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Yam Market Segment Assessment to Develop Product Profiles and Its' Breeding Programs in Sidama and South Ethiopia

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Abstract: Yam is extensively grown throughout the country's Southwest, South, and West parts of Ethiopia. However, despite the potential, yam production at country level and Southern part of the country is endangered by low yields, socioeconomic issues, a lack of varieties suitable for a range of agro-ecologies, and the existence of biotic and abiotic stresses. This study was therefore initiated to identify the major market segments of yam, and identify production, processing and marketing constraints for future intervention programs. In total, 120 sample households were selected from Dilla zuria and Wonago districts (Gedeo zone), Dale, Aletawondo and Wonsho districts (Sidama region) using systematic random sampling technique. Descriptive statistics was used to analyze the data. Market segments comprise of local, town and city market places. Production challenges were land shortage, wild animals, limited access to improved variety, shortage of planting material, prevalence of disease and nematodes, poor agronomic practices and theft. Marketing challenges were presence of poor market linkage, price variability depending on season, and absence of storage facility. Processing challenges on the other hand was lack of knowledge on advanced and diversified processing technique. Introduction of new varieties, scientific agronomic practices, preventive measures for disease and nematodes and wild animals, advancement in processing techniques, stabilization of price, facilitating market linkage, promoting storage techniques and facilities were recommended to improve the yam production in the study areas.

Keywords: Yam, Market Segment, Socioeconomic, Value Addition.

Research Paper

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1. INTRODUCTION

Yam (*Dioscorea* spp.) is a crop belonging to the family Dioscoreaceae and genus *Dioscorea* (Mignouna *et al*., 2002; Dansi *et al*., 2010). It is a multispecies crop. There are 600 species of it distributed throughout Africa, India, Southeast Asia, Australia, and South America (Beyene, 2013; Loko *et al*., 2015). According to Agre *et al.*, (2019), all species are of tropical provenance and are grown for their edible starchy tubers. In the tropics, millions of people rely on staple foods made from ten or so of these yam species (Sesay *et al*., 2013; Dansi *et al.*, 2010).

Apart from its nutritional value, yam storage tubers have pharmacologically active compounds including dioscorine and sapogenin that can be used as medication to treat digestive tract disorders and lower blood sugar levels (Jaleel *et al*., 2007; Nashriyah *et al*., 2012; Mulualem *et al*., 2018). In addition, the crop has a greater impact on reducing the population growth problems and areal yam utilized as a contraceptive by female in local producing areas (Scarcelli *et al*., 2011).

Ethiopia has widely adopted the most significant species as both cultivated and wild cousins (Terauchi *et al*., 1992; Tamiru *et al*., 2007; Dansi *et al*., 2012; Atnafua, 2014). There is a sizable yam pool in Ethiopia that is extensively dispersed throughout the nation in intricate cropping systems with a broad genetic foundation (Hildebrand, 2003; Wendawek *et al*., 2013). Ethiopia is the fifth largest yam-producing country in Africa, with an estimated annual production of 1,191,809 metric tons (FAO, 2015). The country's diverse range of yam species, with approximately nine types reported to

grow in Ethiopia, underscores the crop's importance in Ethiopian agriculture (Westpal, 1975). After sweet potatoes (Ipomoea batatas (L.) Poir) and cassava (Manihot esculenta Crantz), it is Ethiopia's third-most important tuber crop (Tamiru et al., 2007). Over 1.5 million people rely on it, and it is extensively grown throughout the country's Southwest, South, and West (Beyene, 2013). It is also grown and consumed in North West part of Ethiopia (Atnafua unpublished).

The primary attributes of yams are their high yields and good adaptability in a wide range of agro-ecological conditions (Scarcelli *et al*., 2006), as well as their annual food availability cycle, flexibility in harvesting periods, and diverse maturity without requiring a lot of agricultural inputs (Tamiru *et al*., 2008; Bellon *et al*., 2015). It serves as a significant source of income for farmers and is often featured in traditional festivals, coinciding with peak harvesting times. Yam can be grown in a variety of soils, including clay, clay loam, sandy, and sandy loam types, at altitudes ranging from 1140 to 2200 meters above sea level (Miège and Sebsebe 1997).

Ethiopian yam production is faced with low yields, socioeconomic issues, a lack of varieties suitable for a range of agro-ecologies, and the existence of biotic and abiotic stresses that jeopardize the crop's productivity (Asiedu and Sartie, 2010; Daudi *et al*., 2018). To increase yam output in the area, better varieties must be used in conjunction with appropriate agronomic techniques. Furthermore, production and technological development require a thorough understanding of farmers' interests, production issues, and preferences (Daudi *et al*., 2018).

It is important to identify production, processing and marketing constraints to improve production, selection to ensure adoption of improved cultivars by farmers and to address the existed problems in an affordable and sustainable way. Hence, the objective of this study was to identify the major market segments of yam, and identify production processing and marketing, constraints for future intervention programs in major production areas of Sidama region and Gedeo zone.

2. METHODOLOGY

2.1. Description of the Study Area

This study was undertaken by taking Dilla zuria and Wonago districts from Gedeo zone, Southern Ethiopia National Regional State and Dale, Aletawondo and Wonsho districts from Sidama National Regional State.

2.2 Sampling Techniques

A multi-stage sampling technique was employed to draw the sample from the strata of producers yam. First, potential yam-producing *kebeles* were identified purposively from Dilla zuria and Wonago woredas (from Gedeo zone) and Dale, Wonsho and Aletawondo districts (from Sidama region) on basis of their potential in yam production. Secondly, seven *kebele*s were randomly identified for the study.

Thirdly, total 120 yam producers households were randomly selected systematically owing to the homogeneity of the yam producers. Head of the household was communicated for the interview.

2.3 Methods of Data Collection

To collect the primary data, both the household survey and participatory rural appraisal (PRA) tools were employed. The applied PRA techniques included focus group discussions (FGDs), the key informant interviews (KIIs), and observations. While the household survey was conducted using structured questionnaires. The household survey was conducted by trained enumerators. Besides, the household survey questionnaires were pre-tested to check the clarity of the contents, and hence, enabled us to modify the questions. Key informants' interviews were conducted with district experts of crop development and extension.

2.4 Methods of Data Analysis

Descriptive statistics was employed to analyze data and present data collected in the course of the undertaking the research activity.

3. RESULTS

3.1. Agronomic Traits

In the study areas, farmers dig pits; add ash and compost before commencement of rainy season. They source planting material from neighboring farmers through purchase or gift and their farm land after the harvested yam tuber has propagated in the soil. Then after sourcing planting material, they plant it in the pit. They erect the stake for vines to climb after the yam tuber has started sprouting after1-2 months depending on the start of rain. Around the stake there exist 1-3 pits. In each pit, 1-2 yam tubers are planted in order to be propagated. Planting time ranges from September up to December, whereas harvesting time is between mid June up to August.

3.2. Cropping System

From among respondent farmers, the majority (70%) of them used intercropping system for yam cultivation. This was related to land shortage and the need for allotting land for multiple types of crop items which fulfill consumption and cash demands.

Table 1: Cropping system

Cropping system	Frequency	Percent
Sole cropping	36	30
Intercropping	84	70
Total	120	100

Source: Survey result, 2023

3.3. Market Segment Description

As indicated in Table 2 below, Yam is mostly marketed at local markets in ware and seed forms and town areas of woreda administrative centers to road side processors who boil and sell yam with Daxa (spice made of red pepper), bread and avocado.

Table 2: Market segmentation of the study area

Study woreda	Market segmentation
Dilla zuria	Yam is channeled from farm gates of Andida and Chichu kebeles to nearby rural markets and Dilla town
Wonago	Yam is sold at local market of Tumata Chirecha kebele and at woreda market of Wonago town
Wonsho	Farmers in Second Fero kebele sell yam by taking it to the village markets, town markets of Bokaso, Yirgalem, and Hawassa city
Dale	Yam from Shoye kebele is marketed at local market venues of Naramo, Dela, and Yirgalem town; farmers of Shoye kebele source planting from Dagiya kebele of Dale woreda
Aletawondo	Farmers of Dobe Sadeka and Dongora Ilmate kebeles sell their yam produce at local market of Dela in Dale woreda, Yirgalem town, Kebado market, Aletawondo, Aletachuko and Hawassa city

Source: Survey result, 2023

3.4. Disease Occurrences

In the study areas there exists tuber rot and white scale symptoms on the tuber. Farmers call these disease symptoms as 'Santo'. It is said to start showing symptoms on the tuber and forcing the tuber plant to die from its root to the shoot including leaves. It was almost hard to find tubers which were free of such symptoms. Porcupines are also the major challenges when it comes to factors affecting the yield. Also nematodes are vastly prevalent in major yam growing areas of Sidama region and Gedeo zone. The higher the scale, the severe is the disease occurrence.

Table 3: Disease occurrence by woredas

Disease occurrence		Dilla zuria	Wonago	Wonsho	Dale	Aletawondo
	1	43.48%	12.50%	35.29%	23.53%	26.47%
	2	52.17%	87.50%	35.29%	35.29%	52.94%
	3	4.35%	-	23.53%	41.18%	20.59%
	4	-	-	-		-
	5			5.88%		

Source: Survey result, 2023

3.5. Consumption and Processing

When processing yam, women wash the surface of fresh tuber. Then, they chop or sliced it. After that, they put the pieces in the dish made of clay or metal. They add salt and water into the dish and boil it for about 30 minutes. Then it is cooked to the extent of being easy to be sliced with a knife. This is not the only way that yam is served as a meal to the family. After cooking women peel the surface of boiled yam grind the flesh and add butter to make local food called 'Chanchaname'. The way of processing this food item resembles that of 'Bursame', cultural food that often prepared from enset "false banana". False banana is a staple food in the Sidama region. The boiled yam quality of the study area lies mostly between the ranges of 4-5, which indicates a preferred trait. Their yam quality was in preferred rank. Boiled yam color ranges from white to yellow using observation. It is important that boiled yam to be mealy, friable with no black spots after being boiled (Adinsi, 2018). On the basis of these criteria, boiled yam of locally available types (Ado and Ganticha) was mealy with scale of 3-5.

Table 4: Boiled yam quality and texture

Variable	Scale	%
Boiled yam Quality (Index)	1	4.48
	2	1.49
	3	-
	4	37.31
	5	56.72
Boiled yam Mealiness and texture	3	2.22
	4	48.89
	5	48.89

Source: Survey result, 2023

3.6. Tuber Shelf Life

It is important to note that the longer the storage, the higher the risk of decline in quality. Sprouting, transpiration, respiration, and rotting due to mould, bacteriosis, insects, nematodes and mammals (Passam *et al*., 1978). Harvested tubers are frequently

attacked by several viruses, bacteria, fungi and insects. Also rodents feed on some of the harvested tubers stored in the barns (Igbeka, 1985). Sprouting, transpiration and respiration are physiological activities which depend on the storage environment mainly temperature and relative humidity (Passam *et al*., 1978). In the study area, the mean number of days in which farmers store yam in their home is about 5 days. This is because farmers do not store yam for too long. The harvest is done during market days or when they want the seed to plant. Otherwise, they kept it under the ground till they want to cook or sell.

Table 5: Tubers shelf life

Variable	Mean	Std. dev.	Min	Max
Tuber shelf life	4.876106	2.062128	1	10

Source: Survey result, 2023

3.7. Processing Traits

The observation in reference to the minimum score of 0 scale/ 180 minutes after peeling or cutting the tubers, it was found out that the oxidation scale or scale of its' browning effect was 3. This implied that after a while, locally available yam varieties showed browning effect if it is not soon prepared.

3.8. Post Harvest and Storage

Tuber dormancy was reported to be between 1 to 3 months in the study area. Passam (1982) stated that harvested tubers remain dormant (i.e. incapable of developing an internal shoot bud or external shoot bud/sprout) for 30 to 150 days depending on harvesting date, species and growing and storage environmental conditions. In the study area, some farmers harvest and consume yam tubers and immediately they plant emerging buds.

During transportation wounds occur on its surface when it is loaded onto vehicle after being packed in locally available sacks without taking caution.

3.9. Production/Multiplication Traits

Available yam landraces in the study area are Ado (White flesh), Ganticha (Purple and white flesh), and Uwisho (dark purple). The multiplication scales are 7 for Ado, 5 for Ganticha and 3 for Uwisho.

3.10. Farmers Preference, Marketability and Medicinal Uses

Farmers preference is based on the purpose of consuming yam. For example if the household intends to accept a guest, women prefer to process white yam (Ado). Because it is soft, not bitter and convenient to be processed into local food, 'Chanchaname', which is similar to 'Burisame' (local food made of enset product). Those who intend to treat stomach discomfort/stomach ache use Ganticha and Uwisho landraces as these landraces are bitter and hard in their flesh. Both Ado and Ganticha landraces are marketed in the market places. The leaves have liquid things when they cut down. This ooze is assumed to treat skin blotch by farmers. Women who deliver birth are given yam tubers in order to ease the pain.

3.11. Social and Economic Contribution of Yam

During rainy season, farmers use yam for two purposes. First, they use it as a cash crop since there is a high demand for cash for purchasing agricultural inputs like seed, fertilizer. Second, during production season, there is no cereal crop to consume. This gap is filled by using yam to consume.

When there is mourning for loss of beloved one in neighboring homes, women boil yam and fulfill their social responsibilities by taking boiled yam in clay potl to the homes where there is mourning s. Yam can also be processed in the form of 'chanchaname' for this purpose. Indeed, it is prepared during social festivals, holidays and guests.

3.12. Preference of Men and Women

Women prefer Ado for its softness and edibility. Men prefer Ganticha for its hardness and bitter taste. However there is no strict reservation when it comes to both varieties, because many farmers use available landraces from among Ado, Ganticha and Uwisho.

3.13. Market Value

During early times of harvest (mid June-August), the price of yam is 700 Birr/Quintal due to surplus supply at early stage. However, onwards from September to December the price increase and reaches high to 20,000 Birr per quintal. Because, the demand rises even to obtain planting material by farmers.

Table 6: Summary of yam market value

Variable	Mean	Std. dev.	Min	Max
Market price of yam per quintal	6047.881	4985.438	700	20000

Source: Survey result, 2023

3.14. Production, Marketing and Processing Challenges

After peak harvest, some farmers face challenges when it comes to accessing planting material. Disease and nematodes are also challenges since intercropping is practiced and this paves a way for transmittable diseases. The shade effect of crops like grown coffee and enset is perceived to be another source of vulnerability for yam crop. Theft has become

threatening day to day challenge. This is because yam is comparatively more expensive crop than locally available cereal crops. There were only local landraces, Ado, Ganticha, Uwisho except for some farmers who had other yam species of aerial yam and the second yam type called "Wolaita yam".

Table 7: summary of yam challenges

Production challenges	**Rank**
➢ Land shortage	7
➢ Wild animals	6
➢ Lack of improved variety	1
➢ Shortage of planting material	2
➢ Disease and nematodes	4
➢ insufficiency of knowledge on scientific agronomy	3
➢ Theft	5
Marketing challenges	
➢ Poor market linkage	2
➢ Price variability	1
➢ Absence of storage facility	3
Processing challenges	
➢ Lack of knowledge on advanced processing	1

Source: Survey result, 2023

4. CONCLUSION AND RECOMMENDATIONS

4.1. CONCLUSION

In the study area, market segments comprise of local, town and city market places. In the study areas, yam is boiled for meal and processed as "Chanchaneme', local food prepared using boiled yam. Boiled yam quality of the study area lies mostly between the ranges of 4-5, which indicates a good quality for boiled yam. Boiled yam color ranges from white, yellow and purple. Boiled yam of locally available types (Ado and Ganticha) was mealy with scale of 4-5 in terms of boiled yam texture. In the study area, the mean number of days in which farmers store yam is about 5 days due to the fact that farmers do not store yam for long after harvest. They prefer to store it in the ground within harvesting seasons. They harvested it for market, food and planting. The scale of browning effect is 3. Tuber dormancy was reported to be between 1-3 months in the study area. All these traits have to be improved with breeding research activities. Post harvest packing and storage mechanism required scientific interventions in the study area. Farmers preference is based on the purpose of using yam processed yam. Social and economic contribution of yam included serving guests, serving mourning family and as a source of income. The average prices of yam vary based on seasons. It ranges from 700 to 20000 Birr/Quental. This indicated how it can give economical benefit for producing farmers. In some areas, the production challenges were land shortage, wild animals" porcupines", limited access to improved variety, shortage of planting material, prevalence of disease and nematodes, poor agronomic practices and theft. Marketing challenges were presence of poor market linkage, price variability depending on season, and absence of storage facility. Processing challenges on the other hand was lack of knowledge on advanced and diversified processing technique.

4.2. Recommendations

It is important that new higher yielding varieties be introduced in the study area to increase production and productivity. The preferred yam trait has to be improved through breeding research activities. Agronomic practices should be taught to farmers bearing in mind that root crops sub sector is important when it comes to food security and nutrition. Protection measures required has to be taken to prevent disease, nematodes, and wild animals like porcupine and mould rat. The yam food processing techniques and value addition is needed. To stabilize price, it is important to link potential production area farmers with yam processors through establishment of such firms. The storage techniques and facilities better to be promoted to help farmers to store their product for a longer period.

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