.5 Storage in plastic bags or plastic film wraps

Plastic bags may be used to preserve arrowroots by avoiding the loss of moisture and water stress.

Arrowroots treated with an appropriate fungicide such as thiabendazole and kept in an airtight plastic bag or a plastic film wrap can be stored for two to three weeks.

Arrowroots should be dipped in a 0.4 % w/w solution of thiabendazole for 10 seconds then stored in plastic bags.

Arrowroots may also be treated with household bleach (0.95% active chlorine). The use of household bleach is as effective as thiabendazole if sound arrowroots are not stored for much longer than seven

DKS 2843:2018

days.

Freshly harvested roots are put into bags. Fungicides should be applied before the bags are closed to avoid the formation of mould and rot.

low temperatures (below 10 °C) may be used to elongate the duration of storage

5.6.6 Other methods

Other methods of storage and preservation include refrigeration, waxing of the roots and chemical treatment.

5.6.6.1 Refrigeration

Reduced temperatures extend the storage ability of arrowroots by delaying the deterioration processes which occur rapidly at normal storage temperatures. Experiments have shown that the most favourable temperature for the storage of fresh arrowroots is 3 °C.

5.6.6.2 Waxing

Arrowroots may be stored preserved by coating them in food grade wax. The wax may or may not be supported with a fungicide.

6 Sorting and packing for export

For export, fresh arrowroots may be graded in terms of size and shape.

The optimum handling conditions are as follows:

- a) fresh arrowroots shall be carefully cleaned and treated in accordance with section 5.6.5;
- b) after washing and fungicide treatment, the fresh arrowroots should be left overnight in a well ventilated area to dry before packing for departure; and
- c) during shipment, the required storage temperature is 10°C - 15°C.

7 Packaging and labelling

7.1 Packaging materials shall be food grade and suitable for transporting fresh arrowroots.

7.2 The packaging material shall comply with the legal and environmental requirements and shall be tamperproof.

7.3 The following factors may be considered in choosing packaging materials:

- a) the level of losses during marketing;
- b) the cost of current and improved packaging;
- c) the consistent supply of the packaging material;
- d) the acceptability of the packaging method to the market.
- e) the distribution method of the product
- f) convenience and ease of use

7.4 packaging should be done in accordance to the requirements of CAC/RCP 44,

7.5 in addition to the requirements of CAC/RCP 44,
the following various types of packaging material may be used:

- a) natural and synthetic fibre sacks;
- b) moulded plastic boxes;
- c) sawn wooden boxes;
- d) cardboard boxes; and
- e) paper or plastic film sacks.

7.6 The net weight of a lot shall be:

- a) in metric units; and
- b) not more than 50 kg in line with ILO guidelines.

7.7 The labelling of fresh arrowroots shall be in accordance with EAS 38.

8 Criteria for conformity

A lot shall be declared as acceptable if the production and handling processes conform to the provisions of this Code of Practice