

# ADVANCE PRODUCTION TECHNOLOGY IN YAM



**Centurion**  
**UNIVERSITY**

**Presented by – Pritismita Nayak**

**M.Sc (Hort.) Vegetable science**

**220805200002**

**Presented to – Dr. Subhrajyoti Chatterjee**

**Assistant Professor**

**Date – 06/05/23**

**Time – 10:30AM**

# CONTENT

- Introduction
- Origin and distribution
- Cultivated *Dioscorea* species
- Botany
- Uses
- Different production aspect
- Greater yam and white yam
- Varieties
- Lesser yam



# *Dioscorea spp* Cultivation

Botanical Name:

*Dioscorea esculenta*  
(Lesser Yam)

*Dioscorea alata*  
(Greater Yam)

*Dioscorea rotundata*  
(White/African yam )

Family: Dioscoreaceae



## Introduction

- The three yams grown in India are the Greater Yam or 'Ratalu', *Dioscorea alata* L the Lesser Yam or 'Suthni, *D. esculenta* (Lour.) Burkill and the White Yam, *D. rotundata* Poir. There are four other cultivated species of Yam which are grown in other countries, like *D. cayenensis* Lam, *D. dumetorum* (Knuth) Pax, *D. trifida* L. and *D. bulbifera* L. The species *D. rotundata*, *D. cayenensis* and *D. dumetorum* are important sources of food in Africa and *D. trifida* in South America and the Caribbean Islands. The area, production and productivity of yam in the world (year 2001) were 4.1 million ha, 38.6 million tonnes and 9.53 t/ha. respectively (FAO, 2002).
- In India, *D. alata*, commonly known as ratalu is cultivated in Assam, Arunachal Pradesh, Nagaland, Meghalaya, Mizoram and other parts of north-east, Kerala, Wes Bengal, Tamil Nadu and Madhya Pradesh, *D. esculenta* or suthni is grown in Bihar eastern Uttar Pradesh, Madhya Pradesh, Orissa, West Bengal, Khasi hills, Assam and other north-eastern areas.





*Dioscorea alata*



*Dioscorea rotundata*



*Dioscorea cayenensis*



*Dioscorea dumetorum*

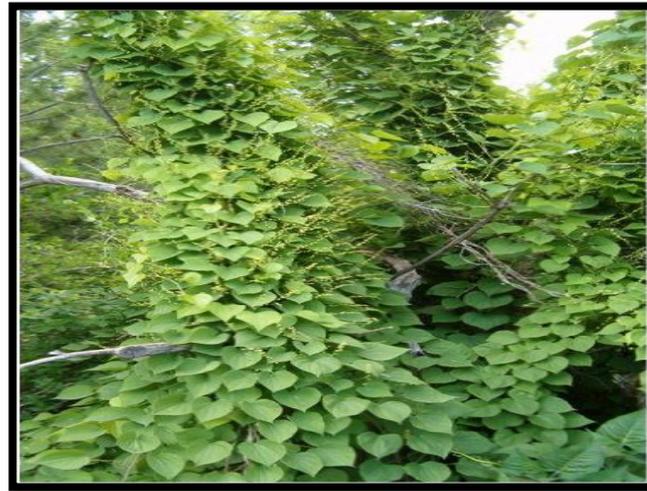


*Dioscorea bulbifera*



# Origin and Domestication

- The origin of *D. alata* and *D. esculenta* was in the Indi centre of origin around Assam and Myanmar, and *D. alata* had a secondary centre of origin in the Indo-Malayan Centre.
- The species *D. rotundata* and *D. cayenensis* are native to tropical Africa and *D. trifida* originated in the West Indies.
- Domestication of yams was mostly in West Africa, as early as 5000 BC.
- It was named by the monk Charles Plumier after the ancient Greek physician and botanist Dioscorides.



# Cultivated Dioscorea species

## Food species

Asia

- ▶ *D.alata*- Cultivated spp

Africa

- ▶ *D.cayenensis*
- ▶ *D.rodundata*- Cultivated species

Americas

- ▶ *D.trifida* -Major food species

## Pharmacuetical species

*D.composita*

*D.deltoides*

*D.elephantipe*

*D.floribunda*

*D.speculiflora*

*D.sylvatica*

## Major food species – domesticated about 3000bc

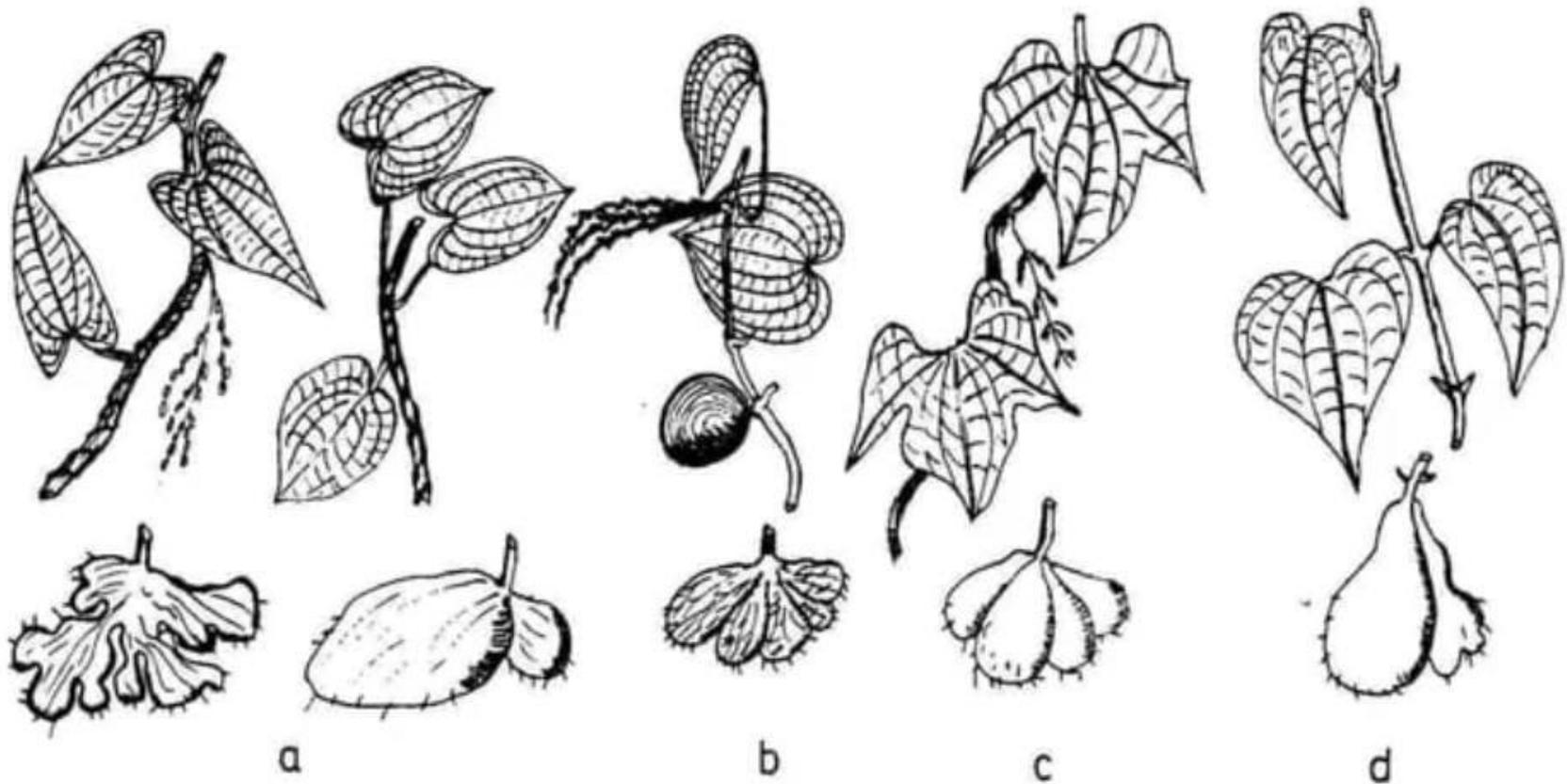
Common Name	Species	origin
Greater Yam	<i>D.alata</i>	South east Asia
Yellow Guinea yam	<i>D.cayenensis</i>	West African forest
White/African yam	<i>D.rodundata</i>	West African savanna
Cush-Cush yam	<i>D.trifida</i>	Tropical America



# Botany

- ❖ Yam tuber is neither a root structure nor a stem, but may have its origin as a hypocotyl structure.
- ❖ Tuber grows from a small corm structure located at base of stem. In all yams, tubers are renewed annually.
- ❖ *D. bulbifera* and *D. alata* produce aerial bulbs called bulbils from axils of leaves.
- ❖ Whole tubers or pieces of tubers with stem are used for planting yams.
- ❖ Bulbils can also be used for propagation. Stem is weak and climbs on trees by twining.
- ❖ In *Dioscorea rotundata* stem remains erect up to one metre height. Leaves are simple.
- ❖ All species are dioecious. Fruits are dehiscent tri-locular capsules.
- ❖ Seeds are small and dispersed by wind.
- ❖ Even though all the species have seed dormancy for three months, *Dioscorea alata* does not exhibit seed dormancy.
- ❖ In *Dioscorea alata*, majority of male clones are tetraploids ( $2n = 40$ ) and majority of females have higher ploidy level ( $2n = 60$  or  $80$ ).
- ❖ Pollination – Cross pollination





Comparison of different yam species a) *Dioscorea alata* (Asia). b) *D. bulbifera* (Asia). c) *D. trifida* (Central America), d) *D. cayennensis* (Africa)



# USES

## Food

- ❖ High in starch
- ❖ 99% of production for food
- ❖ Yams are used as boiled , fried or baked vegetable . They also have medicinal uses .
- ❖ Yams are important source of steroidal sapogenins for oral contraceptive and cortisone used in rheumatism and ophthalmic disorders .
- ❖ The rhizomes of *D. esculenta* contain enough quantity of diosgenin which may be exploited to manufacture presucors of steroids hormones.
- ❖ *D. Tomentosa tubers* are also source of steroid sapogenins .
- ❖ *D. hispida* and *D. dumetorum* are poisonous use for hunting fish, arrow poision.
- ❖ *Dioscorea alata* (greater yam) and *D. esculenta* (lesser yam) are main yams of India.



- ❖ Another species, *D. rotundata* (white yam or African yam), which is under extensive cultivation in Western Africa, recently introduced to India is becoming popular.
- ❖ All species are typical tropical crops grown for carbohydrate rich underground tubers.
- ❖ They form staple food in many parts of Western Africa. In *D. alata*, tubers are peeled, cooked and used as vegetable. *D. esculenta* is consumed after boiling and peeling.
- ❖ Subterranean tuber of a true yam (*Dioscorea sp.*), the third most important tropical root crop after cassava and sweet potatoes.



# Climate and Soil:

► It is a tropical species preferring a tropical climate without extremely to moderate temperature. It is adopted to moderate to heavy rainfall areas. *Dioscorea* plants can be grown in a wide variety of soils. Extremely heavy clay soils are, in general not recommended, as they restrict tuber growth and make harvesting difficult. *Dioscorea* tolerates fairly wide variation in soil pH, though very acid soils should be avoided, the ideal soil pH being 5.5 to 6.5.

❖ Yams require warm and humid climate. The optimum temperature for yam is 26-31° C .

❖ Temperatures below 20°C and above 35°C adversely affect the growth of plant .

❖ Short days are favorable for tuber production.

❖ Yams do not tolerate frost and low temperature



# Varieties

➤ Improved varieties developed at Central Tuber Crops Research Institute (CTCRI), Sreekaryam, Thiruvananthapuram in Kerala are given below:

▶ **Greater yam (*Dioscorea alata*)** (Hindi: Ratula) ( $2n = 20, 30, 40-80$ )

❖ **Sree Keerthi**: Tubers are conical with brown skin and white flesh having 20-22% starch. It yields 25-30 t/ha in 9-10 months.

❖ **Sree Roopa**: Tubers are digitate in shape with black skin and white flesh. Productivity is 25-30 t/ha in 9-10 months.

❖ **Sree Shilpa**: Tubers are swollen, oval and smooth with black skin and white flesh. Yield is 28 t/ha in 8 months.

❖ **Indu**: It is a high yielding (39.39 t/ha) variety developed by Kerala Agricultural University. Tubers are digitate with brownish black skin and white to pale flesh.



## White yam (*D. rotundata*)

**Sree Subhra:** Tubers are cylindrical with brown and partially hairy skin and white flesh. Yield is 35-40 t/ha in 9-10 months.

**Sree Priya:** It produces 2-3 tubers having smooth surface and good cooking quality. Yield is 35-40 t/ha in 9-10 months.

**Sree Dhanya:** This is a dwarf and bushy variety with spineless stem and tubers containing 23.3% starch.



**Greater yam**



**White yam**





**Ubi / purple yam / Greater yam**



**PURPLE YAM**

*Dioscorea alata*





**Hardy yam / *Dioscorea batatas***



**Chinese yam**



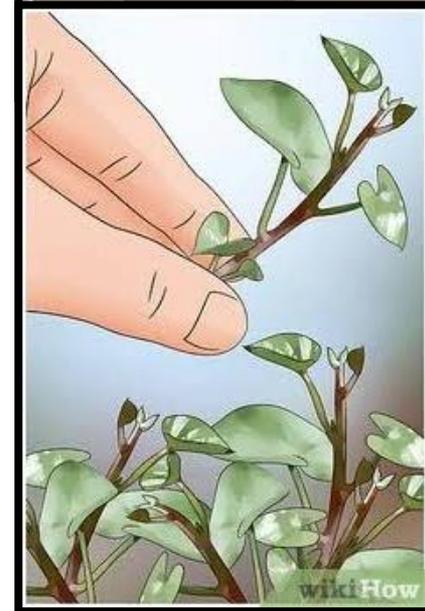
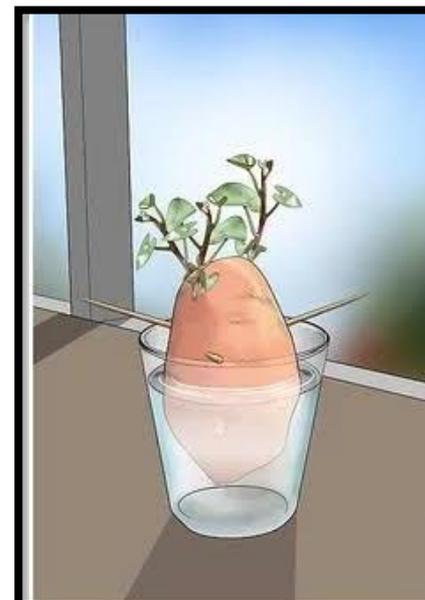
## Common Name

- *Dioscorea sativa* (wild yam, fourleaf yam)
- *Dioscorea alata* (purple yam, greater yam),
- *Dioscorea arachidna*, *Dioscorea bulbifera* (air potato, air yam, bitter yam, cheeky yam, potato yam, aerial yam, parsnip yam),  
*Dioscorea cayenensis* (yellow yam),
- *Dioscorea communis* (black bryony),
- *Dioscorea dugesii*, *Dioscorea dumetorum* (bitter yam),
- *Dioscorea elephantipes* (elephant's foot, Hottentot bread),  
*Dioscorea esculenta* (lesser yam),
- *Dioscorea filiformis*, *Dioscorea hispida* (intoxicating yam, Indian three-leaf yam),
- *Dioscorea japonica* (Japanese yam),
- *Dioscorea mexicana* (Mexican yam),
- *Dioscorea oppositifolia* (betel yam, Chinese yam),
- *Dioscorea panthaica*, *Dioscorea pentaphylla* (fiveleaf yam),  
*Dioscorea polystachya* (Chinese yam),
- *Dioscorea pyrifolia*, *Dioscorea septemloba* (seven-lobed yam, Foochow yam),
- *Dioscorea tokoro*, *Dioscorea tomentosa* (thorny yam),
- *Dioscorea trifida* (Indian yam, cush-cush yam, yampee)



# Propagation and time of planting

- ❖ In greater yam and white yam, tuber pieces of 250-300 g size are used as planting material.
- ❖ For this, tubers are cut longitudinally with a portion of stem end and allowed to dry under partial shade after dipping in cow dung slurry.
- ❖ Planting is usually done during March-April.
- ❖ Plough / dig land to a depth of 15-20 cm.
- ❖ Apply 1½ kg compost or well rotten cattle manure in the pit and full up to % with top soil.
- ❖ Plant tubers and mulch with dry leaves.
- ❖ Approximately 1800-2700 kg seed material is required to plant one hectare.



# Manuring

Apply cattle manure or compost @ 10 t/ha as basal dressing before planting.

A fertilizer dose of 80 kg N, 60 kg P<sub>2</sub>O<sub>5</sub> and 80 kg K<sub>2</sub>O per hectare in two split doses is needed for yams.

Half dose of N, full dose of phosphorus and half dose of potash are to be applied within a week after sprouting, Remaining nitrogen and potash may be applied one month after the first application.

Top dressing of fertilizers should be followed by weeding and earthing up.

## Irrigation:

Irrigation may be given at weekly intervals in the initial stage and afterwards at about 10 days interval. However, during rainy season no irrigation is needed.



# Intercropping

Intercropping with legumes like cowpea, horse gram, cluster bean and French bean has been found to smother weeds and also provide an extra income without adversely affecting the tuber yield and diosgenin content.



# Inter-culture

Vines are allowed to trail on shrubs or trees or props for high productivity.

Tubers are harvested in 9-10 months when leaves turn yellow in colour.

Harvesting is done by digging surrounding area and exposing tubers.



# Lesser Yam

Botanical Name: *Dioscorea esculenta*

Chromosome Number: 40,60,100

Common Name: Suthni

- **Sree Latha:** Tubes are oblong to fusiform in shape with creamy white flesh and greyish brown skin covered with thin hairs. It yields 20-25 t/ha in 8-9 months. Tubers have 18.4% starch content.
- **Sree Kala:** Tuber is sweet, round and smooth. Yield is 20-25 t/ha in 8-9 months.
- Cultivation of lesser yam is different from that of greater yam or white yam.
- Plough / dig the land thoroughly and make small mounds at a distance of 70 cm after incorporating compost or well rotten cow dung.
- Plant whole tubers of 100-150 g.



- Manuring and other cultivation practices are similar to that of greater yam.
- Trailing is necessary to expose leaves to sunlight. It is done within 15 days after sprouting by coir rope attached to artificial supports in open area.
- Lesser yam is harvested in 8-9 months after planting. Harvesting is done by digging out tubers carefully.



Lesser Yam



# Harvesting:

❖ Harvesting in Feb. – March

## Manual process

❖ Dug with wooden spades or digging sticks

❖ Shorter post harvest life

❖ Average 50-60 tones from 1 hac in 2 year

❖ **Yield:** The average yield of greater yam is 33-40 tonnes per hectare and in lesser yams 25-30 tonnes per hac , the average yield for white yams is 18-25 tonnes per hac

# Storage :

## Stored for 2-3 months

❖ Harvested tubers dried a few hours

❖ Stored in well-ventilated waterproof building

❖ Under shade in open

## Temperature

Optimal is 15<sup>0</sup>C

Chilling injury <10<sup>0</sup>C

Sprouting can be problem -rub off



# DISEASES & INSECTS IN YAM

Anthracnose:

*Colletotrichum gleosporoides* (*Glomerella cingulata*)

## Symptoms

- ▶ Small, dark brown spots or black lesions on leaves which may be surrounded by a chlorotic halo; leaf necrosis; dieback of stem; withered leaves and scorched appearance
- ▶ Disease overwinters in plant debris; occurs world wide

## Management

- ▶ resistant to anthracnose TDA 291 or TDA 297



# **Dry rot disease (caused by yam nematode)**

*Scutellonema bradys*

## **Symptoms**

The infected tubers show dry rot of 1 to 2 cm. Initially this dry rot is of cream and light yellow lesions appear just below the outer skin without any external symptom. With progress in disease lesion spreads deeper (maximum up to 2 cm). At later stage the rot become light and dark brown to black in color and tubers may show external cracks. Entry of fungus through this wounds causes further decay of tubers in storage.

There is no above ground symptom with yam nematode infestation .

## **Management**

Use disease free tubers/setts for planting. Treating tubers with hot water for 40 min at 50-55 C before sowing and after harvest to reduce disease both in field and storage. In Africa smearing tubers with wood ash or cow dung shows reduced nematode infection in field. Follow crop rotation with non host or antagonist crops like ground nut, sorghum, maize, chill pepper etc



Dry rot disease



# Yam mosaic disease

## *Yam mosaic potyvirus*

### Symptoms

The common symptoms are infected leaves show yellow and green patterns (called mosaics) between the veins or may show a narrow green strips bordering the veins (called vein banding). If the disease is severe the leaves become long, thin and strap shape (called shoe-string symptom) and whole plant become stunted. Plant may produce few small tubers with less starch content. Some plants may recover from the virus infection soon after first symptom but virus may survive in plant and reduce the vigour.

### Management

Use healthy and disease free tubers or setts for planting. Select healthy and large tubers for planting instead of small tubers. Keep fields free from weeds. Collect crop debris and destroy them.





**Yam mosaic disease**

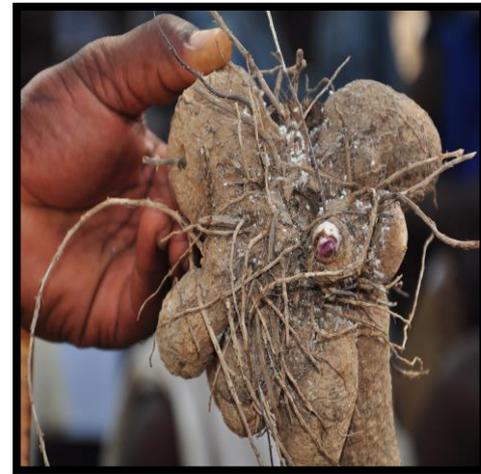


# White Scale insects

## *Aspidiella hartii*

### Symptoms

❖ The leaves and tubers are covered with small white scales from field to storage. Even though it won't effect yield sometimes foliage cause poor growth and tubers may show delay in germination or even stopped. Severe infestation may leads to tuber shrivel.



# Reference

1. Alexander, J.; Coursey, D.G. The Origins of Yam Cultivation; Ucko, P.J., Dimbleby, G.H., Eds., Gerald Duckworth & Co.: London, UK, 1969.
2. Thompson, A.K. Chinese yam. In Fruit and Vegetables: Harvesting, Handling and Storage; John Wiley & Sons :Hoboken, NJ, USA, 2014; p. 1429
3. Vishnu swarup book, Kalyani publication , ASIN – B014UO14BU





**Thank you**

