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Gender and Cropping: Yam in Sub-Saharan Africa

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Introduction

Yam is a major staple in West and Central Africa and an important supplementary food in East Africa. Three varieties of yam are grown in Sub-Saharan Africa (SSA), though only two are indigenous to the region. White yam (*D. rotundata*) and yellow yam (*D. cayenensis*) are native to West Africa, and the production area stretches from central Cote d'Ivoire to Cameroon. East African production of water yam (*D. alata*) is historically low compared with West African white and yellow yam production. SSA yam production increased steadily until the mid 1960s when farmers began replacing yam with the hardier and more easily grown cassava, despite cassava being less nutritious.[1] This decline in yam production continued until the mid-1980s, but production has increased steadily since. In the last decade, production in SSA increased from 34 million tons to recent estimates of over 50 million tons.[2] This increase has been achieved mainly through the use of traditional indigenous varieties and can be partly explained by the rapid expansion of yam fields into marginal lands and in nontraditional yam growing areas.[3]

Sub-Saharan Africa accounts for 97 percent of global yam production, with West and Central Africa accounting for about 94 percent. Nigeria is the leading producer with 37 million tons (nearly 75 percent of total world production) followed by Cote d'Ivoire (5 million tons), Ghana (3.6 million), and Benin (2.2 million tons). Ethiopia (220,000 tons) and Sudan (137,000 tons) are the major producers in East Africa. Ghana exports the largest quantity of yam in SSA (about 5,000 tons in 2006 down from a high of 13,000 tons in 2002) annually, mostly for regional trade.[4,5] Despite recent increases in production, yam cultivation is generally limited by high costs of planting material and labor, decreasing soil fertility, inadequate yield potential of varieties, as well as increasing levels of field and storage pests and diseases associated with intensifying cultivation.

Table 1. Characteristics of Yam in SSA

History	Genus: *Dioscorea* West African Species: *D. rotundata* (White yam)*; D. cayenensis* (Yellow Yam) originated in West Africa East African Species: *D. alata* (Water Yam) originated in Asia
Uses	Human consumption; Cultural events like the New Yam Festival; byproducts have limited use in pharmaceutical manufacturing
Demand	High in yam belt of West Africa; nearly exclusively household consumption
Primary Cultivation Challenges	Anthracnose, yam mosaic disease, nematodes
Current Technology Efforts	Machinery: none Traits: higher yielding, pest and disease resistance
Inputs	Labor, fertilizer, planting material (setts)
Major Producers	Tons/year: Nigeria, Cote d'Ivoire, Ghana, Benin, Togo Tons/capita: Benin, Cote d'Ivoire, Nigeria, Ghana, Gabon
Major Consumers	Tons/year: Nigeria, Ghana, Cote d'Ivoire, Benin, Togo Kg/person/year: Benin, Cote d'Ivoire, Ghana, Togo, Nigeria

In SSA, virtually all yams are produced for human consumption.[6] Average daily consumption per capita is highest in Benin (144 kg/person/year), Cote d'Ivoire (120 kg/person/year), and Ghana (114 kg/person/year), while Nigeria dominates total yearly yam consumption in part due to its large population.[7] Women are responsible for processing yams for human consumption. Fresh, peeled tubers are prepared by frying in oil or boiling and then pounding into a thick paste called fufu. Yam tubers

can also be dried and processed into flour, however, this type of processing is less common.

Throughout most of West Africa, yams have great cultural value. Many ethnic groups across the yam belt celebrate the yam harvest with a festival. The Igbo people in Nigeria sacrifice large yams as an offering to the yam spirit Ahiajoku to ensure good yield and continuity of life itself.[8] This veneration during harvest time is indicative of the larger cultural importance of yam. Yam was traditionally seen as the Igbo icon of masculinity, achievement, and identity, and represents a man's ability to provide for his family.[9]

Men's Crop or Women's Crop?

Yams are neither clearly a women's crop nor a men's crop and perceived gender ownership of yam crops varies widely by region and ethnic group. Evidence from the Tai region of Cote d'Ivoire suggests that among root crops, responsibility for yam belongs primarily to men, though women farmers are responsible for cassava. Interestingly, of the 25 crops studied, only yam, coffee, and cacao are considered to be the responsibility of men, while women are responsible for the rest. Men farmers cut the undergrowth, clear fields, raise yam mounds, and plant the yam setts (tuber cuttings), while women weed the yam fields until men harvest the crop.[10]

Evidence from Tanzania, however, suggests that women are generally responsible for yam cropping.[11] Similarly, among the Tiv people of Nigeria, researchers found yam to be a women's crop.[12] Yet among the Igbo people of Nigeria, yam is strictly a men's crop.[13] Doss (2002) notes this variation in gender patterns of cropping and concludes that among Ghanaian farmers, there were no clear gender distinctions between any crops.[14] In particular, with yam, Doss recounts, "I spoke with a woman who worked on women's programs for the government. She emphatically explained that yams were a man's crop. In the same sentence, she invited me to see *her* yam farm." Even though yam may have traditionally been a men's crop, women in Ghana are currently very much involved in cultivation.

Plant Propagation

Yams are propagated using setts (tuber cuttings) from the previous years' harvest. This type of propagation is low cost and not dependent on market availability of seeds. However, it can be doubly detrimental for household food security, because during droughts farmer may choose to consume seed tubers rather than save them for planting.

Seed Yam System

Smallholder farmers can propagate their own yam setts, meaning the crop is accessible to even the poorest farmers. In some cases, farmers also purchase setts from local seed yam vendors. Because of the many constraints in the seed yam system, obtaining seed yam accounts for over 40 percent of yam production costs.[15] Constraints in the seed system include poor storage facilities and high transportation costs which limit the amount of seed yam vendors can procure. Limited access to capital or credit constrains farmers' purchases of seed yam.[16]

Both men and women sell seed yam. Evidence from Nigeria showed that of seed yam vendors, 55 percent were men while 45 percent were women. Interestingly, this proportional pattern was not consistent across religious areas. In primarily Muslim areas, marketing agents were overwhelmingly men, while in non-Muslim areas, marketing agents were primarily women. Overall, in all regions, for both men and women it is the number of years of education and years of experience trading yams that leads to higher volumes of seed yam traded.[17]

Recently, the International Institute of Tropical Agriculture (IITA) and partners have developed a new propagation technique that eliminates the need for tuber cuttings. Instead, the new technique uses vine cuttings and carbonized rice husks as planting material. This new planting method frees up tubers for human consumption that would otherwise be needed for planting. The new technology may also contribute to faster propagation of improved varieties, as it increases the multiplication rate of yam plants.[18] At this point, it is unclear how the new technology will affect women, but it is clear that the increased amount of yam tubers available for food will partially ease food security issues faced by households.

Improved Varieties

Recent improved varieties released in Nigeria have multiple pest and disease resistance. However, progress is slow on breeding for increased yields, adaptability to marginal environments, and improved tuber quality.[19] These three traits are arguably most relevant to women.

Higher yields provide more food for households, and may leave excess yams to sell as a cash crop. Thus yam cultivation has the potential for household income generation. Because women are the primary processors of bulk yam, they have a strong interest in high tuber quality. Finally, adaptability to marginal environments is relevant, particularly, for women farmers who are often forced to farm on marginal plots of land.

Because yams extract substantial amounts of nutrients from the soil to grow, increased tuber yields will lead to quicker soil nutrient depletion if not accompanied by soil and nutrient management strategies. In the case of women, this means that increased yields, though beneficial in the short term, may be detrimental in the long term if they are not able to replace soil nutrients using fertilizer or other cropping methods.

Land Preparation and Soil Fertility

In West Africa, men are primarily responsible for clearing the land, often using slash and burn techniques. Because yams require fertile soil to grow well, they are often planted as the first crop on newly cleared land. Men also prepare the mounds for planting, creating up to 6,000 mounds per hectare of land. This mound-creating process is extremely labor intensive, as it involves shifting many layers of topsoil into mounds up to one meter in height.[20] Even in areas where plowing is undertaken with animals, mounds are still made manually. Mounds are used for four main reasons: to provide the yam with sufficient nutrients by aggregating topsoil, to create a good physical environment for tuber development, to facilitate harvesting, and lastly, to prevent waterlogged conditions.[21]

Elsewhere in SSA, women farmers play a greater role in land preparation for yam cropping. Evidence from a 1984 study of 200 smallholder farmers in Tanzania suggests that women are more involved than men in preparing land for yam planting. Researchers found that in yam cropping, traditionally women exclusively prepared the land, in addition to planting, weeding, harvesting, processing and storing, and marketing, although in recent years men had tended to supply some labor for land preparation and harvesting.[22]

The labor requirements in yam cultivation for mounding, staking (especially in the forest zone), weeding, and harvesting exceed those for other starchy staples such as cassava. Labor costs account for about 40 percent of yam production while 50 percent of the expenditure goes to planting materials.[23]

Land Tenure

Women's ability to access land for cultivation varies considerably across regions and cultures. Even where women may have legal land rights, lack of enforcement restricts their *de facto* rights.[24] In general, for most crops women are responsible for cultivating food for home consumption on household plots whereas men usually grow the main cash crop on personal plots.[25,26] In the case of yams, this means that women who grow yams for household consumption may often be relegated to the more marginal land and will thus have lower yam yields than men who grow on the more fertile soil. Yams produced in both women's and men's fields are consumed by the household, though men often sell a greater proportion of their crop at the market.

Inputs

Yams require rich soils with high organic matter content, which is why farmers in SSA tend to plant yams as the first crop on newly cleared land. Fertilizer improves soil quality, yet utilization rates remain low among SSA farmers. Similar to herbicides, fertilizer is often too expensive for farmers to purchase without credit, and is also subject to supply disruptions. In addition to cost issues, preferences play a role in farmers' decisions to adopt fertilizer. Ekanayake et al. (2003) report that in surveys from West Africa, farmers do not apply chemical fertilizer to yams because they believe the chemicals will have a negative impact on the cooking and storage qualities of the tubers.[27]

Trends in fertilizer use for yams are consistent with general fertilizer use trends in SSA as a whole. According to Altieri (2002), the majority of Africa's farmers are smallholders with less than two hectares and they grow most of their basic food crops with virtually no or minimal fertilizer.[28]

Staking material is a high-cost input, and the labor required for staking yam plants comprises up to 20 percent of all labor in yam production. Men traditionally stake yam plants by placing a wooden or metal stake in each mound onto which the vine is trained as the yam plant grows.[29] Staking aids yam production by directing

vine growth up and away from weeds. This practice helps improve photosynthesis, prevents leaf diseases, and allows for intercropping. Evidence from Nigeria suggests that staking white yam plants may increase yields up to 105 percent.

Intercropping with certain species provides live stakes. Using existing trees or leguminous plants decreases staking costs and may provide additional benefits to the yam crop. For example, when used as staking material, *Gliricidia sepium* provide mulch and nutrients to the yam crop.[30] Staking is not common in East Africa because the water yam (which is the primary yam species grown in East Africa) performs better than the white yam under no-staking conditions.[31]

Intercropping

Both men and women small-scale farmers in West and Central Africa often intercrop yam with food crops such as cassava, maize, okra, and peppers.[32,33] In East Africa, it is common to intercrop yam in banana or coffee plantations. Women may benefit from intercropping by producing more food for household consumption while using less land than would be needed if crops were not intercropped. Additionally, intercropping with maize, sorghum, or small trees provide natural stakes and thus cut down on input costs.

Some intercropping is more beneficial to yams than others. Evidence suggests that of three leguminous trees available for intercropping, only *Gliricidia sepium* significantly increased yam crop yields because of its nitrogen fixing capabilities, and its large leaves decompose slowly providing mulch that protects against weed growth. *Leucauena leucocephala* and *Flemingia macrophylla* were both found to be unsuitable for intercropping with yam.[34]

Even though leguminous plants increase soil nutrients, women tend to intercrop yams with food crops, like maize. Intercropping with maize actually reduces yam yields up to 33 percent.[35] In light of decreased yields, a possible explanation for intercropping with maize is that women are trying to maximize total food crop yield, and may sacrifice yam yields to grow other needed food. Extension services have great potential to increase women farmer's knowledge of improved yam cropping.

Crop Maintenance

Weeding

Weeding is carried out by both women and men farmers, though men tend to take on the more laborious weeding of perennial and persistent weed species.[36] Weed control is very important during the first four months of yam growth, as weed competition during this time may reduce yam yields by nearly 45 percent. In addition to competing with yam for soil nutrients, the roots of weeds may also pierce the skin of young tubers, thereby increasing the tuber's susceptibility to pathogens.[37] Because white yam matures slower than water yam, white yam requires more weeding than water yam.

Currently, most farmers weed without the aid of technology. Herbicides control weed growth but are often prohibitively expensive, especially for women farmers who lack access to credit. In addition, intercropping practices complicate application schedules.

Harvest

Both men and women harvest yams. Milking (periodic removal of one or more tubers while keeping the plant intact) is a common way to harvest yams.[38] Care is required with the yam tubers as injured areas provide entry points for pests and pathogens. Between 10 and 30 percent of the annual harvest is reserved for planting stock.

Storage

After harvest, women collect the tubers from the field and transport them to the household for storage or market for sale. Unlike cassava and sweet potato, yam tubers can be stored above-ground up to six months at ambient temperatures. This characteristic contributes to household food security, especially in the difficult period at the start of the wet season.[39]

Storage systems differ widely among farmers, but all systems require adequate ventilation, shade, and rain protection. In fields without transport access, yams can be stored in underground pits or piled under a shady tree. This method, however, increases the risk of deterioration in quality and pathogen attacks.[40] Adequate post-harvest storage insures the yam crop and contributes to household food security.

Post-Harvest Processing

Yams are most often processed for household consumption. Women prepare fried yam, pounded yam (fufu), or other culinary dishes. Industrial processing of yams is minimal in SSA. This lack of processing technology constrains yam exports because unprocessed yams are bulky and expensive to transport. Expanded export opportunities for processed yams could greatly benefit women farmers because they are the primary processors of yam. Little research exists on current processing technologies in SSA. In Ghana, 'minimal processing' techniques were introduced to mitigate post-harvest losses and generate yam products that were easily consumed. A small study investigated two methods of quick processing yams: parboiling and steaming. The processed yam were then packaged and frozen for 12 weeks. Results indicated that consumers preferred yams that were steamed before freezing.[41]

To increase the value of yam in urban markets, bulk yam is often processed into dry yam chips by commercial vendors. The techniques have been spreading throughout West Africa from Nigeria and Benin to Burkina Faso, north Cameroon, and Cote d'Ivoire, but dissemination of the technique is by no means complete.[42]

Consumption and Sale

Yams are consumed in various food forms, but most often as fufu (boiled then pounded with a mortar and pestle into a thick paste), fried in oil, or dried into flour. Tuber-quality is a major criterion for acceptance of new varieties by farmers. For example, the water yam (*D. alata)* is not widely grown in West Africa because fufu made with the water yam is not palatable to most West Africans.[43] Yams are high in Vitamin C, dietary fiber, Vitamin B6, potassium, and manganese. They are also a fair to good source of calcium, phosphorous, and iron, but contain no carotene. Yams are low in saturated fat and sodium.[44]

Yams are sold most often as fresh produce in markets in West Africa. Through commercial flows, surplus yams from the West African coastal countries move to the urban areas of the Sahel and several rural areas during times of food shortages. Yams are also a first substitute when cereal prices start to rise.[45]

Conclusion

Yams are an important staple crop in SSA, particularly in West Africa where the majority of yams are produced. The traditional importance of yams in many ethnic groups ensures its continued cultivation, even with increased cultivation of cassava and cereals. Though yam was traditionally considered a man's crop, it is clear that women farmers contribute greatly to yam cultivation, especially during weeding, harvesting, and processing.

Propagation of improved varieties with resistance to pests and diseases like yam mosaic disease has great potential to benefit women farmers. Increased yields and lower post-harvest losses will increase household food security. However, because yams extract high amounts of nutrients from the soil, soil and land management techniques are necessary to ensure future gains in yield.

Women's groups serve as potential venues for dissemination of new yam cultivation and processing technologies. Additionally, women's groups can undertake new propagation techniques as income generating activities. Women farmers need increased extension efforts to fully benefit from technology improvements.

Please direct comments or questions about this research to Leigh Anderson, at eparx@u.washington.edu.

Endnotes

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