

Synthesis Report for Yam in Nigeria

Nigeria, January 2019

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1. PRODUCT DEMAND

Table 1: Sok : Response from Key informants

	<i>Responses of key informants</i>
Scale of production of the crop associated with the product	Farm families produce between 0.5– 3.5ha
Variations of the product	There are variations of the product. These include; Boiled yam, Pounded yam, roasted yam, porridge yam and fried yam
Different demand segments associated with the product	Market demand is high for Yam especially among the adult men who usually sell and buy.-being majorly a male activity. Prepared at home is majorly dominated among the female folk. The major consumers are also the adult men who consume the product in varied forms. Prepared at home is higher than purchased in the markets
Size and trends of the demand segment associated with the product	
Demand segments (geographical, agroecological) for the product and its variations	Most of yams are bought from Benue State and taken to Eastern Nigeria. Lots of yams are also produced in Ebonyi State and riverine parts of Anambra State. The riverine parts of Anambra State release the first ware yams as early as July/August to sustain consumption before yams planted during the rains starts coming to the market from December through April
Demographics of the demand segments for the product	Demand cut across ages that are mainly adult males, gender and marital status. Most large households consume more yams. This is also synonymous with the availability of family labour for most of the laborious operations/activities for yam production
How demand segments correspond to preferred characteristics for the product	Land is usually available and mostly the yam varieties are usually Nwopoko. The constraint is majorly lack of soil fertility and Early maturing varieties
Product chain and how the product is transported, stored and sold	The product chain include:- production majorly men and assisted by women and youths/children in the male owned yam farms. Harvesting is usually a male dominated activity while the adult men and women engage in selling. The adult men dominate the yam transport section. Marketers and consumers include the Hoteliers, households, food vendors, schools, hospitals etc
Profitability of the product, by demand segment	The product is highly profitable and demand driven. Those farmers who produce and sell yam make a lot of profit from it and the retailers. More profit are made by the middlemen who might be whole sales/retailers compared to producers who sell to the wholesalers and retailers. The producers who bring the yams to the market incur a lot of transportation/transactions costs. They therefore prefer to sale in the farm or to middlemen who reap most of the profits within the value chain

Nigeria is the largest yam producer in the world, contributing two-thirds of global yam production each year. In 2016 Nigeria's yam production was 44.1 million tonnes, which represented 67% of the global production (www.fao.org/faostat/). Sahel (2014) states that 92% of the world's production of yam comes from West Africa, with Nigeria and Ghana being the main producers. According to the General Household Survey (GHS)-Panel in 2014, 46% of households in the post-planting season, and 53% of households in the post-harvest season, reported consuming yams in the week preceding the interview.

Several observations stand out clearly in the report by Nweke et al (2013): there is direct association between the frequency of yam consumption and consumer's income group and there is inverse association between the frequencies of yam consumption and retail market price of yam relative to the prices of its substitutes. These observations are dramatic and consistent in Nigeria. The two

observations underscore the argument that an increase in consumer income in the countries (Nigeria, Ghana, Burkina Faso, Mali in this case) or improvement in road network within and among yam producing and consuming countries impact positively on the frequencies of yam consumption. From 2005 to 2009, average annual per capita yam consumption was Nigeria, 84.4 kg; Ghana, 127.4; Mali, 5.2; and Burkina Faso, 2.2 kg (Nweke et al, 2013). Growth in yam consumption was higher than growth in population in Nigeria and Ghana, kept pace with population in Mali and was lower than population growth in Burkina Faso.

Yam consumers can be segmented by income group. An upper income group is likely to be a frequent yam consumer, and a lower income group is likely to consume yam less. Differences in yam consumption frequency between producing and non-producing regions within a country is low, especially in regions with relatively developed market access infrastructure because of high market demand for the food crop. Men and women eat boiled yam *per se* at about equal frequencies but in countries where yam food products are diversified, men and women eat different yam products at different frequencies (Nweke et al., 2013) especially for pounded yam consumed more by men.

In all four countries surveyed (i.e. Nigeria, Ghana, Mali, Burkina Faso) men and women eat yam at about equal frequencies, however where yam food products are diversified such as in Nigeria and Mali, men and women eat different yam products at different frequencies. For example, according to Nweke et al (2013), in Nigeria, men eat pounded yam more frequently than women and women eat pondo yam more frequently than men. In Mali, men eat roasted (grilled) yam more frequently than women and women eat other yam, such as fried yam (yam cooked in oil), more frequently than men. In view of this, it was concluded that men and women may prefer different yam food products, gender does not influence the frequency of yam consumption *per se* (Table 2).

Table 2: Frequency of yam consumption (number of times per person per week) by gender in December 2012

<i>Country</i>	<i>Male</i>	<i>Female</i>
Nigeria	5.50	5.98
Ghana	1.75	1.77
Mali	1.32	1.40
Burkina Faso	0.91	0.87

Source: Nweke et al (2013); survey work.

Yam is not price competitive with substitute staples such as cassava, maize, rice, sweet potato, etc. In Nigeria, the retail price of yam is higher than the retail prices of all the substitute staples. The report revealed that yam production technologies have not changed significantly over time; this could be one of the reasons for high yam prices because high production cost is associated with low production technology. Their conclusion that most commonly grown yam cultivars in the major producing areas have been there since primitive times is close to observations (Nweke et al., 2013).

The time of first introduction of most commonly grown yam cultivars are not known to the present generation of farmers and since such information is transferred from generation to generation, the approximate years were not known to the previous generation of farmers, and so on. Few cultivars which were reported introduced in the past 20 years from other producing areas have not made the list of five most commonly grown cultivars in the major producing areas.

Lack of improved technology for seed yam production, multiplication and storage is a hindrance to the establishment of a formal, i.e. private sustainable yam seed system. The formal yam seed system is weak in Nigeria, sometimes depending on the informal traditional system for support instead of the other way.

The present state of yam storage technologies has a negative impact on yam consumption in two ways. The lack of effective storage technology leads to seasonality in yam supply and exposure of yam in storage to damage by fungus, bacteria, pests, etc., which leads to wastage. Therefore, improvement in yam storage technology that can eliminate seasonality in yam supply and/or reduce losses due to

damage in storage can increase yam supply, reduce cost and drive down the price of yam to consumers and therefore enhance consumption.

Demand for yam for use as a ritual object in cultural rites of passage, thanksgiving, petition and appeasement practiced in major producing and consuming centres is high enough to have significant effect on yam consumption. This market is sustainable because these are important cultural events. It is noted that yam is also used as ritual object in Christian churches in the yam producing areas. Additionally, these cultural rites have their roots planted in the existence of individuals and communities communally and therefore institutionalized.

The influence of the ceremonial yam market on yam production technology is unclear. Farmers focus on production of large-sized yam tubers to satisfy the ceremonial yam market. But it is not known if farmers' reluctance to change production technology has anything to do with their quest to produce the largest yam tubers possible within environmental conditions.

Discussion of whether there is association between farmers' quest for the largest possible tuber size and yam technology development posed several questions. Is emphasis on producing large tubers an impediment to technology change in yam production? Is there conflict between yam technology development and emphasis on producing the largest possible tuber size? Is the need to produce large sized tubers for cultural rites responsible for the farmers' practice of planting yams in mounds? Is there a relationship between yam seedbed type and size of tuber produced? Would higher demand from consumers outside West Africa discourage farmers in West Africa from dogmatic adherence to production methods adapted to generating the highest possible tuber-sized yams?

A note of caution regarding large tubers is found in a study by Amegbeto et al. (2008, quoted in Kleih et al, 2012) who analysed diminishing marginal returns based on tuber size. The study identified optimum yam size, shape, and aesthetic characteristics that suggest farmers would benefit more from targeting majority production of smaller, less heavy tubers that are presented with fewer 'unattractive' properties such as beetle holes and roots. The authors suggest increased focus on crop management practices and management of soil fertility to improve the general quality of tubers produced for commercial sale.

Estimates of future consumption levels show that major yam producing centres will generate significant amounts of surplus yam in the next fifteen years, while minor producing countries will have deficits. Large surpluses are unlikely to occur in any West African country other than Nigeria and Ghana given low levels of aggregate production in all the other countries. In the case of higher consumption than supply in several other countries in the region like, Burkina Faso and Mali, this will generate deficits and result in greater imports from Nigeria and Ghana.

These projections are based on weak methods and on data that has doubtful credibility yet the value of the estimates as indicators of what future consumption level can be call for investment in measures to expand yam consumption at home and/or expand export opportunities in major producing countries. Speeding up the rate of improvement of the West African interstate highways will help distribute surplus yams in Nigeria and Ghana to marginal producing countries through export-import trade.

2. INCOME

Within a country, yam consumer demand segments are best characterized by income; the higher the income groups of the consumer, the higher the frequency of his/her yam consumption. But Nigerian experience reveals that type of yam product consumed is also related to income; the frequency of consumption of pounded yam increases while the frequency of consumption of *amala* decreases from low through medium to upper income group. *Amala* appeals to medium income group because its price is half the price of *pounded yam* but higher than the prices of *semo* and *gari*.

3. COMPETITIVENESS OF YAM WITH ALTERNATIVE FOOD STAPLES

Yam consumption is compared with consumption of alternative staples. Consumption is in terms of frequency, i.e. number of times per week an individual ate yam or alternative staple. In some countries, yam is prepared into different forms, which are different products from the consumer's point of view. A prepared form of yam can have a different set of substitutes than another form. Yam consumption is compared with other staples which are substitutes to yam as a product and where applicable alternative yam products are compared with their specific substitutes like gari, sweetpotato, rice etc. Yam consumption data collected reveal that in south eastern Nigeria yam consumption was above average from September of one year to February of the following year; December was the peak period of yam consumption. Convincing evidence (Nweke et al., 2013) show that high yam production cost is a drag on yam consumption through high product prices. It is also evident that certain physiological properties of the yam tuber are a clog in the wheel of yam consumption especially the instability nature of pounded yam which cannot stay for long after preparation. Range of food staples that compete with yam and range of foods prepared from yam and frequencies of yam consumption all vary significantly among representative countries.



Figure 1: Diverse food forms from yam (*D. rotundata* and *D. cayenensis*).

Source: Obidiegwu, J.E. and Akpabio, M.E (2017)

Kleih et al (2012) show that the consumption of yam is affected by competition from substitute crops. For instance, Asumugha et al (2007b, in Kleih et al, 2012) noted that when prices for yam increase, lower income households increase consumption of gari (processed cassava), and other households switch to the consumption of cereals.

4. DEMAND AND FREQUENCY OF CONSUMPTION PATTERNS FOR DIFFERENT FOOD FORMS OF YAM

In Nigeria, cassava, rice and plantain are basic substitutes for yam as a staple. On average, yam is eaten six times a week and cassava seven times. Rice and plantain are eaten less frequently, rice-five times and plantain three times a week. In Nigeria, yam is prepared as pounded yam, *poundo yam* (industrially prepared yam flour), *amala* (traditionally prepared yam flour), boiled yam and others. Yam is eaten most frequently as boiled yam, followed by *amala*, pounded yam and *poundo yam*. *Poundo yam*, *gari* (granulated cassava food product) and *semo* (industrially prepared grain flour) are pre-processed products.

Comparison of frequencies of consumption of alternative yam food products with their specific substitutes highlights the impact of physiological properties on the frequency of yam consumption. In Nigeria, yam in pounded form, plantain and wheat are a different set of substitutes because, in contrast to gari and semo, they are not pre-processed; cooking each of them includes extra preparation cost.

For examples, most of the time whole wheat grain is bought and taken to the mill to be milled; cooking yam into pounded form includes laborious peeling and pounding. Plantain is cooked in two alternative forms; ripe plantain which is fried (cooked in oil) and unripe plantain which is boiled and eaten pounded or not. Substitution is among pounded yam, pounded unripe plantain and wheat flour because they are eaten the same way as foofoo.

Among yam consumers in Nigeria pounded yam is ultimate in status food, but wheat and plantain have combined to reduce its consumption frequency to an average of once a week. The average frequencies are pounded yam, 1.24; wheat, 1.21; and plantain, 2.99 per person per week. As status food, pounded yam is served at high class ceremonies and at food joints, but it has dual drawbacks. Diabetics who are often people with means to engage in pounded yam avoid it believing it to be high in carbohydrates. Such people's preference for pounded plantain and wheat flour considered by them to be low in carbohydrates reduce the consumption frequency of pounded yam.

Yam is unstable in cooked or pre-processed form such as pouno yam. Cooked yam products, i.e. pounded, boiled, roasted (grilled) and cooked pouno yam are unstable; they lose quality hours after preparation. Therefore yam is cooked in quantities that must be consumed within a short period to avoid waste, with implications for yam as restaurant food. To eat pounded yam in popular restaurants which serve it, one must go in early afternoon before prepared pounded yam runs out. In hotel restaurants, pounded yam is served as *a la cart*.

Apart from high price noted, quality instability is a barrier to pouno yam consumption. Surveys conducted for this report disclosed that packaged pouno yam was not common in market shelves in Nigeria; traders explained that demand was low because of high cost and because consumers have access to the real thing, namely pounded yam. The traders further revealed that when sale was delayed the product deteriorated because pouno yam was more susceptible to weevils and mould than grain flour.

5. AGRONOMIC NORMS AND GENDER ROLES

Yam growing and handling involves many operations, some of which follow gender lines/stereotyping in some regions. In the south-eastern part of Nigeria, for instance, men and women combine efforts to do the planting; the women carry out weeding which is usually done 2-3 times before harvest; and men and women combine efforts again at crop maturity to do the harvest.

There is a well-established seed yam market in states such as Edo and Kogi, for example in the town of Ilushi on the shores of the River Niger (Kleih et al, 2012). As a consequence, the variety of seed yam (also in terms of size and grades) is much more varied than in Oyo State. Popular varieties include *Ekpe*, *Mumunye* (relatively new variety), *Akpaji*, and *Uboko*. The relatively wide planting density tends to result in yam tubers which are considerably larger and heavier than the tubers harvested in yam producing areas in Western Nigeria such as Oyo North. For example, they are often used for ceremonial purposes.

Table 3: Comparative perspectives on yam cropping in Southern Nigeria

	<i>Ibibio (Akwa Ibom State)</i>	<i>Efik (Cross River State)</i>	<i>Igbo (Anambra State)</i>
Gender perspectives	Yam is predominantly a “male” crop	Same practices	Same practices
	Farming tasks are divided by gender: for men it encompasses bush clearing, ground preparation, rituals, seed selection and deposition, staking, trailing, harvesting, barn preparation and storage; for women it encompasses covering yam seedlings, weeding, conveying tubers for storage, and cooking. These are the traditional division of labor between the sexes		
Economic value	Mostly subsistent with less commercial interest	Subsistent and commercial	
Religious values	Ritual ceremonies before cultivation and harvesting (usoro ndem udia, usoro obufa udia)	New Yam Festival (Usoro obufa udia)	
Symbolic value	Enhances the social status of men	Enhances the social status of men	Enhances the social status of men (e.g., certain traditional titles)
	Ownership symbolizes wealth	Ownership symbolizes wealth	Ownership symbolizes wealth
Mode of cultivation	Manual	Manual	Manual
	Small-scale and family-centered	Small-scale and family-centered	Small-scale and family-centered
	Large-scale cultivation creates the need for polygamous relationship as a means to support labor	Large-scale cultivation creates the need for polygamous relationships as a means to support labor	Large-scale cultivation creates the need for polygamous relationships as a means to support labor
Access and ownership rights	Men enjoy absolute access and ownership rights, whereas women’s rights of access are at the will of their husbands	Same	

Source: Obidiegwu, J.E. and Akpabio, E.M. (2017)

Table 4: Gross margin analysis for ware yam produced in Kogi State (near Idah) (400 mounds / 0.3 acres)

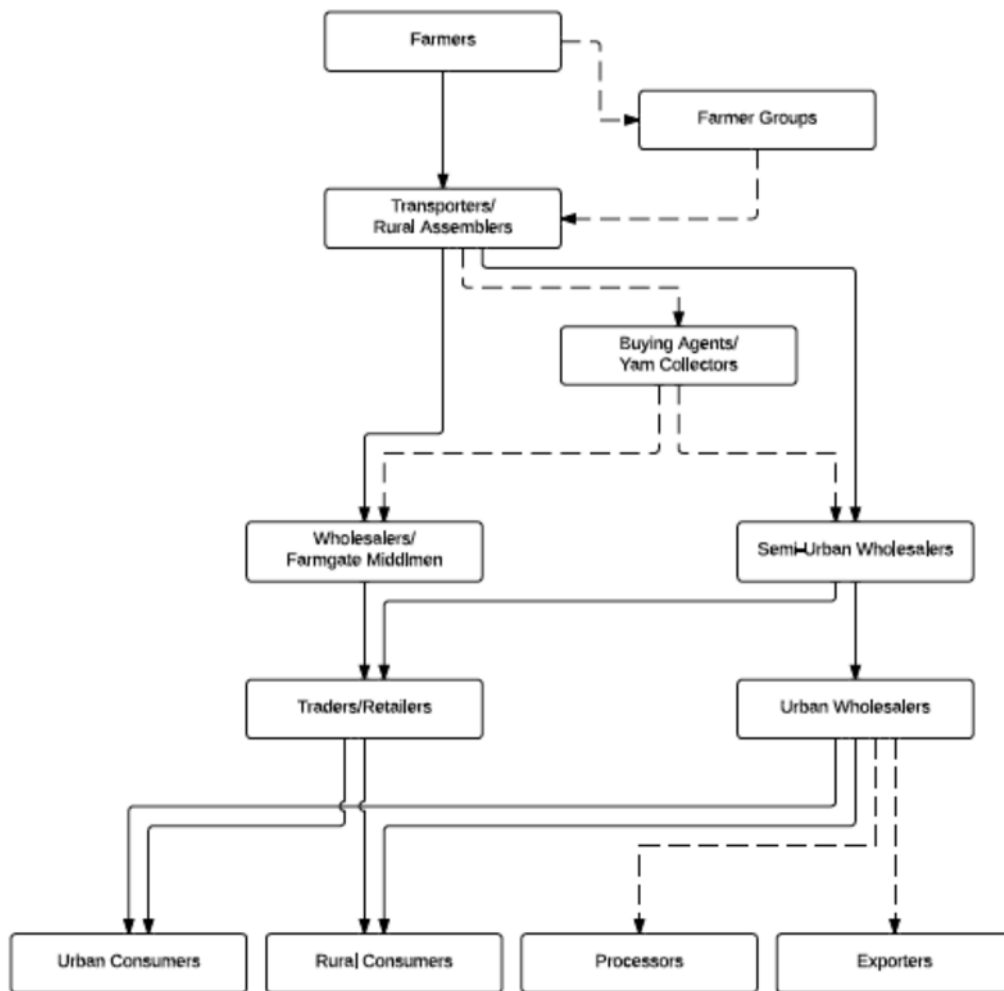
<i>Month</i>	<i>Activity / Input</i>	<i>Cost per mound (N)</i>	<i>Actor/ Gender</i>
	Value of land	12.50	
Nov / Dec	Clearing of land	7.50	M/W
Nov / Dec	Tilling	12.50	M
Nov / Dec	Heaping and planting (labour)	12.50	M
	Seed (good quality seed)	100.00	
Jan – March	Staking (labour)	7.50	M
	Bamboo sticks (used 2 seasons)	12.50	
Jan – March	Roping	3.75	M
	Fertiliser (one bag of urea)	15.00	
	1 st weeding (chemicals)	3.19	
April	1 st weeding (labour)	2.50	M
May	2 nd weeding (labour)	3.75	M/W
August	3 rd weeding (labour)	3.75	M/W
May / June	Boring	15.00	M
Jul/Aug – Oct	Harvest	7.50	M/W
	Transport (field to farm)	10.00	W
	Transport (boat to Onitsha)	25.00	M
	Capital costs (opportunity costs)	25.44	
	Total production costs per mound	279.88	
	Cost of production per field (400)	111,953	
	Tubers sold (70%, rest is loss)	280	
	Price per tuber (large), N	300 to 500	
	Revenue per field (0.3 acres), N	84,000 to 140,000	
	Gross margin per field (0.3 acres)	-27,953 to 28,048	
	Gross margin per acre, N	-93,175 to 93,492	

Source: Kleih et al (2012)

Table 4 provides an example of gross margin analysis of ware yam production in Kogi State, illustrating how the sales price of tubers influences the extent to which a positive or negative gross margin can be achieved. Also, it illustrates how women take part in certain activities of yam production.

6. CROP UTILIZATION AND MARKETING

In the survey by Mignouna et al (2014), farmers provided information on how they utilized the yam they have as total available stock; 6.8% was reported as carry-over stock from the previous harvest. Yam utilization does not vary significantly across the agro-ecological zones (AEZ). The proportion sold from recall-based information is 61% while from farmers' fields about 58% of yam harvested was designated for sale. Yam is more of a cash crop and therefore a potential crop for income generation. The survey results indicate that the village market is the most important point of sale followed by the main/district market. According to Mignouna et al (2014), yam is primarily considered a man's crop and all the agricultural activities are predominantly carried out by men, however this does not exclude women from getting involved in some of the activities, such as marketing and trading. Survey findings indicate that farmgate selling remains almost entirely a male domain. Since men mostly produce the crop, this leads them to take the decision about the disposal of their output. The situation reverses at the main market where women mainly dominate sales. Brokers/ middlemen buy yam directly from farmers for resale and get the major share of the profit, though they also take the most risk.



Key:
 ———> Major link
 - - -> Other possible links

Figure 2: Yam Value Chain:Nigeria
 Source: Bergh et al., (2012)

7. ADOPTION OF YAM VARIETIES

According to Mignouna et al (2014), no improved yam varieties were identified in Nigerian farmers' fields. No adoption of improved yam varieties in the surveyed communities was therefore reported for the main reason that farmers had no access to seeds of improved varieties. Other reasons considered to have inhibited the adoption of improved varieties could be (i) a minimum requirement of cultivable land for demonstrations; and (ii) continuous seed multiplication might have affected improved varieties released so they were no longer easily distinguished from a wide range of local genotypes, especially since these new varieties were released without any friendly local name. The survey results show that improved yam varieties, such as *TDr 89/02565*, *TDr 89/02665*, *TDr 89/02461*, *TDr 89/02461*, *TDr 89/02660*, *TDr 89/02475*, *TDr 95/19158*, and *DRN 200/4/2*, with multiple pest and disease resistances, have been released in Nigeria but these varieties did not reach farmers' fields.

Table 5: Mean value of land holding (ha)

Characteristics	All	SGS	DS	HF
N	800	232	476	92
All	2.38	2.85	2.19	2.19
Allocated to yam	1.53	1.96	1.35	1.38
Allocated to seed yam	0.27	0.37	0.24	0.17
Allocated for women	0.10	0.07	0.09	1.18

N = Number of respondents; SGS = Southern Guinea Savanna; DS = Derived Savannah;

HF = Humid Forest

Source: Mignouna et al (2014)

Figure 3 shows that the perceptions regarding constraints faced during yam production and post-harvest operations are quite similar for households headed by males or females. This could be due to the fact that both are oriented towards a commercial production of the same varieties with a high market demand.

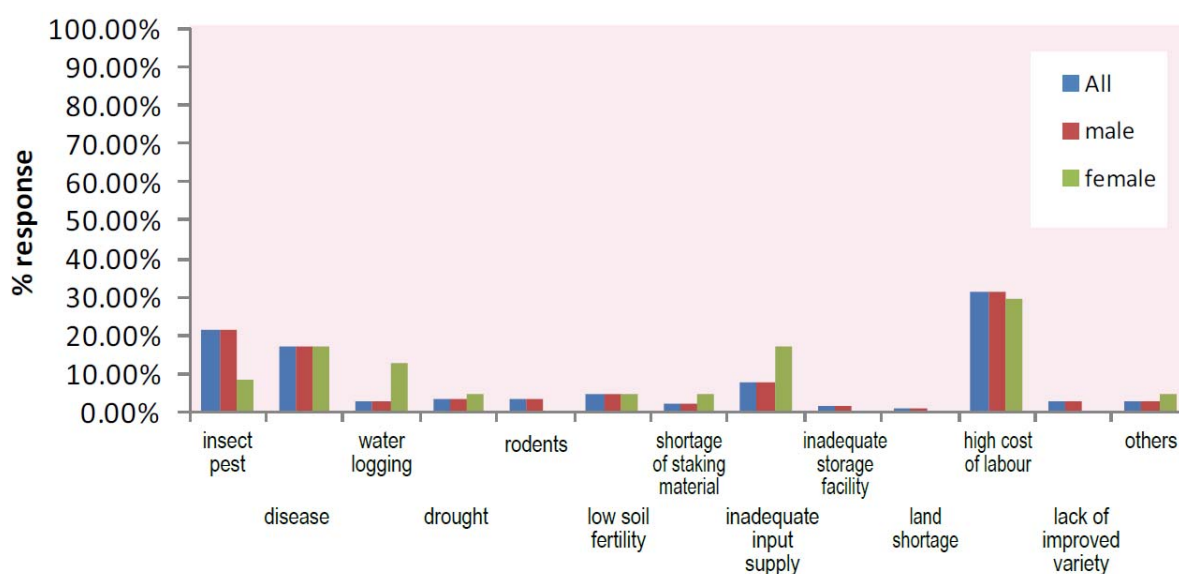


Figure 3: Percentage distribution of households by production and postharvest constraint and gender

Table 6 shows the varietal ranking against various attributes by gender. In particular, this appears to be along the lines of traditional yam varieties.

Table 6: Yam varietal ranking against various attributes by gender

Ranking	Male-headed households	Female-headed households
1	Hembamkwase	Ekpe
2	Amula	Amula/Boboku/Mumuye/Okeji
3	Ame	Abakaliki/Akpaji/Ame/Gbangu/Oku
4	Pepa	Abi/Ewasiko/Nwopoko
5	Giwa	Giwa

Table 7 shows selected findings regarding yam varietal ranking against various attributes by AEZ.

Table 7: Yam varietal ranking against various attributes by AEZ (selected findings)

Criteria	R	SGS	DS	HF
<i>Agronomic</i>				
Tuber yield	1	<i>Hembamkwase</i>	<i>Amula</i>	<i>Obiaturugo</i>
	2	<i>Pepa</i>	<i>Ame</i>	<i>Nwagba</i>
	3	<i>Giwa</i>	<i>Hembamkwase</i>	<i>Abi/Iguma</i>
	4	<i>Ame</i>	<i>Ogoja/Oku</i>	<i>Abakaliki/Boboku</i>
	5	<i>Aloshi</i>	<i>Ekpe/Meccakusa</i>	<i>Kulu</i>
Drought tolerance	1	<i>Hembamkwase</i>	<i>Amula</i>	<i>Obiaturugo</i>
	2	<i>Ame</i>	<i>Ame</i>	<i>Iguma/Nwagba</i>
	3	<i>Pepa</i>	<i>Ekpe/Oku</i>	<i>Oku</i>
	4	<i>Giwa</i>	<i>Useke</i>	<i>Abakaliki/Boboku</i>
	5	<i>Aloshi/Elwusu</i>	<i>Akpaji</i>	<i>Abi/Asuku/Ekpe/Giwa</i>
Disease tolerance	1	<i>Hembamkwase</i>	<i>Ame/Amula</i>	<i>Obiaturugo</i>
	2	<i>Ame</i>	<i>Ogoja</i>	<i>Ekpe</i>
	3	<i>Giwa</i>	<i>Hembamkwase/Useke</i>	<i>Abi</i>
	4	<i>Aloshi/Suba</i>	<i>Mumuye</i>	<i>Agba</i>
	5	<i>Pepa</i>	<i>Gbangu</i>	<i>Agbago/Iguma/Opoke</i>
Market and economics				
Marketability	1	<i>Hembamkwase</i>	<i>Amula</i>	<i>Obiaturugo</i>
	2	<i>Giwa</i>	<i>Ame</i>	<i>Iguma</i>
	3	<i>Pepa</i>	<i>Ogoja</i>	<i>Agba</i>
	4	<i>Ame</i>	<i>Hembamkwase</i>	<i>Ekpe/Nwagba</i>
	5	<i>Kafimata/Kpakogi</i>	<i>Ekpe</i>	<i>Abi/Boboku</i>
Tuber flesh color	1	<i>Hembamkwase</i>	<i>Amula</i>	<i>Obiaturugo</i>
	2	<i>Giwa</i>	<i>Ame/Ogoja</i>	<i>Abi</i>
	3	<i>Pepa</i>	<i>Ekpe</i>	<i>Agba/Boboku/Iguma</i>
	4	<i>Ame</i>	<i>Hembamkwase</i>	<i>Abakaliki/Nwagba</i>
	5	<i>Elwusu</i>	<i>Gbangu</i>	<i>Abala/Ekpe</i>
Tuber price	1	<i>Hembamkwase</i>	<i>Amula</i>	<i>Obiaturugo</i>
	2	<i>Ame/Giwa/Pepa</i>	<i>Ogoja</i>	<i>Iguma</i>
	3	<i>Lagos</i>	<i>Hembamkwase/Mumuye</i>	<i>Agba/Ekpe/Nwagba</i>
	4	<i>Kafimata</i>	<i>Ame/Gbangu</i>	<i>Abakaliki</i>
	5	<i>Elwusu/Gwari/Meccakusa</i>	<i>Meccakusa/Ekpe/Ehuru</i>	<i>Abi/Boboku</i>
Cooking and utilization				
Storability	1	<i>Hembamkwase</i>	<i>Amula</i>	<i>Ekpe</i>
	2	<i>Giwa</i>	<i>Ame</i>	<i>Obiaturugo</i>
	3	<i>Ame/Lagos/Suba</i>	<i>Ekpe</i>	<i>Agba/Nwagba</i>
	4	<i>Aloshi</i>	<i>Oku</i>	<i>Abi/Oku</i>
	5	<i>Pepa</i>	<i>Hembamkwase/Pepa</i>	<i>Mbala/Okeji</i>
Cooking time	1	<i>Hembamkwase</i>	<i>Amula</i>	<i>Obiaturugo</i>
	2	<i>Giwa</i>	<i>Abala</i>	<i>Abi/Agba/Iguma</i>
	3	<i>Pepa</i>	<i>Hembamkwase/Ogoja</i>	<i>Abakaliki/Abala/Ekpe/Mbale</i>
	4	<i>Kpakogi</i>	<i>Ame/Gbangu</i>	<i>Nwagba/Okeji</i>
	5	<i>Aloshi/Suba</i>	<i>Lasirin</i>	<i>Abago/Evu/Lalha/Opalanka</i>
Taste	1	<i>Hembamkwase</i>	<i>Amula</i>	<i>Obiaturugo</i>
	2	<i>Giwa/Pepa/Suba</i>	<i>Ame</i>	<i>Agba/Iguma</i>
	3	<i>Kpakogi</i>	<i>Gbangu</i>	<i>Abi</i>
	4	<i>Aloshi/Ame/Gwari</i>	<i>Ogoja</i>	<i>Ekpe</i>
	5	<i>Onitsha/Asaba</i>	<i>Useke</i>	<i>Boboku</i>
Nutritional value	1	<i>Hembamkwase</i>	<i>Amula</i>	<i>Ekpe/Iguma</i>
	2	<i>Giwa</i>	<i>Ogoja</i>	<i>Obiaturugo</i>
	3	<i>Suba</i>	<i>Gbangu/Mumuye</i>	<i>Abi</i>
	4	<i>Pepa</i>	<i>Hembamkwase</i>	<i>Nwagba</i>
	5	<i>Shakata</i>	<i>Ame</i>	<i>Agba</i>
Total score				
All	1	<i>Hembamkwase</i>	<i>Amula</i>	<i>Obiaturugo</i>
	2	<i>Giwa</i>	<i>Ogoja</i>	<i>Ekpe</i>
	3	<i>Ame/Pepa</i>	<i>Gbangu</i>	<i>Iguma</i>
	4	<i>Aloshi/Kafimata</i>	<i>Ame/ Hembamkwase</i>	<i>Agaba</i>
	5	<i>Elwusu/Kpakogi/Suba</i>	<i>Meccakusa</i>	<i>Nwagba</i>

SGS = Southern Guinea Savanna; DS = Derived Savanna; HF = Humid Forest; R = Ranking.

Source: Mignouna et al (2014)

8. GENDER AND SOCIO-CULTURAL CONTEXT

Table 8: Traditional Ware Yam Production in Nigeria

Month	Activity	Actor
November	<i>Land clearing:</i> Farmers often employ slash and burn techniques to clear land for planting.	men
Nov./Dec.	<i>Tilling, Heaping/Mounding:</i> An extremely labor-intensive process that involves shifting many layers of topsoil into mounds up to one meter in height.	Men
Jan.-Mar	<i>Staking:</i> Stakes, usually two meters in height, are used to train yam plants to vine on them. One stake is used for two plants and the other stake braces with adjacent stakes. The stakes are tied together at the top to reinforce strength. While bamboo is used in Oyo state, sorghum stalks can also be used as staking materials in the savanna zone. Trees, known as “live stakes,” are also be used. See <i>Figure 12</i> following this table for a photograph of yam staking with trees.	Men
Nov.-Mar	<i>Planting:</i> Seed yams (normal size yams reserved from the previous year’s harvest), minisetts (small sections of the yam tuber that cut and used to produce small whole tubers called setts which serve as seed yams), or minitubers (small whole tubers that are byproducts of ware production from the previous year) are placed in the ground. Seed yams are traditionally and most commonly used in yam plant propagation. ³⁹	Men
Nov.-Dec.	<i>Mulching:</i> Plants are protected and covered with dry grass or plant debris weighed down with balls of mud.	Men
April-Aug	<i>Weeding:</i> Manual weeding by hoeing is done 3-4 times before harvest, depending on the rate of weed growth.	Women
August-Dec	<i>Harvest:</i> Yams should be harvested when they have grown to mature size and before the vines become dry and soil becomes dry and hard.	Men
Various	<i>Storing:</i> Yam barns are the principal, traditional form of storage in most yam-producing areas. Usually located in shaded areas and constructed for adequate ventilation and protection from flooding and insect attack, barns consist of a vertical wooden framework to which the tubers are individually attached.	Men/Women
Various	<i>Transport from farm to market:</i> Small quantities of yams are carried in a woven basket and placed on a person’s head or shoulder or tied to a bicycle to be transported to the market or storage facility.	Men

Source: Natural Resources Institute, (2012) cited in Bergh et al (2012)

Note: Storing activity added because several sources cite it as another important part of the process. Explanations of each activity are added by author and based on yam production recommendations from “Growing Yams in Nigeria” by Information and Communication Support for Agricultural Growth in Nigeria.

9. CULTURAL RITES IN YAM PRODUCING AREAS

Yam plays significant roles in the social-cultural activities in countries of Sub-Saharan Africa such as Nigeria and Ghana. For instance, some households used it during marriage and fertility ceremonies. More so, the festival takes place yearly to celebrate its harvest, and other social ceremonies (IITA, 2013; Izekor and Olumese, 2010; Bamire and Amujoyegbe, 2005;

Aidoo, 2009).

This section builds on thoughts of both Basden (1938) and Achebe (1988) and analyses the function of yam in Igbo culture focussing on the passage rite of marriage. The section goes further to discuss these rites as one of the largest factors increasing yam production and consumption in producing areas. The section poses the question: is the ceremonial yam market an impediment to technology change in the yam sector?

Among Igbo people, yam is an essential object in other rites including rites of thanksgiving, petition and appeasement. Similarly, the use of yam in cultural rites is common among major producing centres in the region. For example, Dagombu people who live near Tamale in northern Ghana celebrate yam in festivals, in chieftaincy titles (enskinning) and in sacrifices to the gods, with marginal differences from the Igbo people. The analyses of marriage rites among the Igbo people will sufficiently demonstrate the impact of cultural rites on yam production and consumption in West Africa.

In Igbo practice, there are two parts to the rite of marriage, namely ritual and celebration; celebration is party-like which follows after the ritual. Drinks and foods, including yam are served, therefore celebrations in performance of rites of passage contribute to yam consumption. Of more interest in discussion of those rites as driving fuel to yam production and consumption is the role of yam as ritual object.

The marriage ritual procedure demonstrates the superiority of communal over private interests. In an Igbo village of Ukpo and Dunukofia, the rituals call for the largest sized yam tubers available in the market. At marriage, a specified number of such yams are supplied by the family of the bridegroom. After the leadership of the bride's extended family confirms the adequacy of the yams in terms of number and size of tubers, the yams are distributed in specified numbers to the bride's family, to oldest members of the extended family, the balance of the yams are cooked along with accompanying meat, such as goat for all members of the extended family to share. The procedure demonstrates child raising as communal responsibility..

Marriage does not take place without this ritual; the bridegroom must be accompanied by representatives of his extended family and representatives of the bride's extended family must be present to receive them. Both sides must endorse the marriage for it to take place, for a good reason. A side that is not properly represented, the bride or the groom's family, is understood to be complaining that a family member is a defiant. This is how the various rites constitute glue that binds a community together.

How large is the ceremonial yam market? Is demand for yam for the various rites of passage, thanksgiving, petition and appeasement large enough to make significant impact on yam consumption? The farmer groups interviewed pointed out the irrationality of people looking for largest yam tubers in the market to cook at home because such is wasteful. In a matter of hours, a cut surface of a tuber begins to oxidize turning to unusable cake that must be peeled off when next the yam is used. In a few days rot begins from the oxidized surface and spreads to the rest of the yam (Figure 31). Therefore, it is only rational to cut tubers that must be cooked the same day.

But the farmer groups also pointed out the reason for yam producers to aim for the largest tubers. The farmers' desire for the largest possible tubers is driven by ceremonial market demand compared with the home consumer preference for medium sized tubers is incontrovertible evidence that the ceremonial yam market is in fact large.

To further their argument that amounts of yams used for cultural rites each year were sufficient to constitute significant demand, the farmer groups pointed out that each year numbers of marriages, births and funerals in a rural or urban setting are high. In addition, a litany of heathen shrines demand and accept tributes daily for thanksgiving, petition, and appeasement. The farmer groups explained that rites of passage, thanksgiving, petition and appeasement are also performed in churches. They point out the number of yams presented in each church every Sunday for purposes of petition and penitence and for thanksgiving following marriage, birth and funeral as well as numerous other events which call for thanksgiving.

The size of the ceremonial yam market is convincingly large enough to constitute effective demand for yam. But what about the sustainability of such a market over time, i.e. are the cultural practices sustainable in future? In his latest classic, Soyinka laments the erosion of African culture by both Christian and Islamic civilizations (Soyinka 2012). But, as noted above, rites of passage, thanksgiving, petition and appeasement are practiced in Christian Churches and with yam as an object in yam producing areas. In addition, by being used to enforce compliance to communal interests the rites are important in community governance; such practical values of the cultural rites will, no doubt help to sustain them.

What does medal of honour have to do with ceremonial sized yam production among the Igbo people? Interest in production of ceremonial sized yams is institutionalized by practice. In the past in Igbo yam producing communities, *Di Ji* (master yam farmer) was a community leader whose voice was heard in his community. He received higher social status from size of his yam, in terms of total quantity and size of individual tubers. Today in the area, trade fairs emphasize tuber size; the trophy goes to the largest tuber on display.

10. CONSTRAINTS TO YAM PRODUCTION

High cost of labor stands out as the most pressing problem in yam production in Nigeria. For instance, mounding as a land preparation method, is laborious, and hence expensive. But apart from mound making all yam production operations are labor intensive because they are performed with hand hoes, machetes, and digging sticks without any form of a labor-saving technology.

Another main constraint are insect pests and diseases (Mignouna et al., 2015). The unavailability and high cost of good quality disease-free seed yam had been on one hand a result of pests and diseases and on the other hand a serious hidden constraint due to the fact that farmers do not purchase seed yam. Other important constraints mentioned were the inadequate input supply, low soil fertility, rodents and drought, water-logging, lack of improved varieties, shortage of land and staking material, and others such as theft.

11. PROCESSING

Yam can be eaten

- With oil or sauce when slices are boiled
- With soup when boiled and pounded as pounded yam or amala
- Fried with oil and taken as snacks
- By reconstituting the dried flour and stirring continuously over boiling water and the resultant dough to be eaten with soup.
- As a thickener when added to soups
- With red oil when roasted
- As yam porridge when cooked

General processing methods for the production of pounded yam/pounded yam flour

Traditional methods; the method include yam washing- peeling-slicing- parboiling-pounding.(Ogiemudia et al 2016).This is done using pistle and mortar. Ogiemudia et al (2016) made a comparative analysis on the production of pounded yam using the traditional pounding method and yam pounding machine. He observed that the time it takes for the water to boil and cook yam appears same for the traditional and machine preparation but there was a sharp difference in the pounding time for the two methods. It took 2mins for the machine to pound the yam whereas the manual method used up to 20mins to complete the pounding.

The traditional method of using pestle and mortar is discouraging consumption among elites, due to its laborious and intensive process, however instant pounded yam flour reduced the drudgery associated with the pounded yam production. (komolafe and Akinso 2005)

12. PRODUCTION OF POUNDED YAM FLOUR

Iwoho (2014) used different varieties of yam to produce yam flour (white yam, water yam, yellow yam). However he made changes in the conventional method already existing in the production of yam flour. Conventional method of processing includes peeling-washing-cutting chips into 5mm-drying and milling and lastly packaging. In his work, he used a steeping method (interval of 2,4,6,8 days) and the steep water changed daily.

12.1. Method

Pared down-washed-cut into 5cm chunks-steeped in deionized water for 2,4,6,8 days and steep water changed daily-drip drying-cut into 5mm-spread on aluminium-oven dried for 24hrs at 50oC –sieved using a standard Tyler sieve series of 125,250,500µm. Parameters checked were flour particle size, water retention capacity, swelling index, solubility and iodine affinity of starch. Iwoho (2014) concluded that the water retention capacity of flour particles decreased as tuber steeping duration increased. Water retention capacity also decreased as particle size of the flour samples increased. 125µm particles had a higher water absorption, swelling power and swelling index. Inverse relationship exists between SI and Tuber steeping duration. Kayode et al (2016) used aerial yam flour in composite with cassava flour to produce amala. However he made adjustment in his method of yam flour production by blanching in hot water and fermenting for 48hours.

12.2. Method

Washing-hand peeled-sliced into 3cm thickness-soaked in water at 50oC (to avoid enzymatic browning and remove bitter taste)-blanched at 80oC-fermented for 48hrs-sundried/solar dried-milled and sieved(1mm). He made observations that WAC was higher in the blanched fermented samples than the blanched unfermented samples. He further opined that fermentation process increased the WAC and dispersibility of the samples, hence fermentation had a positive influence on the the swelling capacity and ease of reconstitution of aerial yam/cassava flour composite. Abiodun and Akinso (2014) used trifoliolate yam(white and yellow varieties) to produce yam flour and stiff dough 'amala' using the conventional method but with few modification of blanching at 65oC for 10mins and steeped for 12hours at ambient temperature.

12.3. Method

Washed-peeled-diced-blanched (65oC for 10mins)-soaked in blanched water for 12hours-dried(hot air oven at 60oC for 48hrs) –milled-sieved. They looked at the pasting viscosity, functional properties, brown index and sensory attribute of the stiff dough. He observed however, that blanching improved the absorption capacity of the flour as was observed by other authors.

Dark coloured amala is reported to be caused by inability to control drying process and parameter, weather uncertainties, insect infestation, contamination of dust and other undesirable materials. (Abiodun and Akinso 2014). He concluded that amala from white yam was more acceptable and comparable to amala made from white yam. Akinso and Olatoye (2013) developed energy conservation processing methods to curb energy utilization in preparation of yam flour for the production of instant yam. They made a modification in the already existing conventional method of producing instant flour by varying the thickness and shape of the slices. In practice, 20mm thickness is normally used but 15mm thickness and diagonal shape of yam slices were used instead of the conventional cylindrical shape. Higher efficiency power output Electric motor of 0.85 was used to power the milling and sealing machines in place of 0.65 power factor.

Maziya-Dixon et al (2016) investigated on the retention of iron zinc in yam varieties during processing. He observed that cooking intact yam tubers without peeling is recommended to avoid leaching of nutrients in the water. Boiled yam retained as high as 85% of iron and zinc which was comparable to that found in fresh tubers although it depends on the variety and processing method used, while yam flour contained less zinc and iron. The method used in boiling the yam was the conventional method but without peeling the tubers while the flour was prepared by fermenting in hot water (63±3°C) for 24hrs and thereafter oven dried at 45 °C for 72hrs. The chips are milled into flour which is locally called elubo in Nigeria. He further suggested that nutrients in yam can be increased through breeding programs.

Otegbayo et al (2005) used Histological experiment to study the microstructure of boiled yam and its implication in textural quality and observed that starch granules are loosely arranged (packed) in *D rotundata* varieties studied but are densely packed in *D alata* varieties. He further opined that there was a cell separation and rounding off of cells in cooked yam of *D. Rotundata* varieties while there was only partial cell separation with no rounding off in *D. alata*. It was observed also that complete cell separation and rounding off was only observed in mealy boiled yams and not in the waxy ones. Textural qualities that are important in boiled yam are mealiness, waxiness, sogginess, stickiness and hardness. He described mealiness as the ease to which boiled yam disintegrates and waxiness as the extent to which the yam remains intact and does not disintegrate easily when pressed with fingers or in the mouth.

In the study of post-harvest management practices of yam farmers information needs in the North central of Nigeria, Adejo (2017) revealed that 50% of the farmers interviewed within Kogi and Benue state were highly in need of information on storage of tubers and improved post-harvest management technologies of yam to ensure better value addition. He also observed that 77.50% of the farmers have access to improved transportation system but suggested that more effort should be made in the area of making available post-harvest management information to the farmers in order to increase food security.

Project report by Yam Improvement for Processing (YIP) Nigeria (2014) gathered that white yam varieties with traditional names such as Ada Onitsha, Amula and Abuja yam are the preferred yam varieties for consumption and processing. However, water yams are cost effective than these white yam because they are available during off season and often viewed as inferior.

Otegbayo et al (2010) investigated the perception of food quality in yams among some farmers in two major yam-growing ecological zones of Nigeria (FCT-Abuja) and Oyo North in Oyo state using focus group discussion survey method. He gathered that farmers do not have a definite food quality indicators in yam tubers that can determine or predict the quality of the product. Varieties of yam can be identified through the pattern of leaf foliage, smoothness and shape of the tubers but may not give insight to the food quality of the variety. However what determines the type of yam farmers cultivate are based on the commercial value and yield suitability of the variety for the best yam food product, the agronomic yield of the variety and farming experience they had over the years with a particular variety. He observed that stored yams are usually higher in price than the fresh ones and are more preferred by consumers of pounded yam because of its textural quality. Yam varieties of low storability qualities are rated to be of low food quality. If a yam is not good for pounded yam, it should be good for yam flour (elubo), if it does not fit into any of these products, then it does not have a good food quality.

13. CONCLUSION

Yams are an integral component of food consumption and agricultural sales in Nigeria. However the crop's role differs for the poor and non-poor. Relatively better off households are consuming more yams (particularly those acquired through purchases), but selling less harvested yam than poorer households. Poorer households consume fewer yams, but depend more heavily on yam sales and income than their richer counterparts. The results of the analyses call for investments in development of yam seed technologies to reduce the cost of yam seed, reduce the cost of yam production, drive down the price of yam to consumers, and improve yam price competitiveness against alternative staples. Each existing yam storage technique has downside; security and enhanced aeration, especially in high humidity environments are the main advantages of storage by tying in racks at home while high labour requirement is the major drawback of that method. In less humid environments, storage in thatched hut

or in covered heap is preferred because of its lower labour needs. But this method exposes the yam to pests including rodents. No storage techniques exist that are capable of storing yam from one harvest to another.

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