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**SUBJECT: PRODUCTION OF WARM SEASON VEGETABLE CROPS  
HVSC-0502**

**PRODUCTION TECHNOLOGY IN TUBER CROPS  
(SWEET POTATO)**

**Presented To:**

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# SWEET POTATO

- ▶ Botanical name :*Ipomoea batatas* L. Lam
- ▶ Family: Convolvulaceae
- ▶ Chromosome no: (2n=6x= 90),Hexaploid
- ▶ Sweet potato is described in 1753 by Linnaeus as *Convolvulus batatus*,
- ▶ Later in 1791 Lamarck classified this within the genus *Ipomoea* on the basis of shape of stigma and the surface of the pollen grains.
- ▶ Therefore , the name was changed to *Ipomoea batatas* L. Lam
- ▶ Wild ancestor is *Ipomoea trifida*



## TAXONOMIC CLASSIFICATION:

- ▶ Crop: Sweet potato
- ▶ Commonly known as Irish Potato, White Potato ,Shakkarkand , Shakkaria
- ▶ Kingdom: Plantae
- ▶ Division : Spermatophyta , Subdivision: Angiosperm
- ▶ Order: *Convolvulales* , Class: Monocotyledon
- ▶ Family: Convolvulaceae
- ▶ Genus: *Ipomoea*
- ▶ Species: *batatas*
- ▶ Author: Lamarck



## Origin and distribution

### Origin :

- ▶ Sweet potato is a native of tropical America, South America.
- ▶ It is an important tuber crop in tropical and sub-tropical countries like Africa, China and India.
- ▶ In India, it is grown mainly in Andhra Pradesh, Assam, Bihar, Tamil Nadu and Orissa.

### Distribution:

- ▶ This Convolvulaceae family is also known as morning glory family which covers about 50 genera and 1000 species among of which 650 species belong to genus *Ipomoea*.
- ▶ *I.pandurata*(wild sweet potato),*I.marginata*,*I.paniculata*,*I.campanulata* and important root stocks are Sweet potato cv.Zapalo and Tanzania, Moon flower and Cypressvine .

## Importance and its Uses

- ▶ Sweet potato is cultivated for its sweet root tubers. It is mainly used for human food after boiling or steaming, baking or frying and also as animal feed.
- ▶ Since roots contain 16% starch and 4% sugar, it is used for production of industrial starch, syrup and alcohol.
- ▶ It is a staple food in several tropical countries. It is one of the world's highest yielding crop with reference to total food production and requires low inputs.
- ▶ It can be grown throughout year in tropical and subtropical areas even marginal farmer gets some income. Asia accounts for 92% of world's sweet potato area and production it occupy the seventh rank world statistic, after wheat rice, potato, barley and cassava.
- ▶ It has drought tolerant attributes and can be grown on lands of low fertility and it has the ability of the highest solar energy fixing efficiency. The creepers are used as cattle feed.

## Characteristic features:

- ▶ Sweet potato is a cross pollinated crop with hexaploid species with 90 somatic chromosomes.
- ▶ It is a perennial herb with trailing vines and with a cluster of a few medium sized tubers.
- ▶ For cultivation purpose, it is treated as an annual with duration of 90 to 120 days.
- ▶ Though plants produce viable seeds, highly heterozygous nature of the crop results in a heterogeneous population.
- ▶ Hence stem cuttings are used for propagation purpose.
- ▶ Sweet potato has an extensive fibrous root system both at stem cuttings and at nodes touching soil. Some roots act as storage organs for storing reserve food.
- ▶ Storage roots may be fusiform, spindle or globular in shape and surface is smooth. Skin has white, red or light copper colour



- ▶ Flesh may be white or with different combinations of orange and red. Red skin with white flesh and white skin with red flesh is present.
- ▶ Leaves are simple, alternate and stipulate. They vary in size and shape, occasionally in same plant.
- ▶ Shape varies from ovate to cordate, hastate or deeply lobed and may change on ageing. Leaf shape is an important character for identifying clones which may be reniform, heart shaped etc..
- ▶ Flowers are axillary and borne solitary or in simple cymes. Flowers are bisexual. Corolla is attractive and funnel shaped formed by fusion of five petals.
- ▶ Anthesis starts before dawn and closes by 6-8 am and 9-11 a.m.
- ▶ Pollination is entomophilous.
- ▶ Fruit is a capsule with false septa.



# NUTRITIVE VALUE:

## Sweet Potato Nutrition





## VARIETIES:

- ▶ Sweet potato varieties differ in shape, size and colour of leaves, tubers and nature of tuber flesh.
- ▶ A number of local cultivars like Badrakali chuvala, Chakkaravalli, Anakomban and Kottaram chuvala are grown in Kerala.
- ▶ The Central Tuber Crops Research Institute (CTCRI), Thiruvananthapuram developed quite a good number of varieties and a brief description of them is given below:

### **H-41 and H-42:**

- ▶ Released in 1971, H-41 hybrid varieties (Norin x Indigenous cultivar) H-42 crossed between (Vella Damph x Triumph) yields from 20-25t/ha in 120 days
- ▶ Potential yield upto 30t/ha

### **Varsha:**

- ▶ Released in 1983, A semi-spreading hybrid with reddish purple skin, light yellow flesh and excellent cooking quality; yield 18-22 t/ha in 120-125 days.

### **Sree Nandini:**

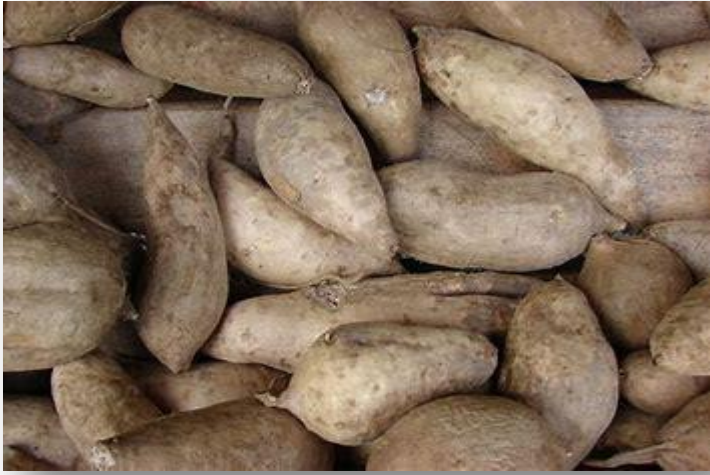
- ▶ Released in 1987, A spreading variety with light cream skin, white flesh and good cooking quality; yield 20-25 t/ha in 100-105 days.

### **Sree Vardhini:**

- ▶ Released in 1987, A semi-spreading variety with purple skin, light orange flesh and high carotene content (1200 I.U.); yield 20-25 t/ha in 100-105 days. Tolerant to Feathery mottle virus.

### **Sree Ratna:**

- ▶ Released in 1996, A spreading variety with purple skin, orange flesh and excellent cooking quality; yield 20-26 t/ha in 90-105 days.



### **Sree Bhadra:**

- ▶ Released in 1996, A semi-spreading variety with light pink skin and cream flesh; resistant to root knot nematode; yield 20-27 t/ha on 90-95 days.

### **Sree Arun:**

- ▶ Released in 2002, A spreading variety with pink skin, cream flesh and good cooking quality; yield 20-28 t/ha in 90-100 days:

### **Sree Varun:**

- ▶ Released in 2002, A spreading variety with cream skin, cream flesh and good cooking quality; yield 20-28 t/ha in 90-100 days.



- ▶ The Kerala Agricultural University developed an improved variety, Kanjangad, Kemhangad yielding 12.39 t/ha.
- ▶ Purple coloured and spindle shaped tubers have yellow soft flesh. It is tolerant to shade and weevil incidence.

IARI, New Delhi released two improved varieties viz., Pusa Safed, and Pusa Sunheri.

**Pusa Safed:**

- A white skinned variety with white flesh.

**Pusa Sunheri:**

- A brown skinned variety with yellow flesh rich in carotene; boiled flesh is attractively orange yellow.

**Pusa Lal:**

- This is a selection from a Japanese variety (Norin).
- A purplish red skinned and white fleshed variety which produces a high proportion of marketable tubers.
- Popular in Delhi, Punjab, Rajasthan, UP, Maharashtra.

- ▶ Acharya Ranga Agricultural University, Hyderabad developed following improved varieties:

### **Kiran:**

- ▶ It is a mid-duration variety, photo insensitive variety escapes weevil infection because of its carliness.
- ▶ Tuber is fusiform with red skin the tissue rich in carotene with height orange colouration.
- ▶ In Kharif, 14 tonnes per hectare in Rabi 17 tonnes per ha summer 4 tonnes per hectare. The crop comes to harvesting in 110 to 120 days.

### **Samrat:**

- ▶ It is also a photo insensitive variety,
- ▶ In Kharif, 12 tonnes per hectare in Rabi 15 tonnes per ha summer 5 tonnes per hectare. The crop comes to harvesting in 110 to 120 days.



### **Cross-4:**

- ▶ Yield 20-30 t/ha in 90-105 days; highly susceptible to weevil infestation.

### **Rajendra Shakarkand-5:**

- ▶ Yield 30 t/ha in 105-120 days; resistant to *Fusarium* wilt and *Cercospora* leaf spot disease.

### **Kalmegh:**

- ▶ A short duration variety (90 days) yielding 26 t/ha.

Tamil Nadu Agricultural University has developed two varieties viz., Co.1, Co.2 and CO.3 yielding 26 t/ha and 32 t/ha, in 135 days and 110-115 days, respectively.



## Soil

- ▶ Crop prefers sandy loam type of soil. It also grows on clay loam but best soils are lateritic soil with good depth and better fertility.
- ▶ Cultivation of sweet potato is to be avoided Heavy clay soils because then hinder the tuber growth and aeration will be a problem.
- ▶ It prefer a pH Range 5.2 to 6.5. Since they favour vegetative growth and vine growth will be luxurious at the cost of tuber growth. Selected soil should have good drainage capacity also.

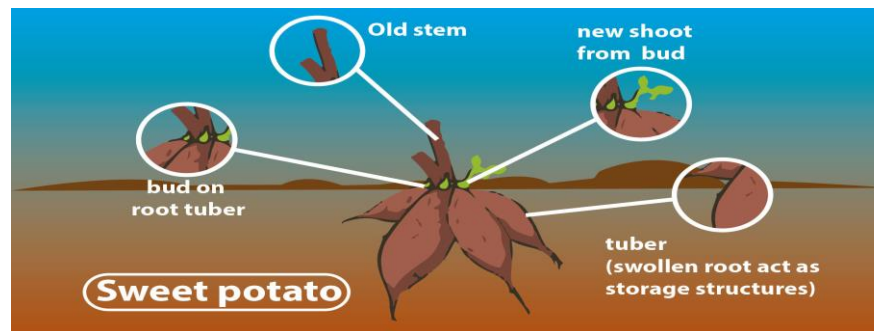
## Climate:

- ▶ Prefers moderate warm climate for at least a period of 4 months.
- ▶ Optimum temperature range 21 to 26°C.
- ▶ Temperature less than 10°C will damage the tubers.

- ▶ Crop requires bright sunshine moderate rainfall ranging and long photoperiods promotes vine growth and reduce tuber formation.
- Shorter days can favour tuber development. It is one of the most drought resistant vegetable thus not stand frost.

## Propagation:

- Propagated by sprouts from tuber and vine cuttings.
- Vine cuttings are preferred when two crops are grown in succession it is faster and cheaper vine cuttings are collected from previous crop and are used for planting the succeeding crop.
- Sweet potato is mainly propagated by vine cuttings of 25-30 cm length. Cuttings for planting are multiplied in two nurseries –
  - primary and secondary.



## **Sprouts from tuber :**

- Sweet potato can yield better when sprout tubers are used for propagation. Medium sized, healthy sprouts free from pests and diseases or branches are selected and they are planted in a nursery.
- Primary nursery: Site is well prepared adequately manured provided with good drainage and it is kept raised.
- The tubers are planted at around 16 to 25 cm row to row 45 cm distance up to around 10 cm depth and is adequately irrigated.
- After maintaining the sprouts for about 45 days in primary nursery will be shifted to secondary nursery.
- Secondary nursery: Sprouts are shifted to secondary nursery. Sprouts are shifted from primary nursery they will be maintained in secondary nursery up to the time when they reach sufficient length for transplantation secondary nursery same spacing.

## **Planting:**

- Vines are planted during June-July for a rainfed crop.
- Under irrigated conditions, plant during October-November in upland and during January-February in low lands for summer crop.

## **Preparation of main field :**

- Main field is prepared by making ridges of 25-30 cm high at 60 cm apart after thorough ploughing.
- 20-30 cm long vines are buried horizontally with 2-3 nodes below soil, leaving the remaining portion above soil.
- Form ridges and furrows at 60 cm apart. Sweet potato can also be grown in beds.

## **Spacing:**

- ▶ Spacing adopted is 12 x 20 cm and depth of planting can be up to 20 to 30 cm even up to 40 cm.
- ▶ Plant the terminal vine cuttings (80,000/ha) at 20 cm spacing.

## **Manures and fertilizers:**

- ▶ A fertilizer dose of 50:25:50 kg NPK / ha is recommended, of which 50% of N, full P and K to be applied as basal dose.
- ▶ Remaining 50% of N is applied one month after along with weeding and earthing up.
- ▶ Well decomposed Farm Yard Manure applied dosage of 20 to 25 tonnes per hectare.

## **After cultivation:**

- ▶ The field should be kept clean by hand weeding till vines are fully developed. Earthing up can be done on 25th, 50th and 75th day after planting.
- ▶ The vines are lifted and turned on 50th and 75th day after planting but before earthing up to prevent root formation at nodes and to make the originally formed roots larger.
- ▶ Spray Ethrel five times at 250 ppm at fortnightly intervals commencing from 15 days after planting.



## Irrigation:

- ❖ During rabi and hot seasons, 12-14 irrigations are required at an interval of 10 days for heavy yield.
- ❖ One light irrigation is essential before planting. Three days after planting one more irrigation is a must it is called as a life irrigation because it is essential for survival after wards the crop is irrigated once in a week.
- ❖ Critical stage varies from north stress 40 days after planting.

## Harvesting:

- ❖ Harvesting is done by digging out tuber with pick-axe when leaves turn yellow in colour. Tubers are cleaned and packed in gunny bags for marketing.
- ❖ Certain varieties comes to harvesting within 90 to 100 days and certain varieties 120 to 180 days.
- ▶ The surface of a mature tuber if cut and exposed to the acer dries up soon while the immature one remain moist and turn dark in colour.
- ▶ Judging the correct stage of maturity crop has to be harvested. If harvested early it cause reduction in yield. If harvesting is delayed up to 8 to 9 weeks it leads to serious loss in yield.



## **Method of harvesting:**

- ▶ Irrigate the field 3 to 5 days before harvest work with space to uproot the crop and while doing so, avoiding mechanical damage to the tubers.
- ▶ The tubers after harvesting are cleaned, graded and either send to market or stored.

## **Storage:**

- ▶ Red skinned varieties store better than white skinned varieties. Tubers are cleaned and packed in gunny bags for marketing.
- ▶ Tubers are stored better at 15oC and 85% RH.
- ▶ Tubers can also be stored for 2-3 months in a pit covered with straw.

## **Yield:**

- ▶ About 20-25 t/ha of tubers in 110 – 120 days can be obtained.

## Pests and diseases

- Sweet potato weevil (*Cylas formicarius*) is the most important pest causing severe damage to the crop. Adult weevil makes puncturing on vines and tubers.
- Grubs bore and feed by making tunnels. Even slightly damaged tubers are unsuitable for consumption due to bitterness. Yield loss is up to 100% in severe cases.
- On an average, 20-55% tuber loss occurs. Integrated pest management practices recommended for control include dipping vine cuttings in Fenthion or Fenitrothion or Monocrotophos (0.05%) solution for 10 minutes before planting.
- Re-ridging the crop two months after planting, installing synthetic sex pheromone traps @ 1 trap / 100 m<sup>2</sup> area to collect and kill the male weevils and destroying crop residues after harvest by burning are recommended control measures.

# Fungal Diseases

## 1. Alternaria leaf spot & Leaf and stem blight: *Alternaria* spp.

### Symptoms:

- ▶ Brown lesions on leaves with concentric rings resembling a target; may be surrounded by a yellow halo; small gray-black oval lesions with lighter centers may occur on stems and leaf petioles stem and results in girdling.

### Management:

- ▶ plant resistant or tolerant sweet potato varieties where available; plant only disease-free seed material



## 2. Black rot : *Ceratocystis fimbriata*

### Symptoms

- ▶ Stunted plants; wilting plants; yellowing plants; dropping leaves; plant death; circular brown-black patches of rot on tubers.

### Management

- ▶ Only disease-free seed material should be planted; sweet potato should not be planted in sites where sweet potato has been grown during the previous 3-4 years; seed material should be treated with an appropriate fungicide prior to planting.





### 3. Fusarium root and stem rot: *Fusarium solani*

#### Symptoms

- ▶ Swollen and distorted base of stems; deep, dark rot extending deep into tuber and forming elliptical cavities; growth of white mold.

#### Management

- ▶ Disease is generally not a problem if good sanitation is implemented; select only disease-free roots for seed; use cut transplants rather than slips; practice crop rotation; treat seed roots with an appropriate fungicide prior to planting.



# Bacterial Diseases

## 1. Bacterial soft rot : *Erwinia chrysanthemi*

### Symptoms:

- ▶ Brown to black water-soaked lesions on stems and petioles which expand rapidly and cause large areas of soft rot on the stem; stem may collapse causing several vines to wilt; entire plant may die; storage roots may develop areas of soft rot which is initially colorless, but eventually turns brown with a black margin

### Management:

- ▶ Avoid wounding storage roots at all stages of growth; plant only disease-free seed material; discard any stored roots which become infected with the disease; plant sweet potato varieties which are resistant to the disease.



## 2. Bacterial wilt *Ralstonia solanacearum*

### Symptoms

- ▶ New sprouts wilting and have water-soaked bases which turn yellow-brown to dark brown in color; vascular system of the sprouts is discolored brown; infection of healthy transplants causes the lower portions of the stems to become water-soaked and turn a similar color to infected sprouts; yellow-brown streaks may develop inside storage roots and, if infection is severe, gray-brown water-soaked lesions may be present on the root surface



### 3. Leaf and stem scab : *Sphaceloma batatas*

#### Symptoms

- ▶ Small brown lesions on leaf veins which become corky in texture and cause veins to shrink which in turn causes leaves to curl; lesions on stem are slightly raised and have purple to brown centers with light brown margins; scabby lesions form on stems when lesions coalesce

#### Management

- ▶ Rotate sweet potato with other crops; use only disease-free planting material; application of appropriate fungicides can help to control the disease, good control of the disease can be achieved with benomyl and chlorothalonil where licensed for use.





# Viral Diseases

## 1.Pox : *Streptomyces ipomoea*

### Symptoms

- ▶ Poor growth of plants; reduced yield; circular dark brown, corky lesions on tubers which are V-shaped in cross section; cracked and distorted tubers which resemble dumbbells; rotting feeder roots
- ▶ **Management**
- ▶ The most effective method of controlling the disease is through the use of resistant varieties of sweet potato; fumigation of the soil prior to planting can be an effective method of reducing the severity of the disease



## 2. Sweet potato virus disease (SPVD) *Sweet potato feathery mottle virus (SPFMV)* and *Sweet potato chlorotic stunt virus (SPCSV)*

### Symptoms

- ▶ Sweet potato virus disease is a disease complex caused by two viruses; sweet potato chlorotic stunt virus (SPCSV) and sweet potato feathery mottle virus (SPFMV). The symptoms are severe stunting of infected plants, stunting, distorted and chlorotic mottle or vein clearing of the leaves. Common symptoms include appearance of feathery, purple patterns on the leaves.

### Management

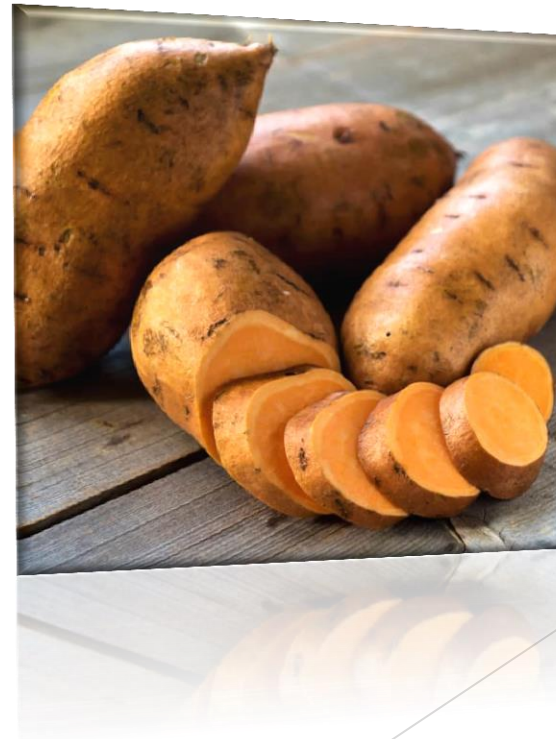
- ▶ Use healthy cuttings for planting. Follow crop rotation. Spray suitable insecticides to control aphids and white flies.





## References

- ▶ <https://agritech.tnau.ac.in/>
- ▶ [Central Tuber Crops Research Institute | Social Sciences \(ctcri.org\)](https://www.ctcri.org/)
- ▶ <https://www.sweetpotatoknowledge.org/>
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HUNKY BOY