Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 01 (JAN-FEB, 2024)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Breeding Program in Sweet Potato and Cassava

(*Jason Wanlambok Mutyen, Dr. Vijay Bahadur, Dr. Anita Kerketta and Dr. Samir. E. Topno)
Dept. of Horticulture, Naini Agricultural University, Sam Higginbotton University of Agriculture, Technology and Sciences, Prayagrag, UP
*Corresponding Author's email: jmutyen@gmail.com

Key words: Sweet potato, Cassava, breeding methods, hybridization, promising cultivars.

Sweet Potato

Sweet potato is ranked as the seventh most important food crop in the world, following wheat, rice, maize, potato, barley, and cassava. Africa is the largest region for sweet potato cultivation globally, with approximately 95% of production coming from developing countries. China holds the highest share of sweet potato production, accounting for 67.09%. In India, sweet potatoes are cultivated across various states, with significant contributions from Odisha, Kerala, West Bengal, and Uttar Pradesh. Notably, Odisha stands as the largest producer of sweet potatoes in India.

Nutritional Value: Cooked sweet potato (baked in skin) consists of 76% water, 21% carbohydrates, 2% protein, and negligible fat. In a 100-gram serving, baked sweet potato provides 90 calories and is rich in essential nutrients such as vitamin A (120% DV), vitamin C (24% DV), manganese (24% DV), and vitamin B6 (20% DV). It also serves as a moderate source of certain B vitamins and potassium.

Sweet potato cultivars with dark orange flesh are particularly rich in beta-carotene, addressing vitamin A deficiency, especially prevalent in Africa. Additionally, sweet potato leaves are edible and can be prepared similarly to spinach or turnip greens.

Improvement Techniques

Selection: Sweet potato's incompatibility system enables the maintenance of high heterozygosity levels, allowing ample scope for selection among local cultivars. Selection criteria typically focus on high yield potential, favorable physiological rhythms in crop development under diverse conditions, and field resistance to major pests and pathogens. Recurrent selection, a common method, involves three phases: genotype selection and hybridization, progeny evaluation, and selection of superior progeny for creating a new breeding population.

Hybridization: Overcoming barriers like self and cross-incompatibility, and shy flowering, is crucial in sweet potato hybridization programs. Selecting parents with high cross-compatibility and profuse flowering types is essential. Emasculation is necessary due to the plant's bisexual flowers, which open before dawn, requiring meticulous hand pollination during early morning hours. Inter-varietal hybridization offers vast potential for producing genotypes with desirable traits, including high yield and adaptability to varying environmental conditions.

Promising Cultivars

Pusa Safed: High-yielding selection with white skin and flesh, well-suited for Bihar, Uttar Pradesh, and Tamil Nadu.

Pusa Lal: Pinkish-red tubers yielding 20-22 t/ha in 120 days.
Samart (S-30): Photo-insensitive type suitable for both arid and summer seasons, yielding 20-22 t/ha.
Centennial: High-quality cultivar susceptible to root-knot nematodes and soil rot diseases.
Varsha: Drought-tolerant hybrid with a yield potential of 17-22 t/ha in the Konkan region of Maharashtra.
CO 2 (IB 81): Medium-sized tubers with light pink skin and white flesh, rich in starch (29.5%), yielding 32 t/ha in 110-115 days.
CO 3 (IB 2837): Medium-sized tubers with light red skin and orange flesh, high in carotene content, yielding 43.6 t/ha in 105 days.
Sree Nandini (76-OP-217): Semi-spreading with light cream skin and white flesh, yielding 20-25 t/ha in 100-105 days.
Sree Vardhini (76-OP-219): Semi-spreading with light pink skin and light orange flesh, yielding 20-25 t/ha in 100-115 days.
Sree Bhadra: Semi-spreading vines with pink skin and creamy flesh, released by CTCRI, Thiruvananthapuram.

Cassava

Cassava, also known as Yuca, Tapioca, Manioc, or Indioca, is a perennial shrub cultivated in tropical regions for its starchy tuberous roots. It serves as a staple food for over 200 million people worldwide.

Role in Tropical Farming Systems: Cassava's importance within tropical farming systems is determined by several key characteristics, including its high carbohydrate yields per unit of land and labor, its adaptation to poor soils and stress, its compatibility with various crops in association, and its tolerance to pests and diseases.

Global Production and Usage: Thailand exported 3.3 million tonnes of cassava in 1995, primarily for domestic animal feed. Latin America is a significant producer, with over 98% of its production being used domestically. Asia leads in the production of starches derived from cassava.

Origin: Cassava has been studied since 1886, with its geographic origin believed to be in the Tropical Americas, sharing a center of origin with crops like peanuts, cocoa, and rubber.

Botany and Taxonomy: Cassava is a perennial shrub with enlarged tuberous roots and variously branched stems. Its leaves are large and palmate with 5-9 deep lobes. There are two main plant types: erect and spreading, each with distinct characteristics. Cassava is monoecious, producing both male and female flowers on the same inflorescence, which are cross-pollinated.

Breeding Objectives: Breeding objectives for cassava include high starch content, high harvest index, responsiveness to additional inputs, unbranching or late-branching plant types, and low hydrogen cyanide (HCN) content.

Breeding Methods
Introduction: Introducing new varieties like M-4 and M-6 from Malaysia.
Clonal selection: Releasing varieties like Vellayani, Nidhi, and Kalpaka from KAU, and Sree Prakash, Sree Jaya, and Sree Vijaya from CTCRI.
Inter-varietal Hybridization: Developing high-yielding strains through careful inter-varietal hybridization, leading to releases like H 105 and H 96. Promising hybrids include H 97 (Manjavella x Brazilian seedling selection) and H 165 (Chaadyamanglam x Kalikalan Vella).
Heterosis Breeding: Exploiting heterosis by producing inbreds up to the 5^{th} generation, which has shown tolerance to inbreeding depression for various economic traits.

References

1. Ceballos, H., and Hershey, C. (2016). "Road map for cassava genetic improvement," in *Proceedings of the World Congress on Root and Tuber Crops and Third Scientific Conference of the Global Cassava Partnership for the 21st Century* (Nanning).
2. Lebot, Vincent (2020). *Tropical Root and Tuber Crops : Cassava, Sweet Potato, Yams And Aroids*. Wallingford, HYPERLINK "https://en.wikipedia.org/wiki/Wallingford,_Oxfordshire"Oxfordshire, UK Boston, USA: CABI (Centre for Agriculture and Bioscience International).
3. Magoon, M.L. (1967) Aole of root and tuber crops in human nutrition. Proc. Int. Symp. Sub·trop. And Trop. Hort. New Delhi. 1,46-61.
4. Purseglove, John Williams (1968). *Tropical crops: D*. Longman Scientific and Technical. New York: John Wiley and Sons.
5. Woolfe, Jennifer A. (5 March 1992). *Sweet Potato: An Untapped Food Resource*. Cambridge, UK: Cambridge University Press (CUP) and the International Potato Center (CIP).