



Seed Certification Standards for Arrowroot (*Maranta arundinacea* L.)

Introduction

Arrowroot (*Maranta arundinacea* L.) is primarily grown for its rhizomatous tubers containing 20% starch, which is valued as a foodstuff, particularly for infants and invalids. It is indigenous to Central America (including the Caribbean area) and northern South America (Suja et al., 2006). Nowadays, it is cultivated throughout the tropics, but on a commercial scale only in the West Indies, especially in the St. Vincent Island. In South-East Asia, it is seen cultivated everywhere, mainly as a home garden crop. In India, arrowroot is grown in the North-Eastern States, West Bengal, Assam and in southern India mostly in Kerala as a rainfed crop in limited areas in homesteads. The arrowroot starch is used as a base for face powders, in the preparation of certain specialised glues and, more recently, in the manufacture of carbonless paper for computers. The rhizomes are sometimes eaten boiled or roasted. Commercial good quality arrowroot starch is pure white, clean and free from specks with a moisture content of not more than 18.5%, low ash and fibre content. Nayar and Suja (2004) reported that there was 7% yield increase in arrowroot under intercropping in coconut gardens. Arrowroot tolerates intense shade without notable yield reduction. Thus, it can be profitably intercropped in plantation crops like coconut, arecanut and rubber (Suja et al., 2006).

Seed is an important input for any crop. Arrowroot does not set seeds and is normally propagated vegetatively from rhizome apices (bits) about 2-4 nodes long and not too thin. Suckers of 30 cm length can also be used, but should be planted immediately after removal. If suckers are used, preparation of planting material should actually start at the time of harvest of the crop. Suckers are separated from the clump and planted 30 to 45 cm apart in the nursery during the off-season. These suckers give rise to new plants, which are uprooted and the canopy cut off to retain 10 cm of the shoot intact with roots (Asha et al., 2024). The seed requirement is mainly met through

traditional seed system where farmers keep a portion of their produce as seed for next season. As a result of continuous use of same planting material year after year, the qualities of seed/planting materials get deteriorated due to degeneration and lack of proper knowledge of farmers about the seed production technique. Inadequate availability of quality planting material of tuber crops continues to remain as a major stumbling block in the faster spread of high yielding varieties and their adoption by the farming community (James *et al.*, 2004). Rapid propagation of arrowroot is limited by the lack of improved varieties, high bulkiness and low multiplication rate. These reasons along with requirements of huge quantity of planting materials attribute for the newly released varieties of arrowroot to take long time in reaching farmers' fields. Unlike other horticulture crops such as potato, banana, citrus, grapes etc., which have a well established system of seed production (Singh, 2011), the Indian minimum seed certification standards are not followed for quality planting material production of arrowroot.

Importance of seed certification standards

The purpose of seed certification is to maintain and make available to the public, through certification, high quality seeds and propagating materials of notified kind and varieties so grown and distributed so as to ensure genetic identity and genetic purity. Seed certification is also designed to achieve prescribed standards. Certification shall be conducted by the certification agency notified under section 8 of the Seed Acts, 1966. Seed of only those varieties which are notified under section 5 of the Seed Act, 1966 shall be eligible for certification (Tanwar and Singh, 1988). As per the national policy of seed multiplication phases, seeds have been grouped into three categories i.e. i) Breeder or basic seed; ii) Foundation Seed I and Foundation Seed II and iii) Certified Seed.

Breeder Seed: Breeder seed is a seed or vegetatively propagating material directly controlled by the

originating or sponsoring plant breeder of the breeding programme or institute and/or seed whose production is personally supervised by a qualified plant breeder and which provides the source for the initial and recurring increase of foundation seed. Breeder seed shall be genetically so pure as to guarantee that in the subsequent generation i.e. foundation seed and certified seed class shall conform to the prescribed standards of genetic purity. The other quality factors of breeder seed such as physical purity, inert matter, germination etc. shall be indicated on the label on actual basis. Breeder seeds are considered to be pure, disease free and no tolerance limit is fixed, while for foundation (FS I and FS II) and certified seed the tolerance limits for viruses off-type, tuber-borne diseases and grades have been fixed by Government of India. Breeder seed is only being monitored by the certification agency but it is not certified by them.

Foundation Seed: Foundation seed shall be the progeny of breeder seed, or be produced from foundation seed which can be clearly traced to breeder seed. Foundation seed produced directly from breeder seed shall be designated as foundation seed stage-I. thus foundation seed produced from foundation seed stage-I shall be designated as foundation seed stage-II.

Certified Seed: Certified seed shall be the progeny of foundation seed and its production shall be so handled as to maintain specific genetic identity and purity.

In India, there are 19 state seed certification agencies in different states certifying the seed of different crops. The states in which seed certification is in operation are Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Sikkim, Tamil Nadu, Uttar Pradesh, West Bengal and Delhi.

Seed certification standards for quality planting material production of Arrowroot (*Maranta arundinacea* L.)

I. Application and Amplification of General Seed Certification Standards

a. The General Seed Certification Standards are basic and together with the following specific standards

constitute the certification standards for arrowroot.

b. The General Standards are amplified as follows to apply specifically to arrowroot.

All certified classes shall be produced from planting material (rhizomes) from the seed field (field where arrowroot is cultivated for the purpose of planting materials) whose source and identity may be assured and approved by the Certification Agency.

II. Land Requirements

- a) Land to be used for seed production of arrowroot shall be free from volunteer plants.
- b) Avoid swampy, low lying and over shaded conditions.
- c) Avoid arrowroot residue and drainage from other arrowroot fields.
- d) Well drained loamy soil is best suited and optimum soil pH preferred is between 5.5 and 6.5.

III. Field Inspection

A minimum of four inspections shall be made for the standing arrowroot crop.

The first inspection shall be made prior to planting. The second inspection shall be made at 75 days after planting to verify the isolation and off-type plants. The third inspection shall be made at 180 days after planting to verify off-types and extent of disease infected plants. The fourth inspection shall be made prior to harvesting or at appropriate growth stage depending on the crop duration of the variety concerned to check isolation, off-types and other relevant factors.

IV. Field Standards

A. General requirements

1. Isolation

Seed fields shall provide minimum isolation distance for foundation seed and certified seed. The isolation distance should be maintained from fields of other varieties as well as fields of the same variety not conforming to varietal purity requirements for certification (Table 1). The details of maximum permissible limits of off types, pest and disease for foundation seed and certified seed are given in Table 2.

Table 1. Isolation distance to be maintained for Foundation seed and Certified seed .

Contaminants	Minimum distances (meters)	
	Foundation seed	Certified seed
Fields of other varieties	5	5
Fields of the same variety not conforming to varietal purity requirement for certification	5	5

B. Specific requirements

Table 2. The details of maximum permissible limits for off-types, pest and diseases in foundation seed and certified seed.

Contaminants	Minimum distances (meters)	
	Foundation	Certified
*Off-types	0.10	0.20
Plants showing symptoms of mosaic	0.10	0.50

*Standards for Off-types shall be met at final inspection for designated pest and disease at each inspection.

Note: 1. All Off-types, pest and diseases infested plants shall be rogued out alongwith rhizomes for destruction. 2. Gaps in the seed field shall not be more than 10.0%

V. Seed standards

A. Specifications in respect of size and weight of the planting material for foundation and certified classes shall be as follows:

For foundation and certified classes seed standards: Small pieces of rhizome known as bits, the bits having 4-7 cm length with 2-4 nodes and 20-25 g weight.

Note:

- In a seed lot, rhizomes not conforming to specific size of seed shall not exceed more than 5.0% (by number).
- The seed material shall be reasonably clean, healthy, firm and shall conform to the characteristics of the variety. The rhizomes not conforming to varietal characteristics shall not exceed 0.10% and 0.50% (by number) for Foundation and Certified seed classes respectively
- Cut, bruised, cracked rhizomes or those damaged by insects, slugs or worms shall not exceed more than 1.0% (by weight).

B. Maximum tolerance limit of planting rhizomes showing visible symptoms of infestation caused by scale insect will be as follows

Factor	Maximum permissible limit (by number)	
	Foundation Seed	Certified Seed
Rhizomes infested with scale insect	None	None

The crop attains maturity in 10-11 months after planting. Maturity is indicated by yellowing, wilting and drying up of leaves. At this stage, the plants are dug out and the rhizomes separated from the leafy stem. Under favourable conditions rhizome yield of 20-25 t ha⁻¹ can be obtained. Intercropping arrowroot in coconut, arecanut and rubber also augments the net income from these plantations. It is a versatile crop, which can adapt relatively quickly and fit well in diverse cropping systems. It can produce high yield of acceptable products and generate economic returns. The amount of starch obtained is 16-18% of the fresh weight of the rhizome. Average production of starch per hectare is 3-3.5 tons.



Field view of quality planting material of production of Arrowroot



Field view of quality planting material of production of Arrowroot



Planting material of arrowroot

4. Storage standards: Keep the planting materials under shade conditions

Transport: Proper care should be taken during the transport and handling.

Conclusion

Arrowroot is an underutilized tuber crop with immense applications in food, feed and industrial sector. In spite of the wide applications of arrowroot starch in food, feed, industrial and pharmaceutical fields it is mostly left as an unexploited crop in the homesteads under shade of fruit crops like jack, mango and other tree crops, tribal pockets and marginal lands without proper scientific management. Cultivation of arrowroot by adopting high yielding varieties with proper seed certification standards is the need of the hour for achieving sustainability in the sector.

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TF- 21/2025

December 2025

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Published by

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