The Sweetpotato

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Editors

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Springer

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Book Cover (Collage by Dov Ronen):

Upper right enclosure – *Upper part* – Sweetpotato harvest (2-row mechanical chain harvester) (Courtesy of Tara Smith, Louisiana State University Agricultural Center)
Lower part – Sweetpotato nursery planted with virus-tested plantlets derived from meristem cultures (Courtesy of Gad Loebenstein, ARO, Israel)

Middle enclosure – Sweetpotato production field in California and sweetpotato just prior to harvest (Courtesy of Scott Stoddard, University of California at Merced)

Lower right enclosure – *Right part* – Sweetpotato plant (cv. Lamote) in tissue culture for three months (Courtesy of Victor Gaba, ARO, Israel)
Left part – Sweetpotato soft drink (Courtesy G. Padmaja, Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala, India.

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Preface

Root and Tuber crops are basic to the diets of millions in the tropics and subtropics where most of the world's undernourished people live. Among these crops, sweet-potatoes contain substantial levels of protein in addition to carbohydrates. They also provide substantial amounts of vitamins and minerals. Sweetpotato is the seventh most important food crop in the world in terms of production. It produces more biomass and nutrients per hectare than any other food crop in the world, and is one of the crops with a unique role in relief famine. Sweetpotato is grown for both the leaves, which are used as greens, and the tubers, for a high carbohydrate and beta-carotene source. In East Africa's semiarid, densely populated plains, thousands of villages depend on sweetpotato for food security and the Japanese used it when typhoons demolished their rice fields. In the developed world it is a tasty food, rich in nutritional value and served both cooked, fried and in pies.

Once established, apart from occasional weeding, sweetpotatoes need little care. Sweetpotatoes are fast growing and rapidly produce ground cover to prevent soil erosion.

Sweetpotato is genetically a challenging polyploid plant. It can hardly be considered as a model species for studies in molecular biology. Therefore, sequence data on the genomic DNA and expressed gene sequences accumulate slowly. Molecular data and sequence information would be pivotal for improving sweetpotato by engineering its own genes and their expression.

There is considerable interest in sweetpotato biotechnology. Also, there is great interest to grow sweetpotato in space missions. Tissue culture, disease elimination, germplasm storage and distribution are all well developed for sweetpotato. Further research is needed in molecular markers and marker assisted breeding, DNA fingerprinting and germplasm characterization, and more genes and transformation of sweetpotato with these genes.

Recently, a patent was granted for the production of bread from 100% sweet-potato flour. It is hoped that these products will appeal to consumers who are allergic to grain breads and flours. Also scientists at two different institutes in the United States have developed genetically modified sweetpotatoes containing edible vaccines. One of these vaccines works against hepatitis B and the other against the Norwalk virus found in food that has not been handled or stored correctly. Edible vaccines such as these may provide cheap protection for some of the poorest people in the world.

The book has two parts: A. General, including *inter alia* Origin, Botany and Physiology, Cultivars, Genetics, Biotechnology, Pests and diseases, and Part B on the Sweetpotato crop in different areas and regions.

In the last four decades of the twentieth century the use of sweetpotato was diversified beyond their classification as subsistence, food security, and famine-relief crop. It is hoped that millions of subsistence landholders in Africa, Asia, and Latin America will be able to use sweetpotatoes for food, stock food, and processed products and to generate income. It is hoped that by bringing the latest developments on this crop in this book, more research, especially interdisciplinary, will be initiated, as well as international conferences together with funding agencies and policy makers. We sincerely hope that this book will give the motivation to direct our research efforts with the strong commitment to help national governments.

We thank all the contributors, Ms. Zuzana Bernhart and Springer who made this book possible.

Bet Dagan, Israel — Gad Loebenstein
Kodakara, Kerala — George Thottappilly

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Color Plates

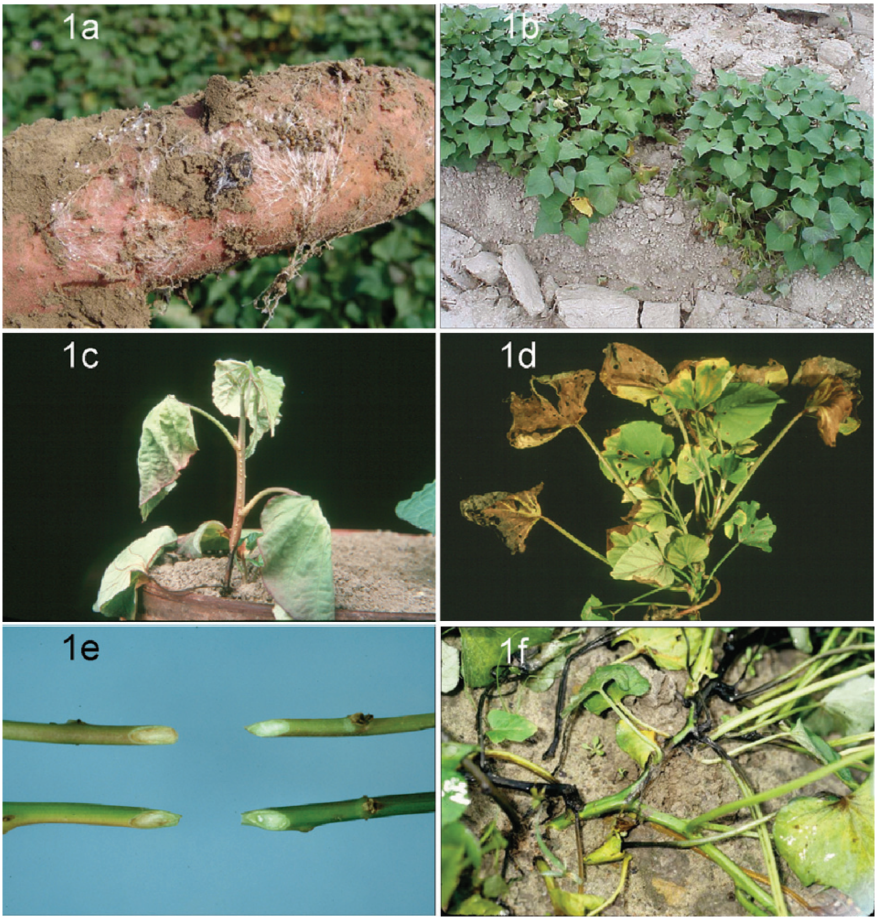

Plate 1 **a**: Root from a bed affected by sclerotial blight with mycelia of *Sclerotium rolfsii* growing on the surface of the root (courtesy Gerald Holmes, North Carolina State University). **b**: Wilting of sprouts and areas without plants due to sclerotial blight (courtesy Christopher Clark, Louisiana State University AgCenter). **c**: A plant with foot rot growing in a greenhouse showing a lesion at the soil line that girdled the plant causing secondary wilting (photo by Weston J. Martin, Louisiana State University AgCenter). **d**: Yellowing and wilting of lower leaves caused by Fusarium wilt (courtesy Christopher Clark, Louisiana State University AgCenter). **e**: Cross sections of stems of plants with Fusarium wilt (*left*) showing discoloration of the vascular system and stems from healthy plants (*right*) (courtesy Christopher Clark, Louisiana State University AgCenter). **f**: Bacterial stem rot caused by *Dickeya didantii* (courtesy Gerald Holmes, North Carolina State University) (See also Plate 7.1 on page 83)

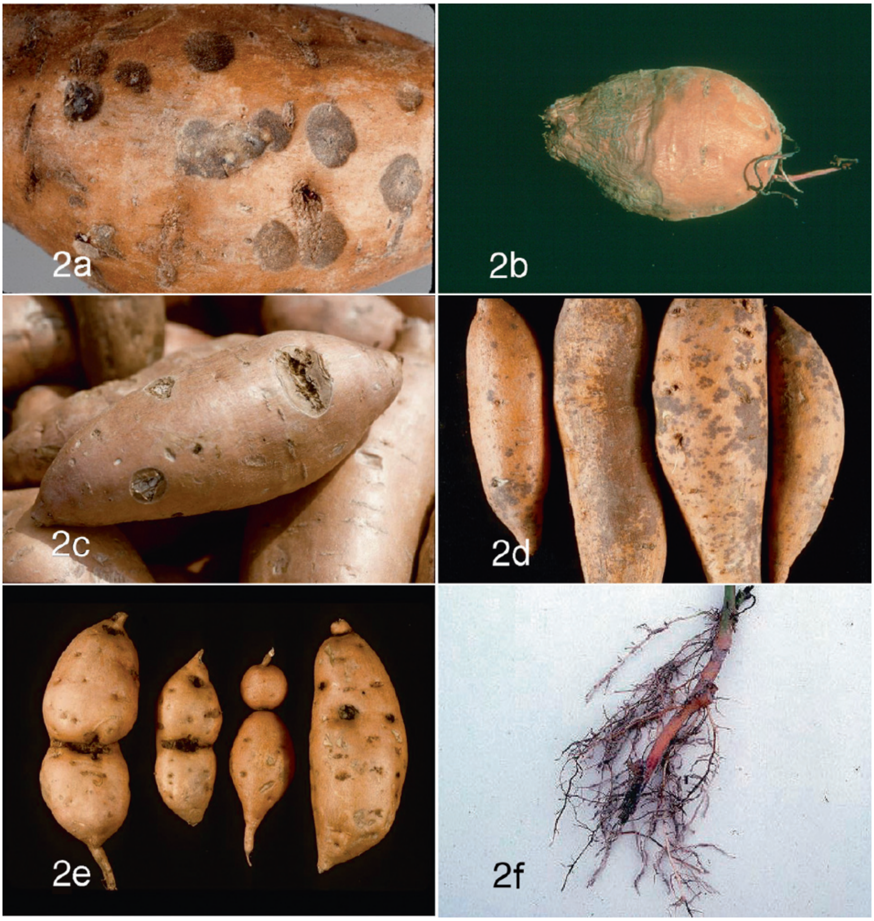

Plate 2 Root diseases. Symptoms on storage roots: **a**: black rot (caused by *Ceratocystis fimbriata*) (courtesy Gerald Holmes, North Carolina State University), **b**: foot rot (caused by *Plenodomus destruens*) (photo by Weston J. Martin, Louisiana State University AgCenter), **c**: circular spot (caused by *Sclerotium rolfsii*) (courtesy Gerald Holmes, North Carolina State University), **d**: scurf (caused by *Monilochaetes infuscans*) (courtesy Gerald Holmes, North Carolina State University), and **e**: Streptomyces soil rot (caused by *Streptomyces ipomoeae*) (courtesy Gerald Holmes, North Carolina State University). Symptoms of fibrous roots: **f**: Streptomyces soil rot (caused by *Streptomyces ipomoeae*) (courtesy Christopher Clark, Louisiana State University AgCenter) (See also Plate 7.2 on page 86)

Plate 3 Storage diseases. **a**: Fusarium root rot (*caused by Fusarium solani*) (courtesy Christopher Clark, Louisiana State University AgCenter), **b**: Rhizopus soft rot (caused by *Rhizopus stolonifer*) (photo by Weston J. Martin, Louisiana State University AgCenter), **c**: bacterial soft rot (caused by *Dickeya didantii*) (courtesy Christopher Clark, Louisiana State University AgCenter), and **d**: Java black rot (caused by *Lasiodiplodia theobromae*) (courtesy Gerald Holmes, North Carolina State University) (See also Plate 7.3 on page 91)

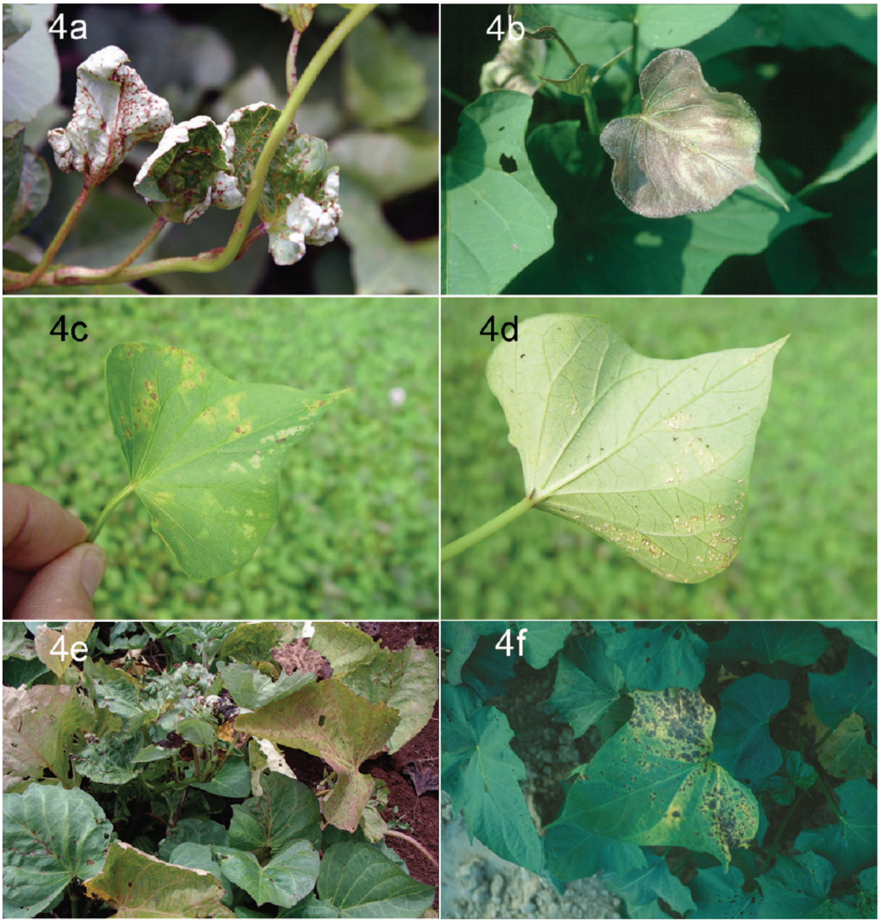

Plate 4 Foliar diseases. **a**: stem and leaf scab (caused by *Elsinoe batatas*) (courtesy Christopher Clark, Louisiana State University AgCenter, **b**: chlorotic leaf distortion (caused by *Fusarium denticulatum*) (courtesy Christopher Clark, Louisiana State University AgCenter, **c**: white rust (caused by *Albugo ipomoeae-panduranae*) as seen on adaxial surfaces of leaves (courtesy Gerald Holmes, North Carolina State University), **d**: white rust as seen on abaxial surfaces (courtesy Gerald Holmes, North Carolina State University), **e**: Alternaria blight (caused by *Alternaria spp*.) (courtesy Christopher Clark, Louisiana State University AgCenter, and **f**: Alternaria leaf spot (caused by *Alternaria spp*.) (courtesy Christopher Clark, Louisiana State University AgCenter (See also Plate 7.4 on page 94)

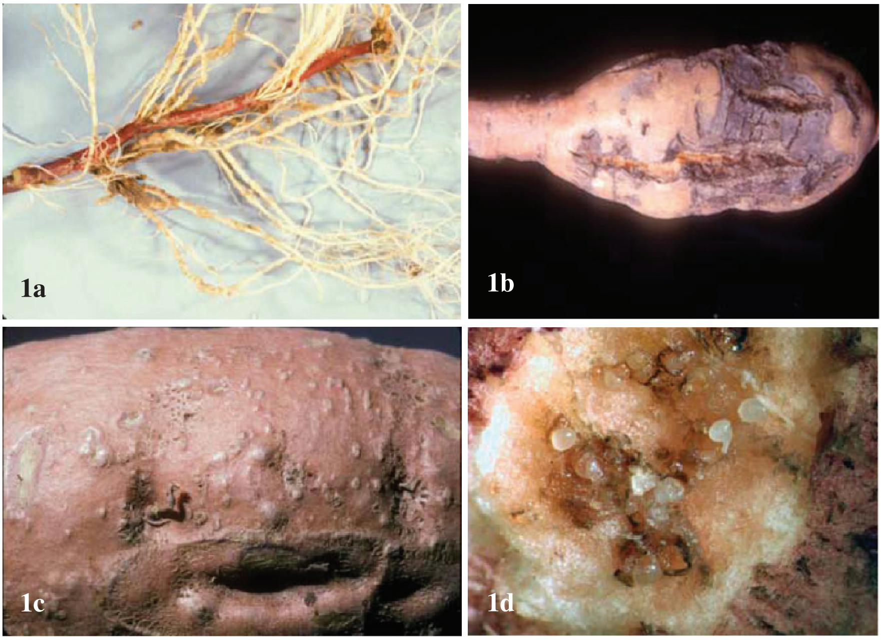

Plate 5 Root-knot nematode *Meloidogyne incognita* (**a**) Root showing galling (courtesy Charles Overstreet, Louisiana State University AgCenter). (**b**) Cultivar 'Centennial' showing cracking and some decay from infection (courtesy Chris Clark, Louisiana State University AgCenter). (**c**) Cultivar 'Beauregard' showing the typical blistering from infection and slight cracking (courtesy Charles Overstreet, Louisiana State University AgCenter). (**d**) Females of root-knot nematode exposed beneath one of the blisters on 'Beauregard'. Several females teased out and laying on the cut area (courtesy Charles Overstreet, Louisiana State University AgCenter) (See also Plate 9.1 on page 139)

Plate 6 Reniform nematode *Rotylenchulus reniformis* (**a**) Developing females (stained red) inside root (courtesy Charles Overstreet, Louisiana State University AgCenter). (**b**) Cultivar 'Goldrush' showing cracking from infection by this nematode (courtesy Chris Clark, Louisiana State University AgCenter). (**c**) Individual hills of sweetpotato from an untreated area (*left*) compared to an area infested with reniform on the *right* (courtesy Chris Clark, Louisiana State University AgCenter). (**d**) A sweetpotato breeding line in a reniform nursery that is untreated on the left and fumigated on right (courtesy Chris Clark, Louisiana State University AgCenter) (See also Plate 9.2 on page 143)

Plate 7 Sweetpotato jam (Courtesy: Padmaja and Premkumar, 2002) (See also Plate 11.1 on page 202)

Plate 8 Sweetpotato soft drink (Courtesy: Padmaja and Premkumar, 2002) (See also Plate 11.2 on page 203)

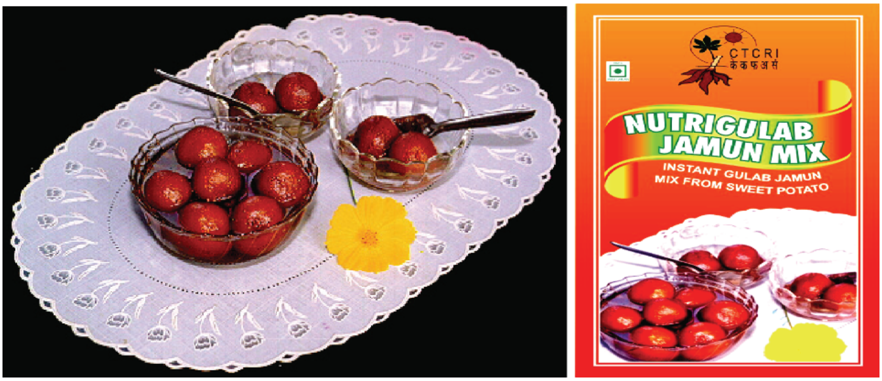

Plate 9 Sweetpotato based gulab jamuns and instant mix (Padmaja et al., 2005b) (See also Plate 11.3 on page 208)

Plate 10 Sweetpotato grading and packing line located at grower-shipper packing shed in Columbus County, North Carolina (See also Plate 13.1 on page 275)

Plate 11 Commercial grower-shipper bulk bin storage room equipped with environmental management controls, Nash County, North Carolina (See also Plate 13.2 on page 275)

Plate 12 Yams and sweetpotatoes for sale side-by-side at Lowe's Grocery Stores, Wake County, North Carolina (See also Plate 13.3 on page 281)

Plate 13 Cello-wrapping of sweetpotatoes on grading line at grower-shipper packing shed in Columbus County, North Carolina (See also Plate 13.4 on page 281)

Plate 14 Sweetpotato bedding wagon and seed distribution in a hotbed or seed bed (Courtesy of Tara Smith, Louisiana State University Agricultural Center) (See also Plate 14.1 on page 300)

Plate 15 Sweetpotato bed covering machine, covering seed potatoes (Courtesy of Tara Smith, Louisiana State University Agricultural Center) (See also Plate 14.2 on page 300)

Plate 16 Sweetpotato mulch/plastic layer being applied to a seed bed (Courtesy of Tara Smith, Louisiana State University Agricultural Center) (See also Plate 14.3 on page 300)

Plate 17 Sweetpotato hotbeds in California (Courtesy of Scott Stoddard, University of California at Merced) (See also Plate 14.4 on page 300)

Plate 18 Sweetpotato seed beds with transplants (Courtesy of Tara Smith, Louisiana State University Agricultural Center) (See also Plate 14.5 on page 301)

Plate 19 Sweetpotato 2-row mechanical transplanter, (Courtesy of Tara Smith, Louisiana State University Agricultural Center) (See also Plate 14.6 on page 302)

Plate 20 Sweetpotato transplants or slips that will be planted in a commercial production field (Courtesy of Tara Smith, Louisiana State University Agricultural Center) (See also Plate 14.7 on page 302)

Plate 21 Virus-tested sweetpotato plants in test tubes (Courtesy of Scott Stoddard, University of California at Merced) (See also Plate 14.8 on page 305)

Plate 22 Sweetpotato commercial production field (Courtesy of Tara Smith, Louisiana State University Agricultural Center) (See also Plate 14.9 on page 305)

Plate 23 Sweetpotato production field in California just prior to harvest (Courtesy of Scott Stoddard, University of California at Merced) (See also Plate 14.10 on page 306)

Plate 24 Sweetpotato harvest (2-row mechanical chain harvester) (Courtesy of Tara Smith, Louisiana State University Agricultural Center) (See also Plate 14.11 on page 313)

Plate 25 Wooden storage bins used to harvest and store sweetpotatoes (Courtesy of Scott Stoddard, University of California at Merced) (See also Plate 14.12 on page 314)

Plate 26 Sweetpotato harvest (shaker harvester method) (Courtesy of Tara Smith, Louisiana State University Agricultural Center) (See also Plate 14.13 on page 314)

Plate 27 Typical sweetpotato storage facility for a large commercial operation (Courtesy of Scott Stoddard, University of California at Merced) (See also Plate 14.14 on page 316)

Plate 28 Marketing containers (Courtesy of Tara Smith, Louisiana State University Agricultural Center and Scott Stoddard, University of California at Merced) (See also Plate 14.15 on page 317)

Plate 29 Marketing containers (Courtesy of Tara Smith, Louisiana State University Agricultural Center and Scott Stoddard, University of California at Merced) (See also Plate 14.16 on page 317)

Plate 30 Marketing containers (Courtesy of Tara Smith, Louisiana State University Agricultural Center and Scott Stoddard, University of California at Merced) (See also Plate 14.17 on page 318)

Plate 31 **A.** "Guangshu 69", **B.** "Yanshu 5", **C.** "Guangshu 79", **D.** "Jishu 15", **E.** "Jishu 18", **F.** "Jishu 98", **G.** "Xushu 18", **H.** "Xushu 25", **I.** "Jinshan57", **J.** "Nanshu 88", **K.** "Eshu 5", **L.** "Chuanshu 34", **M.** A typical meristem used for virus elimination. **N.** Plantlet regenerated from meristem culture, **O.** Culture room of sweetpotato. **P.** Cross breeding. Bars indicate 5 cm (See also Plate 15.1 on page 351)

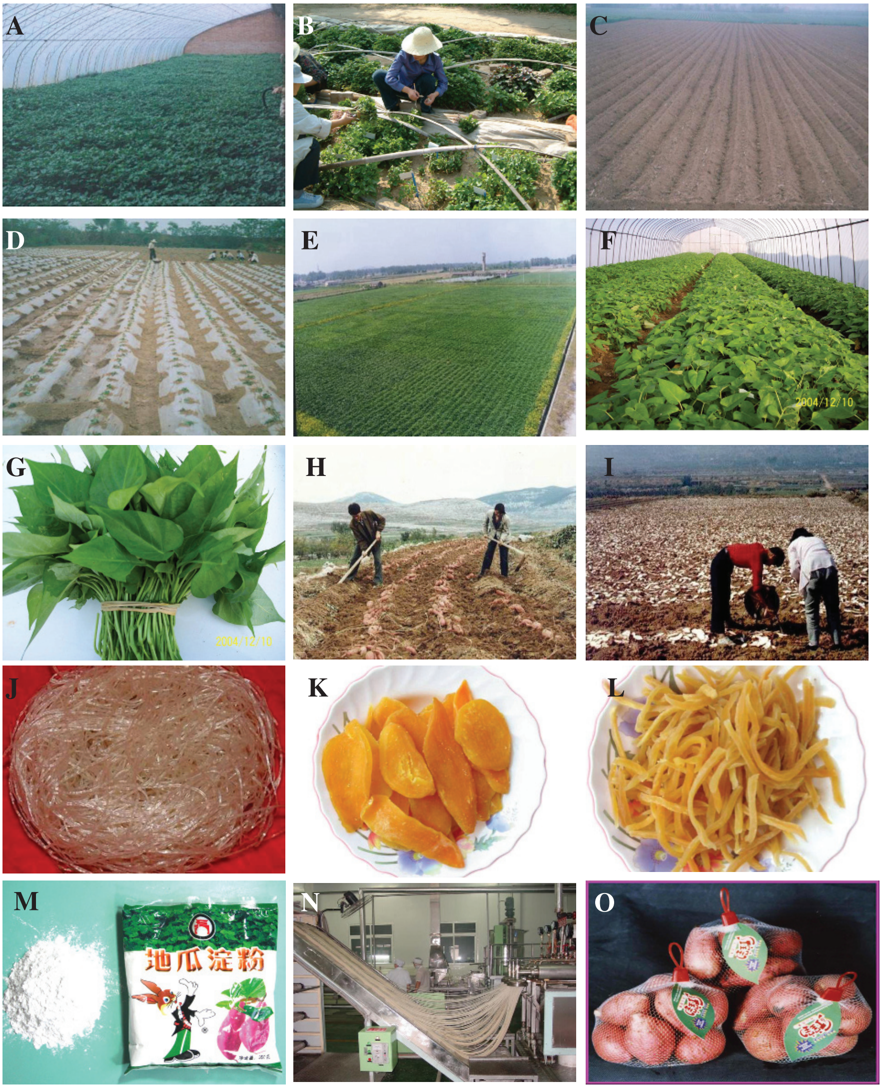

Plate 32 **A.** Propagation bed. **B.** Preparation of cuttings. **C.** Ridge planting. **D.** Mulching field. **E.** Large scale production. **F.** Production of vegetable sweetpotato. **G.** Harvesting of vegetable sweetpotato. **H.** Harvesting of sweetpotato. **I.** Sun-drying of sweetpotato. **J.** Sweetpotato noodles. **K.** and **L.** Preserved Sweetpotato chips. **M.** Sweetpotato starch. **N.** Processing of Sweetpotato noodles. **O.** fresh tuber roots for market (See also Plate 15.2 on page 352)

Part I
General

Chapter 1
Introductory Remarks

G. Thottappilly

A tropical American vine, sweetpotato *(Ipomoea batatas)* is in the botanical family *Convolvulaceae* along with common plants, such as bindweed and morning glory. In developing countries, sweetpotato is ranked fifth in economic value production, sixth in dry matter production, seventh in energy production, ninth in protein production, and it has tremendous flexibility of utilization as food, feed and industrial products (Gregory, 1992). Sweetpotatoes should not be confused with potato *(Solanum tuberosum)* which belongs to Solanaceae and are entirely unrelated, although their uses can be similar. Orange-fleshed sweetpotatoes are often known as yams, especially in the southern United States, but they are quite different from true yams (*Dioscorea* sp.) in growth habit and use. Furthermore, unlike *Dioscorea* yams, which is native to Africa and Asia, the greens of sweetpotatoes are edible and provide an important source of food in Africa (Guinea, Sierra Leone and Liberia) as well as in East Asia (Scott et al., 2000a, b).

Sweetpotato is grown from underground tuberous roots. Leaves are variable in shape, size, and color. The single flowers are funnel shaped and white or rose violet. Where stem nodes touch the ground, the edible storage roots develop to usually four to ten storage roots per plant. It was introduced into Europe in the 16th century and later spread to Asia. Sweetpotatoes are used mostly for human consumption but are sometimes fed to swine. They yield starch, flour, glucose, and alcohol and are especially rich in vitamin A. Sweetpotato's role as an important health food is recognised due to high nutrient content with its anti-carcinogenic and cardiovascular disease-preventing properties (Hill et al., 1992). All varieties of sweetpotato are good sources of vitamins C, B2 (Riboflavin), B6 and E as well as dietary fiber, potassium, copper, manganese and iron, and they are low in fat and cholesterol. Despite the name "sweet", it may be a good food for diabetics as it helps to stabilize blood sugar levels and to lower insulin resistance (Answers.com, 2008). It is expected therefore that sweetpotato marketing will increase in the coming years.

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