The Yam Value Chain: Challenges and Strategies In Overcoming Constraints

Yam (Dioscorea spp) is the second most important tuber crop in the whole world after cassava, in terms of production. They form an important food source in other tropical countries including East Africa, the Caribbean, South America, India and South East Asia. Nigeria is the highest world producer of yam with 47.9 million MT annually with Ghana (7.9 million MT) and Cote d'Ivoire (7.1 million MT) as second and third largest producers respectively (FAO, 2017).

Yam production in Nigeria

Yam production in Nigeria is thriving - in fact the UN's food agency says Nigeria produces more than 60% of the entire world's yams. Despite this, Nigeria is not one of the world top exporters. Its neighbour, Ghana, produces far less but exports more yams to European countries such as the UK than Nigeria does. Yam is majorly grown in Benue, Sokoto, Abia, Anambra, Delta, Edo, Enugu, Ebonyi, Niger, Taraba, Osun, Oyo and Plateau; other producing states include Ondo, Ogun, Ekiti and Adamawa.

Importance of Yam

Yam tubers are high in moisture contents between 60 and 85% and dry matter content ranges between 7 and 40%. The observed high moisture content influences the keeping quality of tubers adversely. In terms of protein and fat, yam tubers may not be considered as a very rich food sources. Yam tubers are good energy sources and the energy is derived mainly from carbohydrate since the tubers are low in fats.

Most of the yam species may be considered rich in three minerals, namely: calcium, phosphorus and iron. The vitamin contents of some yam tubers include carotene (pro-vitamin A), thiamine, riboflavin, niacin (nicotinic acid) and ascorbic acid. Whole yam proteins are low in histidine,

methionine, leucine, isoleucine, and valine. The limiting amino acids in the yam tubers are the sulphur containing amino acids.

Some toxicants of yam tubers include phytic acid, tannins, oxalic acid, hydrocyanic acid, dioscorine, dihydrodioscorine, saponins and sapogenins acid. These toxicants which are present in low amount precipitate upon cooking and are rendered harmless and nutritionally available when yam is cooked with proteinous food substances. Fresh tubers, yam tuber have about 70% water, 25% starch, 2% protein and 3% of vitamins and traces of sugar.

Although they're considered to be a starchy vegetable, yams are made up of complex carbohydrates and dietary fiber allowing for slow uptake to keep blood sugar levels even, giving it the nod as a low glycemic index food. The vitamin A that is converted into beta-carotene when eating yams isn't as spectacular as those in sweet potatoes, but the antioxidants they provide are exceptional. The vitamin A in yams has other functions, such as maintaining healthy mucous membranes and skin, heightening night vision, supporting healthy bone development, and providing protection from lung and mouth cancers.

Yams are a good source of vitamin C – 27% of the daily value for fighting infections such as colds and flu and quick wound healing, anti-aging, strong bones, and healthy immune function. It also provides good amounts of fiber, potassium, manganese, and metabolic B vitamins. The content of vitamin B6 (pyridoxine; 16% of the daily value) is good for shrinking the effects of homocysteine, which can do real damage to cell walls that could lead to heart attacks and/or stroke.

Other nutrients in yams include thiamin (vitamin B1), riboflavin, folic acid, pantothenic acid, and niacin. Copper (which produces healthy red blood cells), calcium, potassium (supporting optimal cell and body fluids), iron, manganese (a component in the super-potent antioxidant enzyme superoxide dismutase), and phosphorus are body-beneficial minerals found in yams. Chinese, Korean, and Japanese medicine has made use of yams for years because they contain allantoin, although that wasn't always known. This compound speeds up the healing process when applied as a poultice to boils and abscesses, but is also used to stimulate appetite and relieve bronchial trouble. Unless they're peeled and cooked, yams may contain toxins such as dioscorin, diosgenin, and tri-terpenes that you don't get from sweet potatoes.

Yam Delicacies

Yam may be barbecued, roasted, fried, grilled, boiled, baked, smoked, pounded into paste (pounded yam) or grated and made into a dessert. It may be cooked or fried with rice, beans, plantain, sweet potato, lamb, chicken, and butter nut as squash soup.

Roasted yam

It can be boiled, roasted and eaten with oil, vegetable or sauce. The tubers may be peeled and sliced into tiny pieces and dried to very low moisture contents and milled into yam flour and flakes. The tubers may be peeled and prepared into porridge and cooked with traditional spices.

Pounded yam served with Egusi soup

Yam flour: The tubers are sliced to a thickness of about 10 mm, more or less, depending on the dryness of the weather. The slices are then parboiled and allowed to cool in the cooking water. The parboiled slices are peeled and dried in the sun to reduce the moisture content. The dried slices are then ground to flour in a wooden mortar and repeatedly sieved to produce a uniform texture. Today, small, hand-operated or engine-driven corn mills or flourmills are increasingly used. Treatment with sodium bisulphate is often used to prevent phenolic oxidation during drying which darkens the colour of the product (especially with white guinea yam, D. rotundata). Blanching in place of sodium bisulphate achieves similar results. The yam flour is rehydrated and reconstituted into fufu and eaten with a soup containing fish, meat and/or vegetables

Yam Flour (Elubo)

Bottlenecks to Yam Production

Many farmers retain and use about 25% of the yam harvested as planting material for next crop. Where the number of seed yams required is large, especially when there is expansion in farm size, the proportion as planting materials may be consistently higher. The cost of planting materials represents about 50% of the cost of yam production. The traditional methods of yam production include double harvesting and cutting large tubers into setts of 150-1000g.

Pests and diseases in both field and storage constitute the most important constraint in yam production; pests especially yam beetles create holes in the tubers and reduced the quality of the tubers and also facilitate fungal infection leading to tuber rots. Attack by nematodes affects the quality of tubers too. Infestations by nematodes in yam producing areas increase due to the shortening of fallow.

Staking could double cost of yam production especially in areas where live stakes or crop stakes are not present in the farm for trailing of the vines. Stakes also deteriorate in value within a year demanding for fresh stakes in subsequent cropping year(s) and this poses a serious stress on the farmer who desires for high yield of the crop.

Weeding is also considered as a major challenge to yam in the tropics because weeds easily developed under stake condition because of low canopy cover. The yam varieties in famers' field are high yielding and low foliage and this situation creates favorable condition and open spaces for rapid weed growth. Farmers weed three times before final harvest and this increases the overhead cost of production and reduces profit margins of yam farmers.

Farmers lack knowledge about definite food quality indicators in the yam tubers that can determine or predict the quality of the product. Indigenous knowledge such as pattern of leaf foliage, smoothness and shape of the tubers are used to identify species and varieties rather than for predicting food quality.

Other bottlenecks include decline in soil fertility, labour cost for land (heap) preparation, and barn making, scarcity of planting materials and consumer preference to its close substitute (potato).

Prospects in the Yam Value Chain

Aggressive efforts towards the realization of the highest yield possible have been intensified. Some of the measures for improvement in yam production include:

The yam minisett technologies were developed by the National Root Crops Research Institute, Umudike several decades ago to address the problem of high cost and scarcity of seed yam (Okolie et al., 1982). Yam minisett is a section from a clean, healthy yam tuber weighing approximately 25g or less, about 15 to 25 setts can be obtained from an average seed yam (Enwezor et al., 1989). A tuber of 20cm long can give about 5-6 disc, which gives 20 to 24 minisetts (Otoo et al., 2001). The minisett technique could increase yam production due to ready availability of planting materials at affordable cost and high multiplication ratio (Ezulike et al., 2006) and this technique could encourage many farmers to go back to yam production (Ekpe et al., 2005), thereby increasing total yam output.

Propagation by Vine Cutting: Sett production through yam vine cuttings increases the multiplication of clones beyond levels possible through conventional use of tuber sett, and a lot of tubers need not be reserved for planting purposes. Cuttings of the vine excluding a node never rooted, even after being treated with rooting substances. A cutting normally involves a node made in such a way that about 2.5cm of vine tissue is left attached below and above the node, with the leaf intact. Increase in number of nodes leads to increase in the growth of the resulting root, tuber and shoot. Using single-node cuttings, procedure has been developed for the propagation of virus-free tested clones of yam. A two step propagation developed for yam involves, placing single-node cuttings in a liquid culture medium for 1 month to induce multiple shoot formation, followed by sub culturing the node cuttings in solid media for distribution. Virus-tested clonal materials are micro propagated and distributed on request to national programmes as plantlets and microtubers of yam

The National Root Crops Research Institute, Umudke, in collaboration with other research institutes has directed attention and research to the development of non-stake yam. Staking has been considered to increase cost of yam production. Breeding and selection of yam for non-staking potentials by the NRCRI, Umudike would be another milestone in the development of farmers friendly technology and could encourage more farmers to go back to yam production, thereby increasing total tuber yield.

Advances in Soil Management: Soil fertility is probably the most crucial factor in the cultivation of yams in Nigeria. Integrated plant nutrition, integrated nutrient supply or integrated nutrient management system is a recent development advocated by the Food and Agriculture organization (FAO). It is the combination of organic and inorganic fertilizer, coupled with soil conservation farming system in the supply of nutrients to crops. Researches conducted on effectiveness of organic mineral fertilizer result in higher crop yield compared with recommended NPK fertilizer alone, efforts in this direction will build up soil productivity and quality on long term basis. Compared with chemical fertilizers integrated plant nutrition ensures longer residual effect and overall development of soil physical, chemical and biological qualities.

Agricultural Policy and Institutional Support: The Federal Government of Nigeria has continued with the implementation of the Agricultural Transformation Action Plan (ATAP). Under the Growth Enhancement Support Scheme (GESS) designed to give farmers timely access to agricultural inputs, 17 major fertilizer suppliers were selected to supply the commodity to about 2,500 agro-dealers across the country. In addition, a national farmers' census was carried out in 2012 to create a reliable database for effective input distribution under the scheme (CBN, 2012). It is expected that yam farmers in Nigeria through the All Farmers Association of Nigeria (AFAN) will key into this noble plan of the Federal Government of Nigeria by demanding for seed yams for farmers.

Packaging: There is need to understand produce packaging methods and procedures in order to meet international standards. There is also need to check whether the yams were well packaged, for instance in perforated cartons to allow for air circulation. This will make the yams not to rot easily.

The way tubers of yam would be packaged is quite different from the way beans or any other commodity would be packaged. For instance, if it fails the best practices test, it would go bad and be rejected on delivery. Tubers of yam cannot just be loaded into containers and exported.

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