A case study of cassava trait preferences of men and women farmers in Nigeria: Implications for gender-responsive cassava variety development

Olamide Olaosebikan[1a], Peter Kulakow[1b], Hale Tufan[3a], Tessy Madu[2], Chiedozie Egesi[1,2,3b], and Béla Teeken[1]

[1]International Institute of Tropical Agriculture, Ibadan, Nigeria, [a]d.olaosebikan@cgiar.org; [b]P.Kulakow@cgiar.org; [c]B.Teeken@cgiar.org

[2]National Root Crops Research Institute, Umudike, Nigeria, tessmadu@gmail.com

[3]Cornell University, Ithaca, NY, USA, [a]hat36@cornell.edu; [b]cne22@cornell.edu

Introduction

Cassava (*Manihot esculenta* Crantz) is an important staple that serves diverse users and plays significant roles in the livelihoods of smallholder farmers in Nigeria. Cassava's major role as a food source connects individuals and households from different social sections and regions in Nigeria. Cassava storage roots, and edible leaves of some varieties, provide an efficient source of carbohydrate and vitamins when consumed. Its utilization as raw material for food and industrial products provides important income generation for both producers and processors and provides revenue for the nation through local and international markets.

Motivation to be Gender Responsive

By ignoring gender inequities, many agricultural development projects fail to achieve their objective (Gates 2014). This asks for gender-responsive studies to understand farmers' and processors' preferred traits for important crops like cassava and inform breeding initiatives/projects for equitable adoption of technologies by users. Recent studies on some aspects of the cassava value chain in Nigeria, such as cassava breeding and agronomy (Maroya et al. 2011; Akoroda 1995); the adoption of improved cassava varieties (Awotide et al. 2015; Abdoulaye et al. 2013); and cassava processing, postharvest handling, and storage (Uchechukwu-Agua et al. 2015), did not consider the influence of gender roles evident within cassava production, processing, and marketing activities. Cassava processing in Nigeria is mainly done by women, for whom it is an important way to add value, whereas its production is done by men and women (Curran and Cook 2009; Walker 2014). Although men dominate activities like land-clearing and soil tillage, women tend to dominate farm maintenance and food-processing activities. Women dominate (75%) the food-processing and marketing sectors; men dominate (95%) the commercial sale of cassava stems (Ilona et al. 2017). Gender roles along the cassava value chain may determine varying preferences of different groups of cassava producers and processors. For an equitable uptake of improved cassava varieties, gender issues shaping specialized roles of men and women along the cassava value chain across regions in Nigeria need to be identified and examined to inform breeding activities for gender-responsive new varieties. Studies on sex-disaggregated farmers' preferences for the crop's varietal traits and gender-based constraints are now gaining approval and are therefore important in informing breeding priorities

as well as seed dissemination and delivery strategies (Teeken et al. forthcoming; Ezeibe et al. 2015; Acheampong 2015; Addison et al. 2014). All these aspects together motivated this study to take gender as an important point of departure and to determine where in the breeding cycle (see Figure 1.1 in Introduction) such gender aspects have possible implications.

Background

In 2015 a cassava-monitoring survey was undertaken to study the adoption of improved cassava varieties by farmers, the cassava seed system, and the variety preferences of men and women in Nigeria. This survey was combined with cassava leaf sampling using DNA fingerprinting to triangulate variety information given by cassava farmers and their spouses (Wossen et al. 2017). This study was followed up with a more qualitative study (Bentley et al. 2017) focused on cassava variety preferences of men and women. The present case study focuses mainly on the findings of the latter study.

In Nigeria, cassava producers and processors show varying preferences for production characteristics, processing needs, marketing demands, and health/nutrient requirements. They basically cultivate, add value, and sell and consume the crop, representing diverse trait preferences and needs. The varied nature of these cassava producers and processors may be based on their experiences and factors such as environment/location, beliefs, age, education, ethnicity, and marital status; all can potentially have an impact on how differently men and women may relate to the crop. This implies the need to breed for different sets of traits in cassava to meet diverse end-uses and end-users. Teeken et al. (forthcoming) asserted that the main preferences of men and women cassava farmers are similar but specific task-related preferences can be distinguished (e.g., women mention relatively more processing-related traits while men mention more agronomy-related traits). This finding suggests the need to investigate processing and food product quality traits, and a closer examination of how gender role specialization influences or shapes varietal choices for adoption and utilization will add to existing knowledge.

The rationale of this study therefore was to inform cassava-breeding objectives to meet the diverse needs of producers and processors, with an emphasis on identifying and responding to the processing- and product-related preferences of women farmers, processors, and marketers.

Methods

Sampling involved a random selection of 20 major cassava-producing communities: 5 each in the southwest, north, south–south, and southeast. Data were collected in 2016 through sex-disaggregated focus group discussions (FGDs), open-ended discussions, and transect walks in the selected communities. A discussion guide for village-level FGDs was developed, covering areas such as varieties grown in the village, trait preferences and why they are important, constraints encountered, and access to seed. Researchers visited cassava fields for clarification and to observe processing activities and have on-the-job discussion with processors. At the end of each day, team members would share their findings, discuss the results, and make constructive criticism. This helped to ensure that findings were consistently in parallel format for women and men.

The FGD team (two men and two women) consisted of social and biophysical scientists with diverse academic backgrounds, namely an agricultural economist, an extensionist, an anthropologist, and an agronomist with experience with research activities in breeding. They were supported by the village-based extension officers and the farmers' leader of cassava growers in each community who provided consent and assistance for proper engagement. In each community, the team conducted separate interviews with adult and young men and women; 40 FGDs were held. An important component of the study was to make sure that women FGDs were facilitated by women. The aim was to ensure probing of relevant gender issues and to make sure that women were not restricted from voicing their opinions. Important aspects of the study were ranking of varieties as well as men- and women- preferred traits within the four regions.

In the southwest all interviews were held in the Yoruba language, whereas in the southeast the respondents were interviewed in Igbo. Other interviews were held in English (or in Nigerian Creole). Notes taken and voice recordings during FGDs were transcribed verbatim and transcribed responses were content analyzed. Similar patterns of responses from all interviews on preferred traits were coded into major themes such as agronomic, processing, and product and culinary traits. Themes on preferred traits and varieties cultivated were entered into spreadsheets and disaggregated by sex of respondents. Preferred traits and varieties cultivated were analyzed and ranked. Commonly reported views were harmonized into text boxes.

Results

With regard to the breeding cycle, preferences were identified at the social-targeting and demand analysis stage in order to set breeding priorities/objectives. However, as this was also part of an adoption study, gender-differentiated preferences were identified at the seed production and distribution stage as well, because the study encountered improved (formally released) and farmer varieties. At the production stage, both men and women farmers are actively involved in the cultivation of the released and farmer varieties, undertaking various production activities till the period of harvesting. These stages gave individual farmers the opportunity to assess/evaluate improved varieties before making assertions as to whether a variety meets their needs or making adoption and utilization decisions.

Analysis revealed that improved varieties have traits that farmers desire and are gradually squeezing out the local varieties. About 80 local varieties and 25 improved varieties were identified from the study communities. Cassava variety names sometimes referred to a preferred trait of the variety. For instance, 'Idileruwa' and 'Oko-iyawo' depict high-yield, root size, and early-maturing traits. Fewer varieties are named after processing traits such as color and taste (e.g., 'Nwaocha', meaning fine white cassava). Trait types mentioned included agronomic (78%), processing (13%), and product and culinary traits (8%). Improved varieties are becoming the standards because they are early maturing and high yielding. Women and men in all regions generally want varieties with high yield, many/big roots, early maturity, in-ground storability (for at least 2 years), tolerance for poor soils, cattle resistance, and drought-resistant properties (in the north) and that are non-watery. A few traits, however, are optional or variable (e.g., some farmers like cassava with high starch content, some prefer low starch content). A recent region-based survey conducted in 2017 on biofortified cassava corroborated findings on starch content—that is,

cassava farmers in Benue (northern central region) prefer biofortified cassava with low starch content, but those in Oyo (southwest) preferred high starch content biofortified cassava (Olaosebikan et al. 2017).

Household-feeding responsibilities (e.g., to cope or survive during a period of food scarcity) as well as seasonal and market demand sometimes call for a variety that is early maturing. It is, however, also important to have cassava all year round, like a bank account from which people can steadily withdraw for food and to make money. There are also some traits that are only required in some varieties, or in some places. For example, some communities prefer shorter varieties that are less likely to topple over in the wind. Other villages are pleased with their tall cassava varieties used for setting boundaries.

In general, some trait preferences described by farmers are easily understood (e.g., high yield) whether targeting women or men in any region. Agronomic traits are in general more important than processing ones. Women demand cassava that is easy to peel, although this need could possibly be met with another research solution—not by plant breeding—as women farmers themselves also indicate that ease of peeling is probably largely related to environmental conditions such as harvesting season. Like the women, the men also mention processing and culinary traits (e.g., "going well in soup").

Gender and ranking of preferred traits

When the respondents were asked in their sex-disaggregated groups what traits they preferred in cassava (not variety by variety), men and women paid attention to agronomic and processing traits. Table 3.1.5 shows that women and men farmers in all regions generally wanted varieties to be high yielding (many and big roots), early maturing (ideally reaching maturity within 6 or 7 months), and capable of being stored underground for a long time (i.e., 1 year or more after maturity). Nigerian cassava farmers may need a mix of early-maturing and late-maturing/durable varieties. Men and women farmers in all regions generally expressed a preference for early-maturing varieties—for men, to make quick cash, and for women, to reduce the number of times that they need to weed. Late-maturing varieties are important for household food security and may serve as collateral for obtaining loans for both men and women. Women farmers know that cassava stored in the ground is their "food bank," and they want varieties that can be harvested in phases, a year or more after they are mature.

Processing traits such as sweet varieties that are low in fiber, low in moisture, easy to peel, and have food color (cream when toasted into *gari* and white when processed into *fufu and Abacha)* are more important to women. In the four regions, the men paid attention to processing traits but ranked them as less important than agronomic traits (e.g., yield). Because women process most of the cassava, they mentioned processing traits (e.g., being easy to peel) more often than the men did. When cassava is difficult to peel, women have less time available for other important tasks and end up cutting off some of the good root with the peel. Being hard to peel not only lowers the efficiency of women's labor but also lowers the crop's economic yield. Women, especially in the southeast region, also appreciated the same agronomic traits of cassava varieties as men (high yielding and early maturing), but these are not as important to women as being easy to peel.

Men farmers have the idea that some processing traits such as color are important. For instance, both white- and yellow-colored roots serve different end-uses, products, and market niches. Unlike men,

women are keenly aware of major processing and agronomic traits. White color is preferred for certain recipes like *eba*, *fufu* (or *akpu*), *lafun*, and *Abacha* and for drinkable *gari* (stirred into cold water). In the southeast yellow is the ideal color for *gari* that is mixed with hot water to make *eba* (moldable solid food made from *gari*). Women all ranked highly the processing traits of dewatering fast, being moldable, swelling when mixed with water, and retaining its color through processing. Married men also process occasionally (e.g., when their spouses are resting from childbirth). Some men are familiar with processing work, because in their teenage years some helped their mothers make *gari* and *fufu.* Men sometimes operate the mechanized presses and graters, for other households, for a small fee.

Table 3.1.5 Cassava traits preferences by women and men in Nigeria

Regions	Women	Men
Southwest	Easy to peel (1st) Other processing (e.g., makes good *gari*) (2nd) High yielding (3rd) Early maturing (4th)	High yielding (1st) Early maturing (2nd) Stores well underground (3rd) Controls weeds (4th) Ready market
North	Easy to peel (1st) High yielding (2nd) Nontoxic (3rd) Stores well underground (4th) Other processing (e.g., makes good *gari*) (5th)	Early maturing (1st) Insect resistant (2nd) High yielding (3rd) Access to market (4th)
South–south	Easy to peel (1st) High yielding (2nd) Stores well underground (3rd) Other processing (e.g., makes good *gari*) (4th)	High yielding (1st) Stores well underground (2nd) Tolerates poor soils (3rd) Early maturing (4th)
Southeast	Early maturing (1st) Easy to peel (2nd) Stores well underground (3rd) Big roots (high yielding) (4th)	Early maturing (1st) High yielding (2nd) Less starch (3rd) Drought resistant (4th)

Gender differences

Gender difference in preferred traits was ease of peeling for women in all four regions. In two regions (southwest and north) men emphasized the need for more access to markets for cassava roots. In these two regions cassava is a main cash crop, contrary to the south–south and southeast, where oil palm and other tree crops are the main cash crops and cassava is mainly a food crop. Women in all the study regions, however, did not express such need for markets for raw roots. For the women, cassava must undergo value addition to make *gari*, *fufu*, *lafun*, and other food products for which there are ready markets in both rural and urban communities.

Women already have a thriving market for their cassava products. If we had interviewed men and women together, the women would not have bothered to contradict the men, when they asked for better markets for cassava. The women did not ask for a ready market for cassava, because they already have one. We understood that when people say they want “ready markets” they mean something like a higher market price and a profitable or stronger demand for their fresh roots. If the men were to find a more profitable market for their fresh cassava, it might deprive the women of one of the opportunities they have to make

money. Men and women may even have conflicting interests. Higher prices for raw roots might benefit men but could even harm women, who buy the roots as raw material to make *gari*, *fufu*, and *abacha*. During this study men indicated that they lacked markets to sell fresh roots, whereas women did not mention this for their processed food products. So what women do not say can be as important as what they do say (Bentley 2016).

Men and women access seed differently. Women farmers' access to planting material is important as most of them cultivate smaller portions of land compared with men, who have better access to planting material and inherit larger portions of land. The women explained that since they grow less cassava than the men (and process more), they are likely to run out of stems sooner. The men can leave a part of their field unharvested, saving the stems for planting time. The women may not always be able to do so, but they can "buy a cassava farm," meaning that they buy the standing crop in the field, harvest it for the roots, but also keep the stems. The women said, "It's our trick." The men may not even realize that they are selling seed when the women buy the standing crop.

Complete data

A complete overview of the tables with data can be found in the full report of the research: http://www.iita.org/wp-content/uploads/2017/Cassava_farmers_preferences_monograph.pdf

Conclusion

Women and men farmers in all regions may be looking for a "basket" of cassava types. For example, most varieties should be early maturing, but there may be a demand for some later maturing varieties, especially if they store well in the soil for 2 years or more. Both genders in all regions expressed a demand for non-bitter (poundable) cassava, but some communities (in all regions) are under pressure from Fulani cattle and might also want some bitter varieties that cattle will not eat. Processing traits such as sweet varieties that are low in fiber, low in moisture, and easy to peel and have the desired food color (cream when toasted into *gari* and white when processed into *fufu* and *Abacha*) are more important to women. Women and men farmers in all regions want some varieties that are high in starch and some that are low in starch. Varieties with yellow roots may find a place alongside white ones. In other words, demands for some different traits may not be contradictory but complementary, because a household or a community needs some different types of cassava.

The overall similarity between cassava traits as expressed by women and men in this study suggests little or no competition between the gender-based tasks with regards to preference traits. Having mechanical peelers could reduce drudgery and time which women can use within cassava production system and/or to better market their food products. Genome-assisted breeding methods with markers linked to cassava outer-skin thickness and adhesiveness to the inner flesh can assist selection in the development of new varieties for gender-responsive breeding. Culinary and processing traits, such as moldability or good to make *gari*, need to be brought up to a more measurable definition if these traits are to be more actively taken up within breeding. However, more specific information on the positionality, future outlook, and

possibilities of specific groups of women farmers and processors is needed to further specify their possibilities, needs, and preferences with regards to the different food products that they make.

Implications for Breeding

This qualitative case study has enlightened researchers' prior knowledge on cassava farmers' traits preferences, thus spotlighting product quality and cooking traits. Drawing lessons from this study conducted in one of the world's largest cassava producing countries, breeders could breed more effectively in line with documented preferences to enable equitable benefits for men and women farmers and processors. For example, women farmers will prefer varieties that are easy to peel in order to save time as well as those with weed-smothering characteristics so that women will not spend much on hired labor or herbicides. This study has been able to inform plant breeders on important new traits such as ease of peeling and weed-smothering, and quality traits such as swellability and "good to make *gari*" that can be considered when setting breeding priorities. From the preferences conveyed by men and women, a composite of key preferences should be realized to gear breeding efforts toward improved varieties that, for example, combine food product/processing quality, are high yielding, can be stored in-ground, are easy to peel, and can compete with weeds, to achieve equitable impacts. Farmers often combine varieties with very different properties (such as early- and late-maturing varieties). The amount of traits that can be bred for simultaneously is limited because of trade-offs and limited financial resources. But breeding can identify popular existing land races that can cover some essential traits (like in-ground storability) while others can be included in the breeding program (such as early maturity or food product quality traits). As such, the composite of necessary traits can be divided between existing material and improved material in order to derive a set of varieties that addresses more traits simultaneously.

Research activities using triangulation methods are now ongoing to get specific markers that depict ease of peeling and food quality traits like swelling ability in *gari*. Here, the cassava breeding unit now focuses especially on women farmer–processors (responsible for the production of the largest part of food products within Nigeria) and their preferences. They have hands-on experience in cultivation and processing of cassava, and can inform us on how variety is related to product quality. This requires triangulation with biochemical and food science data. Selection and inclusion of food or product quality traits markers in the development of new varieties will likely lead to more rapid uptake and continued use of these varieties when released and disseminated.

This study, together with the Cassava Monitoring Study (Wossen et al. 2017) study and an additional study on variety preferences that focuses on gender norms (Teeken et al. forthcoming), has motivated the cassava breeding unit to integrate social science and food science within its efforts to define additional traits to be bred for in order to increase adoption.

References/Further Reading

Abdoulaye, T., A. Abass, B. Maziya-Dixon, G. Tarawali, R. Okechukwu, J. Rusike, A. Alene, V. Manyong, and B. Ayedun. 2013. Awareness and adoption of improved cassava varieties and processing technologies in Nigeria. *Journal of Development and Agricultural Economics* 6(2):67–75.

Acheampong, P.P. 2015. Economic analysis of farmer's preference for cassava variety traits: Implication for breeding and technology adoption in Ghana. PhD diss., Kwame Nkrumah University of Science and Technology, Ghana.

Addison, M., S.E. Edusah, and P. Sarfo-Mensah. 2014. Gender constraints and rice varietal characteristics preferences in lowland rice ecosystem in Ghana. *Developing Country Studies* 4(15):92–98.

Akoroda, M.O. 1995. Alleviating hunger in Africa with root and tuber crops. *African Journal of Tropical Root Crops* 1:41–43.

Awotide, B.A., A.D. Alene, T. Abdoulaye, and V.M. Manyong. 2015. Impact of agricultural technology adoption on asset ownership: the case of improved cassava varieties in Nigeria. *Food Security* 7(6): 1239–1258.

Bentley, J. 2016. Listening to what women don't say. RTB CGIAR Blog

Bentley, J., A. Olanrewaju, T. Madu, O. Olaosebikan, T. Abdoulaye, T. Wossen, V. Manyong, et al. 2017. Cassava farmers' preferences for varieties and seed dissemination system in Nigeria: gender and regional perspectives. IITA Monograph, Ibadan: IITA Monograph 90p. https://cgspace.cgiar.org/handle/10568/80554?show=full

Curran, S., and J. Cook. 2009. Gender and cropping: Cassava in sub-Saharan Africa. Evans School of Public Affairs, University of Washington, Seattle, WA, USA.

Ezeibe, A.B., D.O. Edafiogho, N.A. Okonkwo, and C.C. Okide. 2015. Gender differences and challenges in cassava production and processing in Abia State, Nigeria. *African Journal of Agricultural Research* 10(22):2259–2266.

Gates, M.F. 2014. Putting women and girls at the center of development. *Science* 345(6202): 1273–1275.

Ilona, P., H.E. Bouis, M. Palenberg, M. Moursi, and A. Oparinde. 2017. Vitamin A cassava in Nigeria: Crop development and delivery. *African Journal of Food, Agriculture, Nutrition and Development* 17(2):12000–12025. DOI: 10.18697/ajfand.78. HarvestPlus09.

Maroya, N.G., P. Kulakow, A.G.O. Dixon, and B.B Maziya-Dixon. 2011. Genotype × Environment Interaction of Mosaic Disease, Root Yields and Total Carotene Concentration of Yellow-Fleshed Cassava in Nigeria. *International Journal of Agronomy* vol. 2012, Article ID 434675, 8 pages. doi:10.1155/2012/434675

Olaosebikan, O., B. Abolore, and D. Owoade. 2017. International Institute for Tropical Agriculture (IITA)/ GREAT RTB Blog.

Teeken, B., O. Olaosebikan, J. Haleegoah, E. Oladejo, T. Madu, A. Bello, E. Parkes, C. Egesi, P. Kulakow, H. Kirscht, and H. Tufan. Forthcoming. Cassava trait preferences of men and women farmers in Southwest and Southeast Nigeria, what are the implications for trait prioritization within breeding?

Uchechukwu-Agua, A.D., O.J. Caleb, and U.L. Opara. 2015. Postharvest Handling and Storage of Fresh Cassava Root and Products: A Review. *Food and Bioprocess Technology* 8(4):729–748.

Walker, T., A. Alene, J. Ndjeunga, R. Labarta, Y. Yigezu, A. Diagne, R. Andrade, R. M. Andriatsitohaina, et al. 2014. Measuring the Effectiveness of Crop Improvement Research in Sub-Saharan Africa from the Perspectives of Varietal Output, Adoption, and Change: 20 Crops, 30 Countries, and 1150 Cultivars in Farmers' Fields. Report of the Standing Panel on Impact Assessment (SPIA), CGIAR Independent Science and Partnership Council (ISPC) Secretariat: Rome, Italy. Link .

Wossen, T., G. Girma, T. Abdoulaye, I. Rabbi, A. Olanrewaju, A. Alene, S. Feleke, et al. 2017. The Cassava Monitoring Survey in Nigeria. Report International Institute of Tropical Agriculture, Ibadan, Nigeria.