

Sweetpotato for the New Millennium: Trends in Production and Utilization in Developing Countries

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Sweetpotato (*Ipomoea batatas* L. Lam.) is among the world's most important, versatile, and underexploited food crops. With more than 133 million tons (FAOSTAT, 1998) in annual production, sweetpotato currently ranks as the fifth most important food crop on a fresh-weight basis in developing countries after rice, wheat, maize, and cassava. Sweetpotato is cultivated in over 100 developing countries and ranks among the five most important food crops in more than half of them (FAOSTAT, June 1998). Only in the last decade has the crop been the focus of an intense, coordinated, global effort to realize its full potential as a source of food, feed, processed products, and income for millions of small farmers and low-income consumers in Africa, Asia, and Latin America.

Sweetpotato is also one of the most misunderstood of the major food crops. Not all sweetpotatoes are particularly sweet—many have a neutral to dry flavor. None are like potato, where the tubers are harvested. Instead sweetpotato roots are dug and eaten like carrots or cassava. Potato foliage is not used for human consumption. But sweetpotato leaves and tips are an important source of vitamin A in several developing countries in Asia and Africa. They are a trendy, luxury vegetable in Japan. Still, relatively few sweetpotatoes are produced and consumed in industrialized countries. Over 98% of global sweetpotato output is currently harvested and utilized in developing countries.

This paper analyzes recent trends in sweetpotato production and use from a

global, regional, and sub-regional perspective. Developments in Asia, China in particular and Sub-Saharan Africa merit particular attention as upward trends in output are linked to the changing role of sweetpotato in local food systems. The results presented serve as the basis for recommendations for policymakers and research scientists and are aimed at building on the local momentum to fully exploit sweetpotato's untapped potential in the new millennium.

Materials and Methods

Analysis done for this paper relies heavily, although not exclusively, on FAO production and utilization data (FAOSTAT, June 1998). These statistics are supplemented with information from other sources including official publications of national governments, survey results, and related analyses found in scientific papers and the gray literature.

Estimated growth rates for production for particular time periods and descriptive statistics on utilization for selected years were calculated on an average annual basis. These figures are presented for different regions and countries to provide the matrix for comparative analysis.

Results and Discussion

Four facts have generated growing interest in trends in sweetpotato production and utilization. First, sweetpotato is typically a small-farmer crop and often grown on marginal soils with limited outputs. Furthermore, although the crop is widely cultivated in Asia (31 countries), Africa (39), and

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Latin America (31), production tends to be concentrated in those countries with lower per capita incomes (Figure 1) and within those countries in regions such as Sichuan Province in China or western Kenya where income levels are relatively low. Hence, increasing sweetpotato production is often considered as a means to improve food security among the poorer segments of the rural and urban population. Similarly, expanding utilization through improvements in processing and feed use is seen as a way to raise incomes and thereby reduce poverty.

Second, average yields in several countries are well below the average of 15 t/ha for developing countries as a whole (Table 1). This average in turn is well below current average yields obtained in countries such as China. Potential yield increases based on experiment station trials are much higher still. Some recent developments—such as the tendency in some Asian countries to push the crop onto more marginal land—do raise additional challenges to develop and diffuse yield-increasing technologies for sweetpotato and help explain the prevailing yield gap. Nevertheless, rapid improvements in productivity are considered more readily feasible with relatively less investment in research and extension for sweetpotato than other crops, such as rice. This is because farmers' yields

are far below what has been shown already to be technically feasible, and because by using standard scientific techniques can raise experimental yields even higher.

Third, the last decade has witnessed a return to a positive growth rate for sweetpotato production in China—a remarkable reversal of previous trends in a country where some 85% of the world's output is harvested (Figure 2). Similar upward trends have emerged in a number of other developing countries. Some of these trends are evident from FAO statistics; others are not.

Fourth, several eastern and southern African countries have witnessed major increases in sweetpotato production in recent years. With this expansion in output have come shifts in both the orientation of production and the utilization of the harvested crop. Given the heightened concern about food security and poverty alleviation in many of these locations as well as for the region as a whole, these developments have raised the prospects for a more prominent and diversified role for sweetpotato in these countries in the decades ahead.

Sweetpotato Utilization: Food, Cash, Feed and Processed Products

Though commonly categorized as strictly a "subsistence," "food security" or "famine relief" crop, sweetpotato uses have diversified considerably in developing countries over the last four decades. Hence, while these longstanding uses are still important in some countries or some regions within these countries, other uses have clearly emerged, particularly in Asia (Table 2), where the share used as feed has increased from 14.5% in 1961–63 to 44.6% in 1993–95. Many of these changes are either not quantified or blurred in the published aggregate utilization figures. Among the most notable examples are (1) the use of vines in addition to roots for animal feed—this is simply not quantified into the estimates of feed use as these are typically based solely on estimated root production,

Crop	US\$	Ranking
Soybean	7,004	1
Lentil	6,130	2
Wheat	2,014	8
Maize	1,782	11
Potato	1,550	14
Cassava	1,419	16
Rice	1,112	17
Sweetpotato	881	18

Average income/capita = average, over all dev. countries, of proportion of overall production of the crop in each country multiplied by that country's per capita GNP.

Figure 1. Average income per capita and commodity ranking of major food crop production in developing countries. (Source: Scott and Maldonado, 1999.)

Table 1. Average sweetpotato production, yield, and area in developing countries.

Region/country	1995-97			Average annual growth rate ^a					
	Production	Area	Yield	Production		Area		Yield	
	(000 t)	(000 ha)	(t/ha)	(%)		(%)		(%)	
				1	2	1	2	1	2
Asia ^b (n=31)	125,058	7,178	17	1.1	0.8	1.4	-0.3	2.5	1.1
China	117,848	6,160	19	1.2	1.0	-1.5	-0.1	2.7	1.1
Indonesia	2,013	212	10	-1.2	-0.4	-2.3	-1.5	1.1	1.1
Vietnam	1,675	292	6	1.1	-1.7	0.6	-1.1	0.5	-0.5
Africa ^c (n=39)	6,957 ^d	1,519 ^d	5 ^d	2.1	1.5/2.7 ^e	2.6	1.9/2.3 ^e	-0.4	-0.4/0.3 ^e
Uganda	1,888	513	4	3.7	0.9	3.5	2.8	0.1	-1.9
Rwanda	967	150	6	1.9	0.5	2.1	1.5	-0.2	-1.0
Malawi	962 ^f	99 ^f	10 ^f	n.a.	25.3	n.a.	14.0	n.a.	9.7
Kenya	725	74	10	4.7	3.7	3.2	3.8	1.5	-0.1
Burundi	663	108	6	1.7	1.0	1.7	1.4	-0.1	-0.4
Latin America (n=31)	1,850	247	7	-1.2	-1.7	-1.0	-2.2	-0.2	0.5
Brazil	655	58	11	-2.3	-1.5	-2.7	-2.9	0.4	1.5
Argentina	339	20	17	-0.3	-1.1	-1.8	-3.9	1.5	2.9
Cuba	220	60	4	0.4	-2.6	0.9	0.2	-0.5	-2.8
Peru	191	11	18	0.7	3.6	-1.2	-0.7	1.9	4.3
Developing countries	133,865 ^d	8,944 ^d	15 ^d	1.1	0.8 ^d	-1.0	0.0 ^d	2.1	0.8 ^d

Source: Scott and Maldonado, (1999); (Source for Malawi data only, Ministry of Agriculture and Irrigation, Malawi).
^a 1. 1961-63 to 1995-97, 2. 1985-87 to 1995-97.
^b Asia (excluding Japan, Israel) + Oceania (excluding Australia, New Zealand).
^c Excludes South Africa.
^d Totals do not include data for Malawi.
^e Includes data for Malawi.
^f For 1995/96 to 1997/98.

and (2) the lack of division in the share of output devoted to food consumption between fresh roots and processed products, e.g., noodles made from starch. Consequently, any analysis of the trends in utilization for sweetpotato must be done with considerable caution.

Average annual per capita consumption of fresh roots for 1994-96 is estimated at: Africa, 9 kg; Asia, 18 kg; Oceania, 73 kg; Latin America, 2 kg; Japan, 9 kg; and USA, 2 kg (FAOSTAT, June 1998). In contrast to potato, per capita sweetpotato consumption in Canada, Europe, and Australia is ex-

tremely limited and often confined to an immigrant population.

The quantities of sweetpotato consumed can vary tremendously within developing country regions. In Africa, for example, annual per capita sweetpotato consumption in Rwanda is estimated at 160 kg; Burundi, 102 kg; and Uganda 85 kg. Sweetpotato consumption also varies within countries by regions, by time of year, and by income group. In northeast Uganda, one of the poorest parts of that country, sweetpotato becomes a seasonal staple during the dry season when supplies of most other food

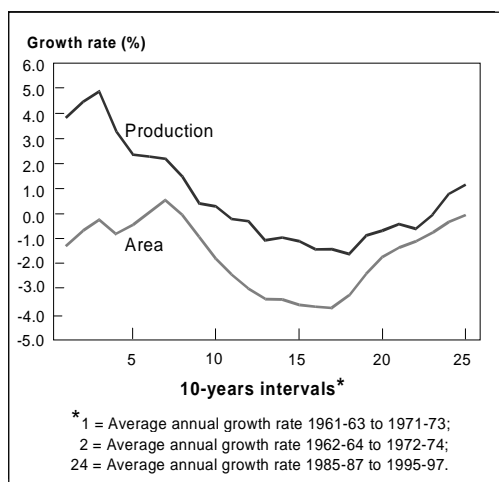


Figure 2. Average annual growth rates (%) for sweetpotato in China calculated in 10-year intervals from 1961-97. (Source: Scott et al., 1999.)

stuffs are exhausted (Hall et al., 1998). Even under such circumstances the importance of the crop may be underestimated given the increasingly apparent flaws in the calculation of such estimates.

For developing countries as a whole, per capita consumption of sweetpotato, particularly in fresh form, has declined over time. According to available statistics,

average per capita consumption fell from 37.5 kg/yr in 1961-63 to 18.8 kg/yr in 1994-96 (FAOSTAT, June 1998). As incomes increased, urbanization accelerated, and the availability of cheaper, more preferred substitutes (meat, wheat breads, etc.) became more abundant in many parts of Latin America and Asia, in particular, consumers on and off the farm reduced their intake of fresh sweetpotato. However, the trend has been more volatile in Sub-Saharan Africa with consumption rising and falling and then rising again. In some countries of the region, e.g., Malawi, the trend has been a rapid rise in consumption. For the mostly poor consumers in eastern and southern Africa, per capita sweetpotato consumption has either stayed roughly constant or risen as real incomes have deteriorated, imports of traditional substitutes have been cut back, and production of (other) local staples stagnated or shrank as a consequence of weaknesses in the overall economy and continued strong population growth. In some cases this was exacerbated by problems in specific commodity subsectors, e.g., maize in Malawi, cassava in Uganda. In Asia, rapid expansion of consumption of processed sweetpotato in the form of such products as noodles has helped offset the decline in fresh consumption.

Table 2. Distribution of the uses of sweetpotato in Africa, Asia, Latin America, and the industrialized countries, 1961-63 and 1993-95.

	1961-63 (%)				1993-95 (%)			
	AF	AS	LA	IC	AF	AS	LA	IC
Total (000 t)	2,755	87,143	2,578	7,483	5,748	120,771	1,628	2,284
Food	84.8	79.7	65.8	60.1	85.3	49.9	71.1	65.5
Feed	3.7	14.5	24.5	23.6	2.9	44.6	18.5	19.3
Processing	0.0	0.0	0.0	10.7	0.0	0.2	0.0	9.1
Seed	1.1	0.2	0.2	3.8	0.7	0.0	0.3	3.5
Waste	10.4	5.5	9.5	1.8	11.0	5.2	9.6	2.6
Net export ^a	0.0	-	0.0	-	0.1	0.1	0.6	-

Source: FAOSTAT (June 1997, accessed July 1997).

Note: AF = Africa; AS = Asia; LA = Latin America; IC = Industrialized countries. Regions as defined by FAOSTAT.

^a - = None recorded.

Tastes and preferences for fresh sweetpotato are also highly variable and show some signs of evolving as well. Some consumers prefer sweet varieties with a floury taste; others prefer bland roots. Yellow-to-orange fleshed cultivars with high β -carotene content have been introduced and diffused recently in East Africa as part of an integrated effort to reduce vitamin A deficiency (Low et al., 1997). Wide genetic variability found in sweetpotato means that these and a number of other desirable traits can be found in existing germplasm.

Recent research has documented the widespread use of sweetpotato by small farmers in their efforts to sustain local livestock production systems (Scott, 1992; Woolfe, 1992). In fact, virtually wherever sweetpotato is cultivated, from Brazil to Madagascar to China, some part of the plant in some form is used in some type of animal production. The steady increase in the use of sweetpotato roots and vines in pig and other livestock systems in China over the last 30 years now means that from 30 to 50 million tons or more are used annually as feed. Vines also play an underexploited, but important role in animal production in other Asian countries such as Indonesia, the Philippines, and Vietnam.

Processed products made from sweetpotato including starch, noodles, candy, desserts, and flour have long been made by farm households to extend the availability, diversify the use, and increase the value-added for the crop. In China, in particular, production of sweetpotato starch in recent years has evolved into a cottage industry that utilizes millions of tons of roots per year as raw material inputs. The magnitude of these new uses is not easy to quantify in a systematic way; partly for that reason, available statistics on processing do not always reflect their true level of importance. Recent estimates from China suggest that 3 to 5 million tons of sweetpotatoes are transformed into starch to make noodles for both the domestic and export market (see Fuglie et al., 1999).

Sweetpotato Production

Driven by strong demand for feed and starch, growth rates for sweetpotato output and area planted have turned upward in China after years of decline (Figure 2). Trends for other countries and regions have been mixed (Table 1). Given weaknesses in the data, these figures should be interpreted with caution.

Asia. Sweetpotato production in Asia has been characterized by four trends. (1) The continued overwhelming dominance of China with recent positive growth rates reversing an earlier decline. (2) Shrinking area planted in sweetpotatoes—a trend that accelerated in much of the region during the last ten years. (3) Leveling off of yields as the rate of growth has slowed in many countries, including China. As sweetpotato cultivation has been pushed onto more marginal land and average yields have improved to 17 t/ha, it has become more difficult to maintain the rate of growth of improvement in yields. (4) The possible shift in the future prospects for regional sweetpotato production due to recent changes in relative prices for sweetpotato versus traditional substitutes such as imported wheat flour, as a consequence of the economic crises in Southeast Asia.

Latin America and the Caribbean. For much of this region, production and area planted to sweetpotato is most important in smaller, poorer countries such as Cuba, Haiti, and Paraguay. In Cuba, a recent sharp decline reflects the pressure on sweetpotato yields resulting from a shortage of chemical pesticides in the current transition to biological control of important pests. In bigger and/or wealthier countries, the decline during the last decade represents more of a long-term trend toward higher-value crops, the use of farmland for alternative purposes, or the migration of small farmers to other occupations outside agriculture. In Peru, production and yields rose spectacularly over the last decade as agro-climatic conditions improved, the general economy went through structural adjustment, and many small growers turned

to sweetpotato because of the shortage of farm credit and the low costs of production per hectare.

Africa. The continent produces nearly 7 million tons of sweetpotato yearly and nearly all of it south of the Sahara; Egypt in North Africa is the prominent exception. Growth rates in sweetpotato production and, in particular, area planted are the highest of any region though most of the major producers saw growth rates decline over the last decade. As area planted continued to expand, the annual average rate of improvement in yields turned negative in some cases (e.g., Uganda: – 1.9%), and offset what would have otherwise been faster rates of growth in production. In other words, as planting took place under more marginal conditions, and perhaps by farmers less acquainted with the most appropriate cultural practices, yields suffered in the process.

An average yield of 5 t/ha for sweetpotato in Africa (Table 1) is the lowest of any developing region, and less than a third of the average yield in Asia. This suggests ample room for improvement in productivity in the years ahead even taking into consideration the common criticism that FAO data underestimate average yields for sweetpotato in this region. Prospects are brightest for the adoption of yield-increasing production technology for sweetpotato in Eastern and Southern Africa where cash sales of fresh roots have risen in importance in a number of countries. Although only a minor share of current consumption, the emerging demand for processed products made from sweetpotato shows signs of increasing. This should further bolster prospects for additional production. African farmers will continue to increase their production of sweetpotato for food security and income generation in response to continued high population growth and the economic hardships associated with political instability, natural disasters and limited production infrastructure.

A Word of Caution

Any review of the recent trends in sweetpotato production, consumption, and use in developing countries would be incomplete were it not to draw attention to discrepancies in data for this commodity. It is difficult to estimate production for a crop produced by small farmers on non-contiguous plots, harvested several times a year, and not sold through regulated domestic marketing channels or traded abroad in appreciable quantities. Therefore, FAO statisticians frequently resort to using the available national statistics to estimate production, area, and yield. Unfortunately, there are often discrepancies between FAO figures and national data. For example, FAO reports Malawi produces no sweetpotato, while Ministry of Agriculture figures show the country harvested over 800,000 t during 1995-97 (Phiri, 1998). This is not an isolated case, especially when one goes beyond the national statistics and compares those figures with data gathered in farm surveys as reported in the gray literature or consults with commodity specialists based in the countries themselves. Similar problems apply in the case of the figures for utilization. In conclusion, readers are advised to use these “trends” with caution.

Conclusions

Sweetpotato is an important source of food, cash, feed, and raw material for processing in developing countries. Although production is highly concentrated in China, recent years have witnessed a surge in sweetpotato output in a number of Sub-Saharan African countries. With the germplasm for sweetpotato largely underexploited, ample prospects exist to develop varieties with particular traits in addition to yield to satisfy the emerging demand for diversified end uses. Development of the crop’s full potential in the new millennium will require a fully integrated approach in which efforts aimed at germplasm improvement are closely tied to the following.

- Identification of market segments for which there is the greatest demand—currently this involves feed and starch in East Asia, and flour and fresh uses in Latin America and Africa.
- Improvements in the technical efficiency of processing (e.g., via new or improved small equipment) as well as feed use and preparation (e.g., vine fermentation).
- Reductions in per unit production and marketing costs through better cultural practices and trading procedures.
- Strengthening linkages of producers as sources of raw material to processors, managerial improvements in sweetpotato processing at the enterprise level as well as more informed utilization of fresh and processed sweetpotato by final consumers.

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