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Sweet Potato Value Chain: Ethiopia
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Dan Jones,
Mary Kay Gugerty, & C. Leigh Anderson

Prepared for the Agricultural Policy Team of the Bill & Melinda Gates Foundation

Professor Leigh Anderson, Principal Investigator
Associate Professor Mary Kay Gugerty, Principal Investigator

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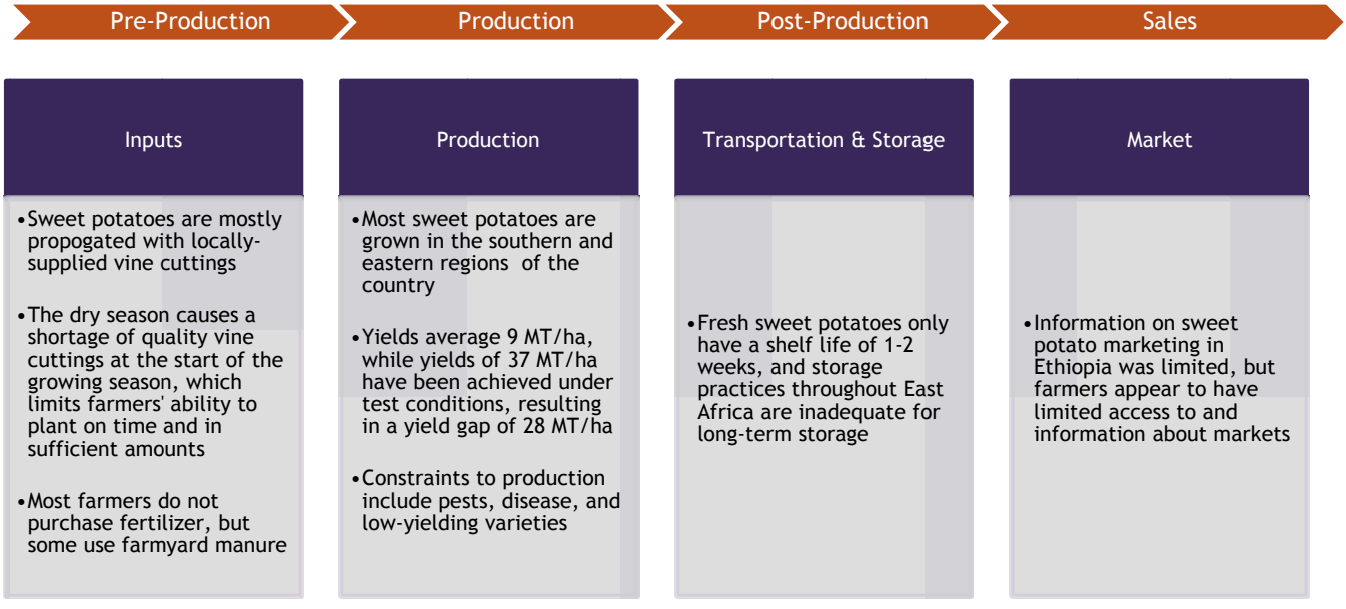
Ethiopia ranks fifteenth in the world in terms of sweet potato production. Production has been rising quickly since 2008, following a period a slow decline in the early 2000s. Yields have also been rising slowly since 2008, but are below their peak from 2001. Sweet potato roots are consumed domestically, mostly by poor rural households. The vines also provide an important source of feed for livestock during the dry season. Major constraints to sweet potato production in Ethiopia include a lack of quality planting materials, pests and disease, and underdeveloped markets.

This brief provides a general overview of the sweet potato value chain in Ethiopia. The first section describes trends in sweet potato production and consumption since the early 1990s. The second section describes the uses and importance of sweet potatoes in Ethiopia. The final section discusses major issues in production, post-production, and marketing. The literature available on sweet potatoes in Ethiopia was quite limited, particularly for storage and marketing. As a result this brief relies on a relatively small number of studies in Ethiopia and draws on the wider literature on sweet potatoes in East Africa where needed.

Ethiopia Sweet Potato Value Chain Highlights

The below figure summarizes key findings along the different stages of the sweet potato value chain in Ethiopia.

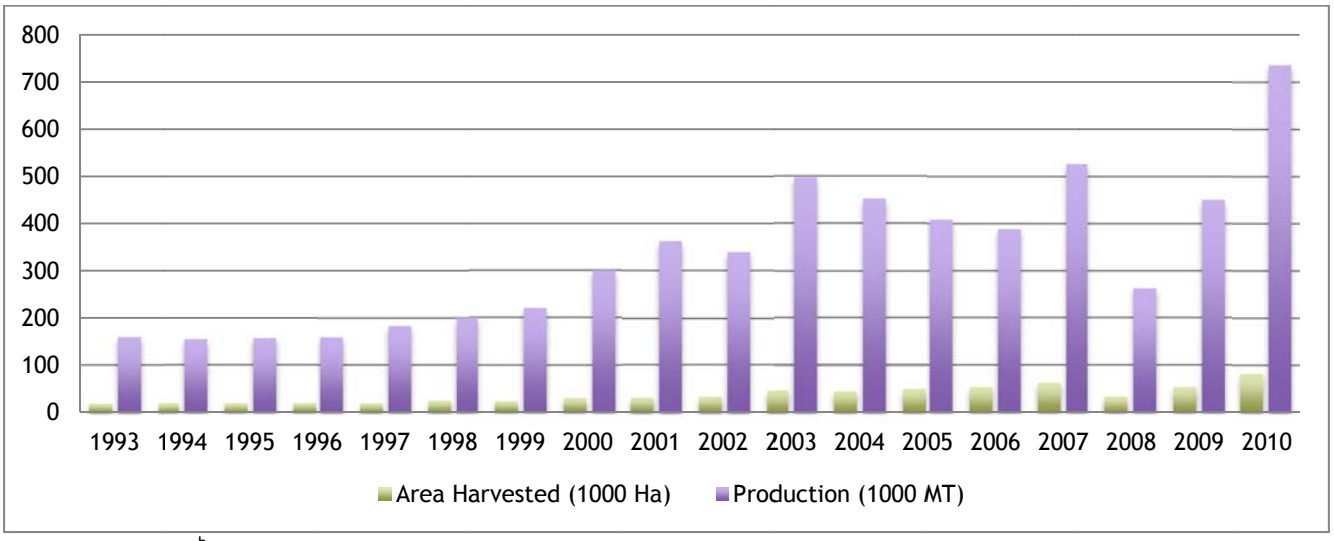


Key Statistics about Sweet Potatoes in Ethiopia

Production

Ethiopia produced 736,000 MT of sweet potatoes in 2010, which is the highest year of production in FAOSTAT records (see *Figure 1*) and the ninth highest production among African countries.[1] Production steadily increased until 2003, mostly declined until 2008, and then made large gains in 2009 and 2010. Sweet potatoes contributed $34 million (in constant 2004-2006 US$) to Ethiopia's gross agricultural production value in 2010, representing .7% of the total for crops. This amount places sweet potatoes 21st among single crops[a]. By comparison, wheat ranks 1st, contributing $626 million, or 12.2% of the total.

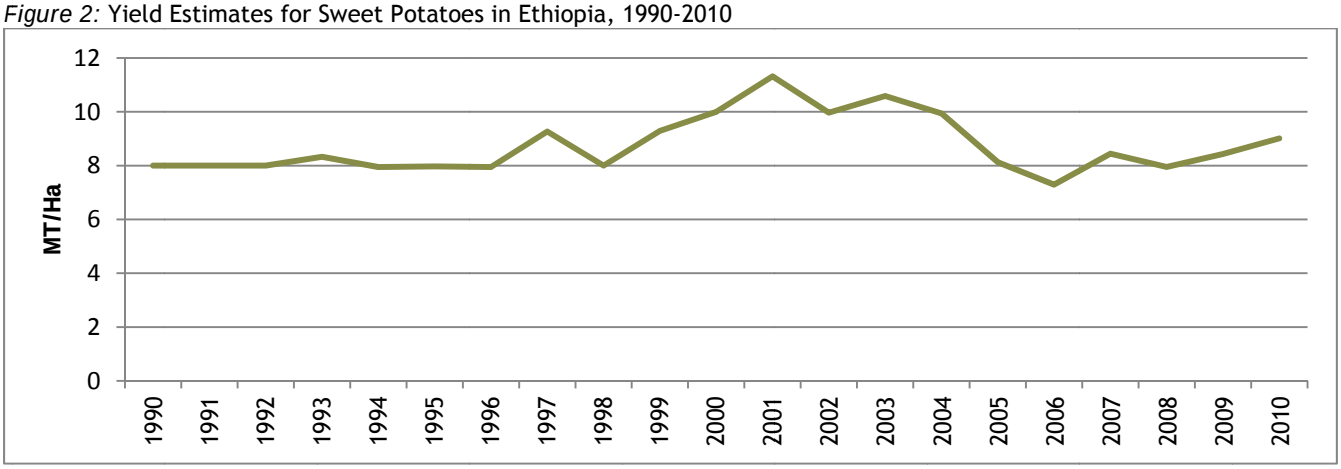
Figure 1: Estimates of Area Harvested and Production of Sweet Potatoes in Ethiopia, 1993-2010



Sources: FAOSTAT[b]

The average sweet potato yield in Ethiopia in 2010 was 9 MT/ha (see *Figure 2*). Yields peaked in 2001 at 11.3 MT/ha, but declined to 7.3 MT/ha in 2006, and have rebounded since.

Figure 2: Yield Estimates for Sweet Potatoes in Ethiopia, 1990-2010



Source: FAOSTAT

[a] Excluding four composite categories that ranked above sweet potatoes: cereals (not elsewhere specified), roots and tubers (not elsewhere specified), fresh vegetables (not elsewhere specified), and oilseeds (not elsewhere specified)
[b] CountrySTAT Ethiopia area harvested and production data were also reviewed, and were identical to the FAOSTAT figures.

Consumption

According to FAOSTAT, all of the sweet potatoes that are produced in Ethiopia are consumed in the domestic food supply, and are not used for animal feed or other uses. This may refer to roots only; as discussed below, the literature clearly suggests that sweet potato vines are used for animal feed by smallholder farmers.

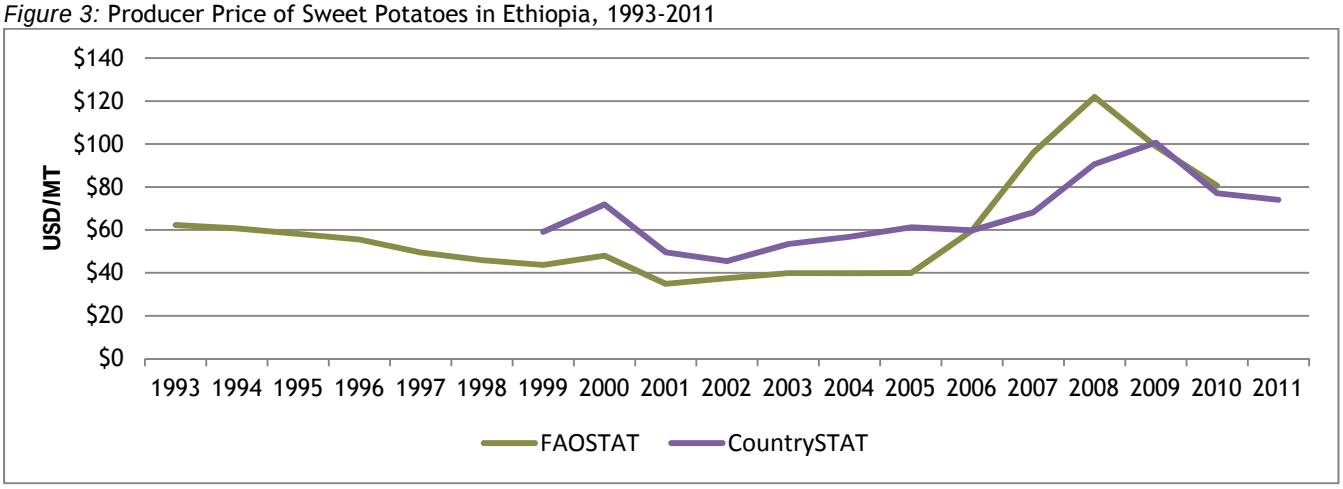
Trade

Ethiopia does not import or export significant amounts of sweet potatoes. FAOSTAT reports export amounts for only three years, all for negligible amounts under 10 MT.

Prices

After a period of decline and stagnation since 1993, the producer price of sweet potatoes rose sharply from $39.90/MT in 2005 to $121.90/MT in 2008, but has since fallen to $80.60/MT in 2010, according to FAOSTAT. CountrySTAT Ethiopia data, by contrast, show a more gradual increase, from $45.49/MT in 2002 to $100.61/MT in 2009 (see *Figure 3*). By comparison, the 2010 producer price of sweet potatoes was $259.40/MT in Kenya and $140.90/MT in Rwanda.

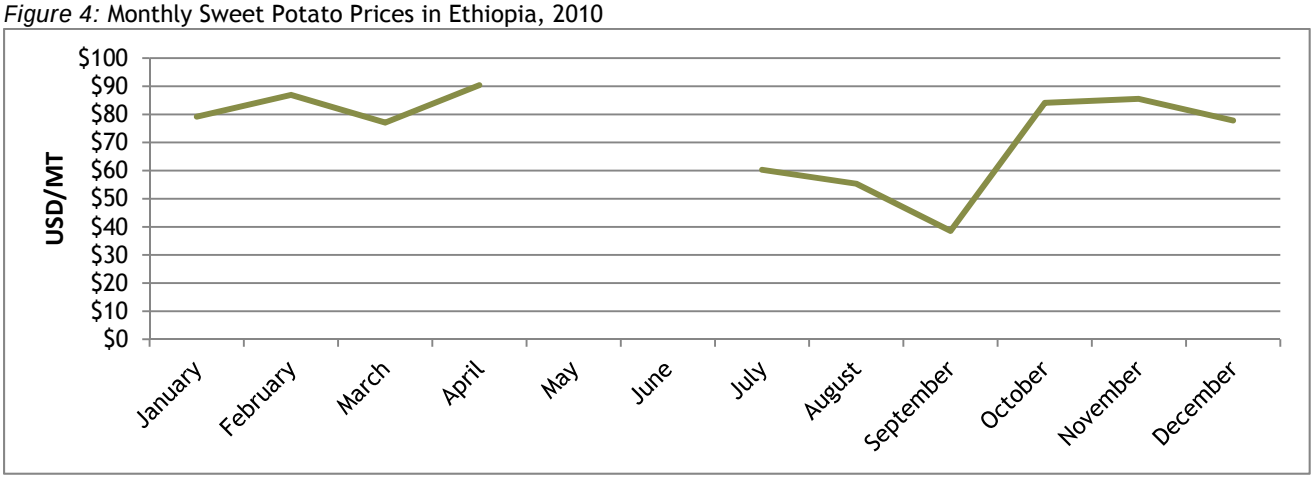
Figure 3: Producer Price of Sweet Potatoes in Ethiopia, 1993-2011



Source: FAOSTAT and CountrySTAT Ethiopia
Note: CountrySTAT prices were converted from Ethiopian Birr/kg, using the same Birr to USD exchange rates used in FAOSTAT yearly price data. Because FAOSTAT data was not available in 2011, the exchange rate listed for December 30, 2011 on freecurrencyrates.com was used.

See *Figure 4* for 2010 sweet potato prices by month. Prices were highest in October through April, after the long rainy season has finished, varying between $77.80/MT and $90.42/MT. Prices were lowest in August and September, during the long rainy season, when they fell to $38.55.

Figure 4: Monthly Sweet Potato Prices in Ethiopia, 2010



Source: FAOSTAT
Note: No data available for May or June.

Sweet Potato Varieties Grown and their Uses

Most of the sweet potato varieties grown in East Africa have white or cream-colored flesh. Orange-fleshed varieties of sweet potato are not as popular, but have received attention in the literature for their capacity to decrease vitamin A deficiency. Constraints limiting expanded production of orange-fleshed varieties include a lack of planting materials and capital, consumer preference for varieties high in dry matter,[c] vulnerability of introduced varieties to disease, and lower average yields.[2]

Sweet potatoes are often boiled or steamed, or sometimes roasted or fried, by poor rural households. The crop has traditionally been viewed as a poor person's food and is less popular in urban households, although it is becoming more popular in urban areas in Tanzania.[3]

Importance of Sweet Potatoes

Sweet potatoes are an important traditional food crop in Ethiopia, valued by farmers for their versatility, high caloric content, and taste. Sweet potatoes are also a resilient food security crop than can withstand drought, low soil fertility, and high levels of rainfall.[4] They are grown mostly by small-scale, resource-poor farmers for both human consumption and animal feed. Women typically have most of the responsibility for growing sweet potatoes. According to Belehu (2003), sweet potatoes are one of the most important roots crops in Ethiopia, although as *Table 1* indicates, at the national level sweet potatoes are a relatively small proportion of overall consumption.

The importance of sweet potatoes in the diet varies by region. In a 2005 survey conducted in two districts in the Southern Nations, Nationalities and Peoples Regional State (SNNPRS), 21.1% and 53.3% of farmers, respectively, named sweet potatoes as a major staple food in their diet.[5]

[c] Orange-fleshed sweet potatoes have a low dry matter content.

Table 1: Annual Consumption of Food Items in Ethiopia by Quantity, 2009

Food Item	Quantity Consumed (MT)	Percent of Total Quantity Consumed
Roots, Other	4,292,436	17.5%
Maize	3,592,093	14.6%
Wheat	2,870,653	11.7%
Cereals, Other	2,150,612	8.8%
Sorghum	2,045,537	8.3%
Roots & Tuber Dry Equivalent	1,359,803	5.5%
Pulses, Other	1,137,202	4.6%
Vegetables, Other	1,079,679	4.4%
Barley	1,073,607.00	4.4%
Fruits, Other	516,562.00	2.1%
Potatoes	473,959.00	1.9%
Sweet Potatoes	450,763.00	1.8%

Source: FAOSTAT, author's calculations
Note: Excludes beverages. "Roots, other" category includes cocoyams, flour of roots and tubers, dried roots and tubers, and roots and tubers not elsewhere specified. Although not specified in the FAO documentation, this category likely also includes enset, which helps account for the relatively large consumption figures.

Animal Feed

Sweet potato vines are a major source of animal feed in Ethiopia.[6] One survey (Beyero, Tolera, and Abebe, 2010) that focused on livestock production in the Southern Nations, Nationalities and Peoples Regional State (SNNPRS) found that crop residues, including sweet potato vines, were the main feed resource during the dry season; natural pasture was the main source of feed during the rainy seasons. Approximately 88% and 99% of the farmers in this survey used sweet potato vines for animal feed.[7] Sweet potato vines were fed to livestock either fresh or after curing. During sweet potato harvesting, farmers fed most of the collected sweet potato vines to livestock, and used the remainder for sweet potato propagation.

Nutrition

Sweet potatoes are low in fat and protein, and high in carbohydrates. They are a good source of antioxidants, fiber, zinc, potassium, sodium, manganese, calcium, magnesium, iron, and vitamin C. Orange-fleshed sweet potatoes (OFSP) are high in beta-carotene, which is a precursor to vitamin A. As in other parts of Sub-Saharan Africa, vitamin A deficiency is a public health problem in Ethiopia.[8] Vitamin A deficiency can lead to infant and maternal mortality, a weakened immune system, or blindness.

Table 2: Daily Macronutrient Intake from Sweet Potatoes in Ethiopia, 2000 and 2009

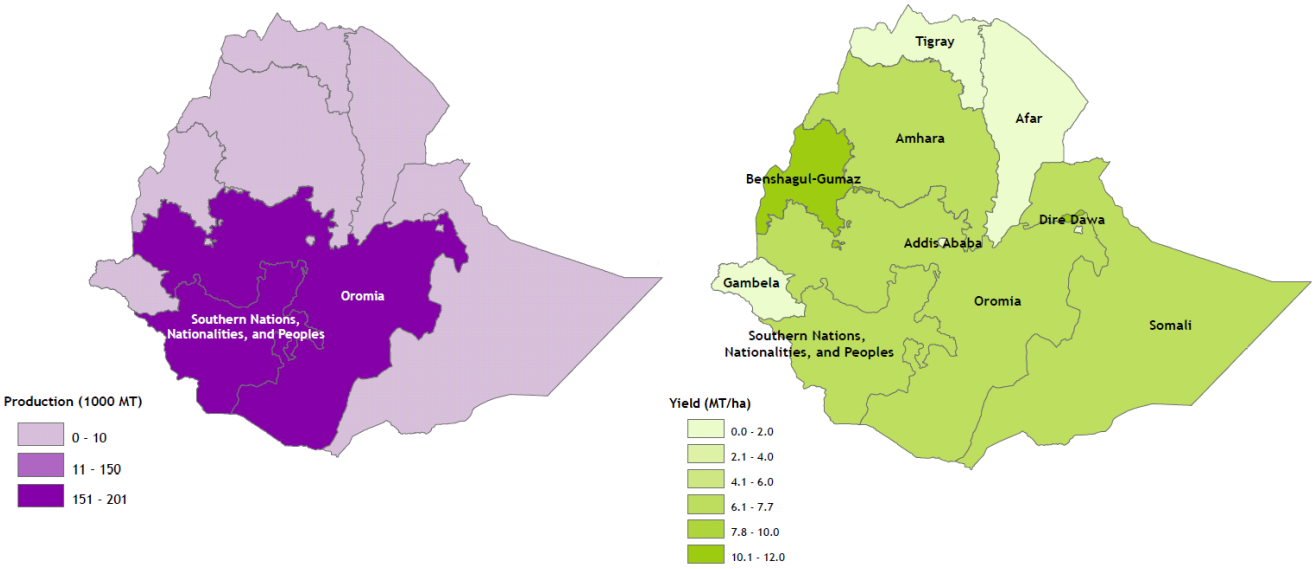
	Per capita caloric intake from sweet potatoes (% of total caloric intake)	Per capita protein intake from sweet potatoes (% of total protein intake)
2000	12 kcal/day (.7%)	.1 g/day (.2%)
2009	14 kcal/day (.7%)	.1 g/day (.2%)

Source: FAOSTAT

Overview of Sweet Potato Production in Ethiopia

Sweet potatoes are grown both in the short rainy season (February through April) and the long rainy season (July through September).[9] Sweet potatoes are grown mainly in the southern, southwestern, and eastern parts of Ethiopia, where the climate is warm and humid.[10] Sweet potatoes grow best at an average temperature of approximately 24 degrees Celsius (75 degrees Fahrenheit).[11] Sweet potatoes are damaged by frost, and yields decline with increasing altitude, along with the proportion of roots that are marketable.[12] *Figure 5* shows that production levels are highest in Oromia and SNNP, with yields fairly consistent across all growing regions.

Figure 5: Sweet Potato Production and Yield by Region, 2011



Source: Maps generated by the authors using data from the Ethiopia Central Statistical Agency

Sweet potatoes can be propagated either through vine cuttings or through sprouts from tubers. Vine cuttings are the preferred method, as they lead to higher yields, avoid soil-based diseases, and enable the farmer to save the whole tuber for consumption or marketing, rather than using part of it for planting.[13] However, root sprouts or storage root pieces are sometimes used when vines are unavailable.

Table 3: Sweet Potato Harvesting Times Reported in Badawacho and Sodo Zuria Districts, Southern Ethiopia

Time of Harvest	Badawacho (One Harvest per Year; N=90)	Time of Harvest	Sodo Zuria (Two Harvests per Year; N=90)
Feb-Apr	41.1%	Jan and May	45.6%
Feb-Mar	32.2%	Oct and Feb	24.4%
May-Jul	26.7%	Oct and May	20.0%
		Nov and Mar	10.0%

Source: Beyero, Tolera, and Abebe, 2010, p. 53

Common methods of planting sweet potatoes in Sub-Saharan Africa include ridging, flat planting, and mounding.[14] In ridging, cuttings are planted at the crests of ridges. Optimum ridge height varies by soil and cultivar type, but generally the higher the ridge, the greater the yield, up to a ridge height of 36 cm.[15] One disadvantage of ridging is that rains often wash soil from the ridge top and can expose the roots, leaving them vulnerable to rodent and insect attacks. In flat planting, cuttings are planted in rows on unridged land that has been ploughed. In mounding, mounds of topsoil are created with a hoe. The larger the mounds, the more space is left between mounds, and the greater the number of cutting that may be planted on each. However, mounding is not common in Ethiopia.

Ahmed, Nigussie-Dechassa, and Abebie (2012) conducted a study comparing the effect of different planting methods and vine harvesting dates on sweet potato vine yields in the Afar Region. They found that sweet potatoes grown on ridge and flat seedbeds had vine yields 22% and 17% higher, respectively, than sweet potatoes grown on sunken seedbeds. They also found that sweet potatoes whose vines were harvested after 105 days of growth had the highest yields, exceeding sweet potatoes whose vines were not harvested during growth, were harvested 45 days after growth, or were harvested 75 days after growth by 12-36%.[16] The authors also compared fresh sweet potato root weights and found that sweet potatoes grown on ridges weighed 7-11% more than sweet potatoes grown on flat or sunken seedbeds. There was no statistical difference between the number of sweet potato roots produced by the three methods. Harvesting the vines after 105 days did not significantly affect root quantity and weight, as compared to not harvesting the vine at all, but harvesting the vine after 45 or 75 days produced significantly fewer and significantly lighter sweet potato roots.

Abdissa, Chali, Tolessa et al. (2011) tested the impact of the spacing between plants and rows of sweet potatoes on the yield of two high-yielding varieties in the central rift valley. The study concluded that the optimum spacing for the Bareda variety was 20 cm between plants and 60 cm between rows, while the optimum spacing for the Belella variety was 20 cm between plants and 80 cm between rows.

Fertilizer

Sweet potato producers in Ethiopia generally do not use inorganic fertilizer, both because the response of various cultivars to fertilizers has not been clearly established, and because it is not cost-effective.[17] Farmers do use organic fertilizer from farmyard manure on sweet potatoes[18] and there is some evidence that using organic fertilizer in combination with phosphorus is effective in raising yields.

Previous experiments have tested the effectiveness of NP (nitrogen and phosphorus) fertilizers on sweet potatoes in Ethiopia, and found that they did not significantly increase production and yields.[19] However, Teshome-Abdissa and Nigussie-Dechassa (2012) studied the effect of farmyard manure and phosphorus on sweet potato in the central rift valley, and concluded that farmyard manure was an effective means of increasing yields. They found that the application of farmyard manure and phosphorus combined had a significant effect, increasing yield from 8.8 MT/ha without manure and with 180 kg/ha of phosphorus to 32.6 MT/ha with the use of 20 MT/ha of manure and 180 kg/ha of phosphorus. Changing the level of phosphorus did not have a significant effect on yield. The researchers obtained the highest specific gravity (a measure that correlates with the dry matter content of the sweet potato) through the use of 10 MT/ha of farmyard manure and no phosphorus.

Yield Gaps

Current sweet potato yields in Ethiopia are far below what has been achieved under test conditions. Research station studies in 2006 and 2007 using improved varieties resulted in yields of up to 37.1 MT/ha.[20] Given the FAOSTAT's yield figure of 9 MT/ha for 2010 (see *Figure 2*), this suggests the yield gap in Ethiopia for sweet potatoes could be as high as 28 MT/ha.

Factors Constraining Production and Yields

Factors that constrain sweet potato production and yields in Ethiopia include drought, frost at high altitudes, lack of irrigation, lack of high yielding and adapted cultivars, lack of quality cuttings, damage from handling, lack of appropriate management techniques, and pests and disease.[21]

Planting Materials and Methods

A major constraint to sweet potato production in Ethiopia is the lack of planting material at the beginning of the rains, which leads to late planting over a limited area. This lack of planting material is the main reason why sweet potato production is lower in parts of Sub-Saharan Africa that are relatively farther from the Equator, such as Ethiopia.[22]

No further details were found in the literature on the lack of planting materials in Ethiopia. Evidence from elsewhere in East Africa, including Tanzania, suggests that the lack of good planting materials is one of the largest barriers to production

for farmers.[23] Without sufficient planting materials at the beginning of the growing season, farmers must delay planting, which leads to sweet potatoes that mature after the rains have stopped. This delay causes roots to dry and crack, encouraging weevil infestation. The low availability of vines also increases the likelihood that farmers will use vines infected with disease.

Pests and Disease

Sweet potato diseases in Ethiopia, and elsewhere in Sub-Saharan Africa, are often transmitted through plant propagation.[24] There are approximately 20 viruses that infect sweet potatoes, sometimes in combination.[25] Among the most common are sweet potato feathery mottle virus (SPFMV) and sweet potato chlorotic stunt virus (SPCSV). While not especially damaging to production on their own, these two viruses in combination lead to sweet potato virus disease (SPVD), the most damaging sweet potato disease in East Africa.[26] SPVD leads to stunted plant growth, low production of roots, leaf narrowing and distortion, and chlorosis (a sometimes deadly condition that disrupts photosynthesis).

Until recently, viruses have not been a major limiting factor in sweet potato production in Ethiopia.[27] However, Abraham (2011) studied the level of virus contamination on sweet potato germplasm resources in two research stations in Ethiopia, and found a high level of virus contamination. Based on his own observation and unpublished data from other researchers, Abraham concluded that virus contamination was widespread in southern Ethiopia. Virus contamination in germplasm is a problem because infected germplasm used in breeding programs can easily spread to many farmers and because they may get introduced to new geographic areas. The researchers identified sweet potato featherly mottle virus (SPFMV), sweet potato chlorotic stunt virus (SPCSV), and one incidence of sweet potato virus (SPV2).

Another study (Tesfaye, Feyissa, and Abraham, 2011) examined 97 sweet potato fields in eastern and southern Ethiopia in 2009 and tested vine cuttings for disease. Disease prevalence varied from none at all (in Eastern and Western Hararge Zones) to 12.5% in Awassa Zone and 15.6% in Wolayita Zone. Overall, viruses were frequent in southern Ethiopia and uncommon in eastern Ethiopia. The researchers hypothesized that this was a result of differences in climate, since southern Ethiopia has a lower altitude and warmer, drier climate that favors the aphids and whiteflies that carry the diseases.[28] The most common infections were SPFMV (15.1%), SPCSV (12.9%) and SPVD, the combination of the two (9.3%).

Sweet potato production in East Africa, including Ethiopia, is also vulnerable to pests, especially sweet potato weevil. Weevils damage sweet potato roots and reduce their market value, both during growth and in storage after the harvest. Female sweet potato weevils lay eggs at the base of the plant stem and in the tuber, and the larvae feed and burrow in the plant.[29] No studies were found on the prevalence of sweet potato weevils in Ethiopia. Possible weevil control measures include quarantines of effected areas, insecticides, crop rotation, and early harvesting.

In southern Ethiopia, as well as parts of Uganda, Rwanda, Burundi, and the DRC, the sweet potato butterfly A. acerata is a second major pest.[30] Outbreaks in southern Ethiopia in recent decades have led to yield losses of 31-53% in unsprayed plots.[31] The larvae feed on sweet potato leaves, which in heavy attacks can lead to complete defoliation.[32] Defoliation leads to slower growth and reduced yield in young plants. Sweet potato butterflies are only effectively controlled through insecticide.

Post-Harvest Practices and Challenges for Sweet Potato Farmers

Storage and Transportation Practices

No studies were found that examined sweet potato storage or transportation practices in Ethiopia. In East Africa in general, many farmers practice piecemeal harvesting, and leave the sweet potatoes in the ground until they are needed. Farmers also use underground pits covered with grass, platforms, or baskets.[33] Fresh sweet potatoes have a short shelf life in Sub-Saharan Africa, generally only 1-2 weeks without proper storage.

Post-Harvest Losses

No studies were found that discussed post-harvest damage to sweet potatoes in Ethiopia. Elsewhere in East Africa, several

types of damage have been described in the literature that reduce market value. In conditions of low humidity, sweet potato roots lose water through the protective outer layer, leading to weight loss and shriveling. Rough handling during loading and unloading, as well as impacts while in transit, cause cuts and breaks in the sweet potatoes. Weevil attacks on stored sweet potatoes are also a major source of post-harvest losses.[34]

Marketing Systems

No literature was found that detailed the marketing system for sweet potatoes in Ethiopia. In other parts of East Africa, marketing systems for sweet potatoes are underdeveloped, due to the short shelf life of sweet potatoes. Other common issues for sweet potato marketing include distant or inaccessible markets, lack of available traders, and overproduction during the high season.[35]

One household survey taken in the Amhara and Oromia Regions in the 2005-06 growing season looked at the marketing for crops in Ethiopia in general. The study found that only 2 households out of 141, or 1.4%, grew sweet potato, making it the least common of the 11 vegetable crops in the survey.[36] However, the survey did not focus on sweet potatoes specifically and did not include any locations in southern Ethiopia, the major sweet potato producing region of the country. In addition to the 141 farming households, 95 consumers were surveyed. Of the 26 consumers surveyed that purchased sweet potato, most purchased it from retailers. None purchased it directly from farmers.[37] These sweet potato consumers purchased, on average, 2.3 kg of sweet potato per market day (which occurred 2-3 times per week), at a low price of 1.5 Birr/kg (.17 USD) and a high price of 2.4 Birr/kg (.28 USD). Sweet potatoes sold at a low price for 4.1 months out of the year, and at a high price for 6.4 months of the year.[38]

Literature Review Methodology

Searches for literature were conducted through Google Scholar and the University of Washington library website, using combinations of the terms “Ethiopia,” “sweet potato,” “production,” “price,” “intercropping,” “value chain,” “roots and tubers,” “planting material,” “cutting,” “sales,” “storage,” and “marketing.” Data was also gathered from FAOSTAT and CountrySTAT Ethiopia.

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[6] Kebede, Lemma, Tadesse et al., 2008
[7] Beyero, Tolera, and Abebe, 2010, p. 51
[8] Tofu, Anshebo, Tsegaye et al., 2007
[9] Abdissa, Chali, Tolessa et al., 2011, p.2
[10] Belehu, 2003
[11] Belehu, 2003
[12] Belehu, 2003, p. 3
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[14] Belehu, 2003
[15] Belehu, 2003, p. 17
[16] Ahmed, Nigussie-Dechassa, and Abebie, 2012, p. 1132
[17] Belehu, 2003, p. 23
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