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Importance and cultivation of Sweet Potato/ Spanish Potato

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Introduction

Sweet potato *Ipomoea batatas* (L.) locally known as Sakarkand is one of the popular tuber crops in India and abroad owing to its yield potential and high calorific value production capacity per unit of time and area. Sweet potato is second largest cultivated tuber crop in India. Sweet potato has tremendous potential as a food crop and it rank first among cultivated crop in the developing countries in terms of edible energy produced per unit area per unit time. It is grown as root tuber vegetable and also manufacturing starch used in industry. Its importance has increased growing good prospects of producing ethyl alcohol from its starch. Being a stable food of a large section of people in India, there is a need to evolve its lines rich in protein. This would considerably reduce protein deficiency in Indian diet. It is also known as Poor Man's Energy food and Famine relief crop (Bengal Famine-1942). Orissa, Utter Pradesh and Bihar account for 89% area and 88% of production of sweet potato.

Botanical Name	***Ipomoea batatas* L. (Poir)**
Family	Convolvulaceae
Genomic formula	2N=6X= 90 (extremely heterozygous & hexaploid)
Edible part	Tuberous root
Origin	Central America (Mexico). Portuguese brought it in to India.
Progenitor	*Ipomoea trifida*
Photoperiodically	Short day plant (day length 11.5 hrs)
Flower colour	White- pink
Skin colour	Red – Purple – Brown - White

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Flesh colour	White – Yellow – Orange - Purple
Inflorescence	Cymose
Nature of pollination	Highly cross pollinated due to **sporophytic self incompability**

Scenario of sweet potato in country (Horticos 2018-19)

- ✓ Area : 0.11m ha
- ✓ Production : 1.17 m t
- ✓ Productivity : 10.3 t/ha

Note: Out of 50 genera and 1000 species only *Ipomoea batatas* is of economic importance. Genus also includes several garden flowers called morning glories i.e. why the family is also called morning glory family.

Benefits of Sweet Potato

- An excellent source of fibre, vitamin B6, E and C
- Good for the heart
- Helps in controlling blood sugar due to low glycaemic index.
- Good for digestion and contains a good amount of starch
- Have strong immunity and anti-inflammatory properties
- Helps in relieving stress and preventing cancer

Uses of Sweet potato:

- **Animal feed**
- **Human consumption:**
- **Sweet potato tuber after boiling, steaming, baking or frying**
- **Sweet potato floor is processed for**
  - Candies
  - Noodles
  - Chapatti
- **Industrial products** (tubers contains16% starch & 4% sugar i.e. 20% alcohol producing material)
  - Alcohol
  - Ethanol
  - Starch
  - Citric acid

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Tuberous root or Storage roots: It is not an actual tuber as it develops from root tissues rather than stem tissues as true tubers do. It is long, tapered with smooth skin.

Differences between tuberous roots and ordinary roots in sweet potato

S. No.	Tuberous root	Ordinary roots
1.	Synthesizes food materials in them	They cannot do so
2.	Edible	Non edible
3.	Xylem is having 5 or 6 plates	Xylem is having 3 to 4 plates
4.	Small pith centre	Large pith centre
5.	Root primordial is larger	Root primordial is smaller
6.	Thick roots with different shape and size	Thin and long roots
7.	Receive Food materials from different plant parts and accumulated	Absorb nutrients from soil and supply to different plant parts

- It is an staple food and third most important crop after potato and cassava
- China is the leading country in the world.
- Major importing countries from India: UAE > Maldives > Nepal > Japan > Bahrain
- Area leading states in country: Orissa > W. B. > Kerala > U. P. >Assam
- Production leading states : Orissa > Kerala > W. B. > U. P. > Chhattisgarh

Climate:

- It does not tolerate frost and plant damage below 10^0C
- Ideal condition for growth and development
- Long days
- 24^0C temperature (Day/night temperature = $29/21^0$C)
- Abundant sunshine (light intensity = 18000-40000 lux)
- Warm night
- Ideal condition for higher yield
- Short days + low light intensity promotes tuber formation
- Sunny days
- Moderate cool night
- Moderate rainfall (750– 1000 mm annual with minimum of 500 mm) during early growth.

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- Dry weather during tuber bulking and maturity stages
- Sensitive to drought at tuber initiation stage (50- 60 DAP)
- Sensitive to water logging as poor aeration results in
- Rotting of tubers and
- Reduce the growth of storage tubers

Soil:

- Acid tolerant crop and require optimum pH 5.8-6.7 with ideal pH 5.2.
- Well drained sandy loam rich in organic matter is considered the best
- Liming is necessary.
- In heavy soils, tuber size is reduced.

Varieties: Sweet potato varieties differ in shape, size and colour of leaves, tubers and nature of tuber flesh

Source	Varieties/Hybrids	Characteristic features
Introduction	Triumph Nancy Hall	
Clonal selection	Sree Nandani	A spreading variety with light cream skin, white flesh and good cooking quality; yield 20-25 t/ha in 100-105 Drought tolerant,
	Sree Vardhani	A semi-spreading variety with purple skin, Yellow flesh, 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 Bhadra	A semi-spreading variety with light pink skin and cream flesh; yield 20-27 t/ha on 90-95 days. Excellent trap crop for RKN
Hybridisation (CTCRI,	H41	Sweet and low fibre content
	H42	

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Thiruanantpuram)	Sree Varsha	Double cross hybrid
	Sree Ratna	A spreading variety with purple skin, orange flesh and excellent cooking quality; yield 20-26 t/ha in 90-105
	Sree Arun	A spreading variety with pink skin, cream flesh and good cooking quality; yield 20-28 t/ha in 90-100 days.
	Sree Varun	A spreading variety with cream skin, cream flesh and good cooking quality; yield 20-28 t/ha in 90-100
	Sree Kanaka	Inter varietal hybrid, short duration & beta carotene rich.
	Gouri &Shankar	
IARI	Pusa Lal	Skin red and flesh white
	Pusa Sunheri	A brown skinned, yellow fleshed rich in carotene; boiled flesh is attractively orange yellow.
	Pusa sufed	A white skinned variety with white flesh Excellent cooking quality
	Pusa Bharati	Higher Vit C and beta carotene
RAU	**Rajendra Shakarkand-5**	Yield 30 t/ha in 105-120 days resistant to ***Fusarium* wilt and *Cercospora* leaf spot disease**.
	RS-35 & RS-43	
TNAU	**Kal Megh**	**Round tubers**, Very early (90 DAP) and yield 26t/ha
ANGRAU, Hyderabad	**Cross-4**	Yield 20-30 t/ha in 90-105 days; **highly susceptible to weevil infestation**
Others	**Kiran**	High starch content (29-30%)
Fortified varieties	**Bhu Sona**	**Beta carotene rich (12.5-40 mg/100g) variety.**

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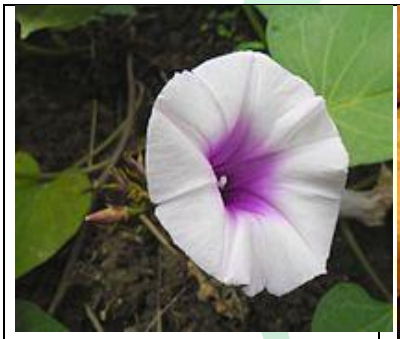
	Bhu Krishna	**Anthocyanin rich variety**

Propagation:

Sexual propagation of sweet potato is limited because of:

- Delay germination due to hard seed coat, which require scarification
- Non blooming habit
- Low blossom fertility
- Wide variation in cultivars due to heterogygosity nature
- Self-incompatibility *i.e.* Gametophytic SI
- Poor seed setting
- Less seed content
- Plant grown from seeds are poorly developed top growth & tuberous root



Sweet potato flower

Sweet potato tuberous roots

Digging of Sweet potato

Commercial propagation is done by

1. Stem or Root cuttings
2. Advantageous root (Clip) that grows out from primary ones during storage**.**

Breeding objectives:

- ✓ High yield with better test and quality
- ✓ Early maturity and wider adaptability
- ✓ Resistance to disease and pests mainly for sweet potato weevil
- ✓ Drought –tolerance, and better storage and keeping quality
- ✓ Processing attributes and nutritional value such as carotene contain

Genomic constitution of *I. pomoea*

Species	**Synonyms**	**2n (x = 15)**	**Constitution**

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I. batatas var. batatas f. trifida	*I. trifida*	90	BBBBBB
I. batatas var. batatas Var. littoralis	*I. littoralis*	90	BBBBBB
I. batatas var. batatas Var. leucantha	*I. leucantha*	30	BBBB
I. triloba Var. triloba	*I. triloba*	30	BB
I. batatas var. batatas Var. lacunose	*I. lacunose*	30	AA
I. batatas var. batatas. f. trichocarpa	*I. trichocarpa*	30	AA
I. batatas var. batatas f. ramoni	*I. ramoni*	30	AA

Nursery: The secondary tubers separated from primary ones, is stored in sandpits for propagation.

1. **Primary Nursery:** Advantageous roots (Clip) are used for producing vines
   - Area= 100 m^2
   - Weevil free tubers= 100 kg (125- 150g size)
   - Spacing= 60 cm x 20 cm and 5-6 cm deep
   - N= 1.5 kg/ 100 m^2 as top dressing after 15 days of planting
   - Irrigation at alternate day till first 10 days and once in 3 days afterward.
   - Vine get ready for planting in 2nd nursery after 45 days
   - Cut the vine to a length of 20-30 cm for multiplication in second nursery.

2. Secondary Nursery: Vines are used to multiply for planting in main field.

- Area = 500 m^2
- Vine = 4000 - 4200 cuttings of 25-30 cm length
- Spacing= 60 cm x 20 cm
- FYM= 1 kg/m^2
- Urea = 5 kg in two splits (15 and 30 DAP)
- Get ready for planting in main field after 45 days of planting in 2nd nursery.

Planting:

- Rainfed (Kharif): June – August
- Irrigated- October – December (Ideal time for vine cutting is late Sep- early Oct.)
- 35000-40000 cuttings /acre or 85000-100000/ha

Selection of panting material:

- Apical cutting is ideal
- Keep 20-25 cm vine length with 3-5 nodes

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- Store cut vine in shade with intact leaves for 24-48 hrs. **it promotes**
- Better root initiation
- Early establishment and
- Higher yield

Methods:

1. **Mound:** under drainage problem area
2. **Ridge:** In sloppy area to prevent erosion in U.P., A.P and NER
3. **Furrow:** Bhubaneswar and Orissa
4. **Flat:** Recommended in Bihar

Note: Ridge (20-25cm high) method is best followed by furrow and flat methods.

Manures and fertilizers:

- FYM: 10 t/ha
- N:P:K:: 90:80:90 kg/ha (GFR, Bihar)
- Azospirillum @ 2 kg/ha (Vine dipping)

Weed control:

- Critical period: 30-45DAP. Latter on weeds are supressed due to smothering effect.
- Weeding and earthing up along with top dressing between 15-30 days is beneficial.
- Turning of vine is practiced in sweet potato
- Pruning back to 20-30cm s also practiced after a month

Harvesting:

- 5-6 month after planting into the main field.
- Delay harvesting favours weevil attack.

Note: Cut surface of immature tubers gives dark greenish colour, while mature tubers get dry.

Yield:

- 35-40 t/ha tubers
- 5-7 t/ha fodder

Curing:

- Tubers are cured best when it was kept at 28-30^0 C temperature and 80% Relative Humidity for 10 days.
- It helps in the formation of protective layer (callus) on injured portion i.e. wound healing process.

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- Wound healing process includes
    - Rapid healing of wounds (Suberization of wounded root surface)
    - To increase toughness of skin (Periderm)
    - Minimise microbial infection.

Storage:

- At 13-16^{0}C temperature and 85-90% R. H. it can be stored for 6months

Disease:

- **Pox and Scurf are serious diseases in neutral pH.**
- **Feathery mottled disease**
    - Mycoplasma disease
    - Vector- Aphid
    - **Control**: Use virus free planting materials

Insect:

- **Sweet potato weevil**
    - Pest like ants
    - Feeds on all parts prefers tuberous roots
    - White grub makes tunnel in the tubers rendering them to bitter for human
    - **Control**: Use pheromone trap @ 1trap/100 m^2

Physiological disorders:

- **Growth crack:**
    - Due to excessive moisture or moisture stress
    - Delay harvesting
    - **Control**: Use potassium to check tuber cracking