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Gender Roles in Sourcing and Sharing of Banana Planting Material in Communities with and without Banana Bunchy Top Disease in Nigeria

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Gender roles in banana seed sourcing and sharing towards banana bunchy top disease management in Nigeria

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Abstract:

Banana bunchy top disease (BBTD) is the most devasting disease of banana and plantain (*Musa* spp.) that spreads along with the vegetative propagation of planting material. This study seeks to understand the gender dimensions and socio-cultural aspects of banana seed sourcing and sharing practices among men and women farmers, and its influence on BBTD spread and disease control efforts. Quantitative and qualitative methods were used to collect data from 300 banana farmers in BBTD and non-BBTD areas in southwest Nigeria. Results revealed that seed sharing within the communities is a social responsibility with members expected to share banana seed with the needy mainly as gifts rather than sold for cash. Male farmers mostly sourced seed from old fields, while women sourced seed from relatives. Harvesting of banana seed was predominantly the responsibility of men with women as helpers. Both men and women farmers in the non-BBTD area cultivated larger farm sizes and harvested more banana seed than farmers in the BBTD area. The existing seed sourcing practices between men and women farmers heighten the risk of the disease spread. Awareness-raising on disease spread through infected seeds should consider the gendered-differentiated roles and social practices to reduce its spread within communities.

Keywords: banana and plantain; seed systems; gender; banana bunchy top; BBTV; virus control; seed systems; Africa

1. Introduction

Seeds store the genetic potential of crops and their varieties resulting from continuous improvement and selection over time [1]. Seeds, including botanic seed and vegetative propagules, are indispensable agricultural inputs central to food production and biodiversity conservation and determine overall crop yield [2, 3]. The quality and genetics of seeds alone account for at least 15% of crop productivity, often much more [4]. However, seeds are inherent carriers of several plant pathogens known to cause devastating crop diseases, especially in crops propagated using vegetative planting materials, such as stems, tubers, and corms, including in vitro generated plantlets [5]. Banana bunchy top disease (BBTD) caused by the *Banana bunchy top virus* (BBTV, genus *Babuvirus*) is a classic example of a seed-transmitted virus that has caused a severe economic loss in banana,

collectively used here afterward to refer to banana and plantain (*Musa* spp.). BBTD has been recognized as the most devastating viral disease of banana as BBTV causes severe stunting (dwarfing) and halts fruit production leading to 80 to 100% production loss within one or two seasons [6]. The virus, first recognized in Fiji in the 20th century, has spread to over 35 countries in Africa, Asia, Australia, and the South Pacific Islands [6], presumably through the inadvertent movement of virus-infected planting material. The virus readily spread through the suckers (shoots developed from the lateral bud of rhizome that grow below the ground) commonly used as vegetative planting material. The introduced propagule serves as a source for virus acquisition and further spread by the insect vector, banana aphid (*Pentalonia nigronervosa*), which is known to occur in all the banana production areas. In sub-Saharan Africa (SSA), BBTV was first detected in the Democratic Republic of Congo (DRC) in the 1960s [6]. The virus has since spread to all the major banana production regions in DRC and other parts of SSA. [7]. The spread of virus-infected planting material was found the be the major factor for within country and continental spread of BBTV in Africa [8]. The BBTV occurrence in Nigeria was first identified in Idologun community in Yewa-South local government area (LGA) in 2012 [9]. The virus has since emerged as a major threat to banana production in Nigeria [8, 9].

Banana is one of the staple foods in Nigeria. According to the FAO (2018), 2.09 million tons of fruit was produced on 502,00 ha at an average of 6.12 t/ha. Plantain and cooking banana types are popular and widely grown throughout the country as backyard plantations or in mixed cropping systems, but the intense production of the crop is confined to the humid forest zones in the southwest, south-south, and south-east of Nigeria, which includes Akwa-Ibom, Cross River, Delta, Edo, Enugu, Imo, Lagos, Ogun, Osun, Oyo, and Rivers states. Most banana producers are smallholder farmers with less than 5 ha landholdings and cultivate the crop under subsistence farming conditions. Farmers manage the crop as semi-perennial to perennial plants with minimum management interventions. Where there is no organized seed system, i.e., formal production of seed under a quality certification regime, farmers often establish new fields with planting material sourced from own farms or acquired from the neighbors or others as a gift, barter, or trade. Most of the planting materials are derived from the plantations affected by pests and diseases and are known to perform poorly [8]. This practice of sourcing seed was suspected to have caused the extensive spread of BBTV since its introduction in 2012 to the southwest part of Ogun State. This study was conducted to characterize the seed sourcing behavior of banana farmers and its implication on the spread of the virus and control interventions in the southwest region.

A seed system is a multi-stakeholder value chain that contributes to the planting material available to farmers. Seed systems are commonly categorized as the formal and informal systems, depending on the process, quality, and monitoring controls used to regulate the flow of seed along the value chain from the producer to the end-user. The formal seed system provides farmers with quality tested seed of improved varieties, entails a series of activities, starting with plant breeding and ending with commercial seed sold on the market through commercial seed producers, input dealers, and government channels under regulatory oversight [10]. Informal seed systems, on the other hand, cover methods of seed selection, production, and diffusion by farmers, including the exchange of seed. These seeds are obtained through informal networks in exchange for gifts from relatives and neighbors, bartering with other farmers, or purchasing from local markets [11]. In Nigeria, as in many developing countries, farmers have limited access to the formal seed-supply, especially that of vegetatively propagated crops such as banana. This leads to the domination of the

informal seed system, which is estimated to account for >80% of seed used among farmers [12, 13]. However, this seed system often involves limited quantities and exposes the farmer to the risk of seed-borne diseases as most seeds are generally untested for health and quality, particularly for vegetatively propagated crops such as banana [14, 15]. Moreover, planting material for such crops is bulky, difficult to produce due to low multiplication ratios, and highly perishable, further complicating seed delivery channels [16]. Seed systems largely depend on the availability of and accessibility to seeds of varieties with preferred traits or characteristics, which often differ across geographical locations and between men and women farmers. For this paper, banana suckers are referred to as seeds.

Banana seed systems and disease management are embedded within social and gender relations. Studies on differences in specific trait preferences as well as gender-specific research along the banana value chain is limited [17]. Studies have shown the need for gender consideration in banana seed systems given the difference in access to and control over resources and services, social structures, and institutions in the communities [18-20]. These differences often mean that men and women face unequal constraints in seed sourcing and this reflects in differences in where seeds are sourced, shared, the quantity of seed sourced and shared, and variety preferences [7, 21]. Therefore, an understanding of the interactions, behavior, and decision-making among men and women in informal banana seed systems is vital to improve seed distribution, BBTD containment, and other targeted interventions.

This study focused on elucidating the roles of men and women in banana seed sourcing in the BBTD-affected communities in Ogun State, vis-à-vis with communities without BBTD in southwest Nigeria. Specifically, the study focused on seed sourcing and sharing practices and insights into constraints in banana seed sourcing by men and women farmers.

2. Materials and Methods

3.1. Site selection

The study was conducted between October and December 2017 in six communities in Ogun and Oyo states in Nigeria, employing qualitative and quantitative methods. The tools used include household surveys, focus group discussions, key informant interviews, daily activity schedules, problem trees, and participant observation. These tools provided information on the socioeconomic and cultural background of the households, social networks and seed systems, productive resources, and constraints to banana seed production and sourcing. Ogun State was selected purposively due to the prevalence of BBTD, while Oyo State was selected as a control (Fig 1). Purposively, Yewa South and Ido local government areas were selected in Ogun and Oyo states, respectively, because banana is a primary crop grown by the residents. Three communities were selected in each local government area. Idologun, Odon, and Olokuta in Yewa South were selected because they are BBTD endemic communities, while Aba-paanu, Olowa, and Adejare in Ido Local Government Area, Oyo State were selected because they are BBTD-free communities (Figure 1). Fifty banana farmers consisting of men and women were randomly sampled in each community to give three hundred (300) farmers surveyed in BBTD and non-BBTD areas.

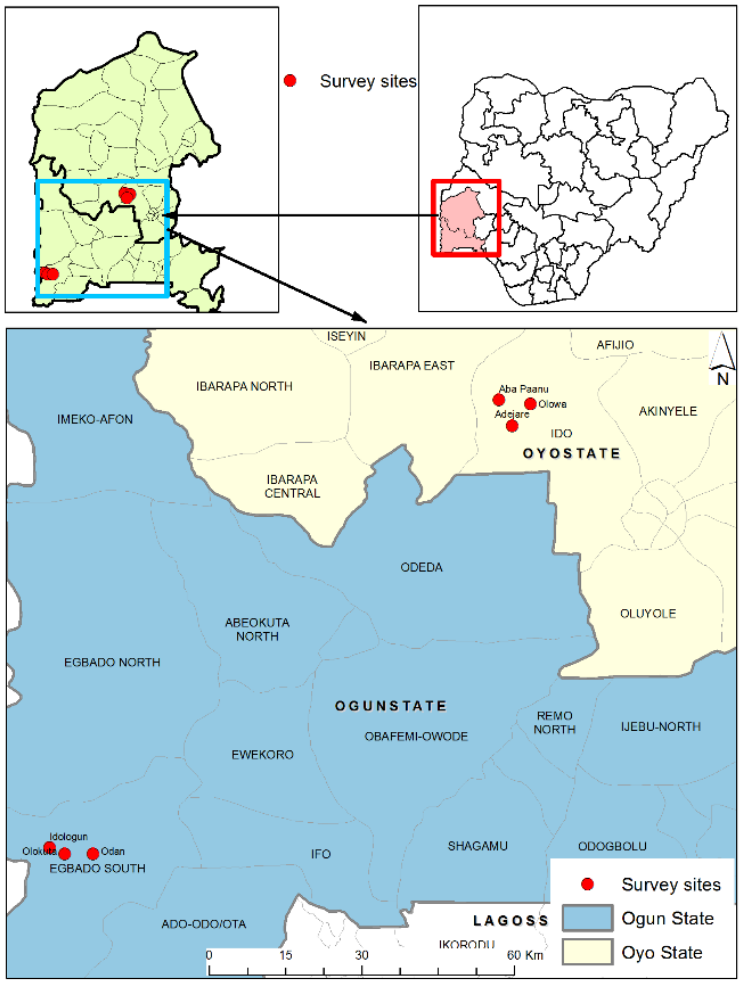


Figure 1. Map of surveyed communities in Ogun State (BBTD endemic area) and Oyo State (BBTD-free area), Nigeria

3.2. Sampling, data collection, and analysis

Respondents in the study comprised men and women banana farmers within households in the selected communities and banana seed producers. Banana seed producers were primarily involved in monoculture and produce banana seed mainly for marketing. Primary data were collected at individual and community levels using quantitative and qualitative approaches. Quantitative data were collected through household surveys of banana farmers across the selected communities. Interviews were conducted with 150 banana farmers in BBTD-affected areas and 150 banana farmers in unaffected areas. Participating households were selected randomly within the selected communities. A household was defined as a domestic unit consisting of the members of a family who live and have meals together, including non-relatives such as servants [22]. Within the sampled households, interviews were conducted with the person [male or female] identified as the banana farmer.

Qualitative data were collected through focus group discussions (FGDs). FGDs comprising 8–10 participants were organized separately for male and female participants in each community. The participants' selection was based on the farmer's knowledge of banana production and the social and cultural norms existing in the communities and those that would help us to understand the

phenomenon of gender roles in banana seed production and sourcing. A focus group discussion guide was developed with questions to be used during the FGD. Focus group discussions held as a follow-up for specific interaction with farmers on themes such as banana seed production, seed sourcing and sharing behaviors within households and communities, and access to and ownership of productive resources such as seed, land, and BBTD management. Furthermore, a problem tree analysis (a mind mapping tool used for understanding cause and effect) was used as a participatory tool to highlight the challenges faced by men and women in banana seed production and sourcing.

Quantitative data were aggregated by sex and location (BBTD zone and non-BBTD zone). This was analyzed using descriptive statistics such as percentages and mean using SPSS (Statistical Package for Social Science). Qualitative data were collected through FGDs. Twelve sex disaggregated FGDs were carried out: six in BBTD areas and six in non-BBTD areas. Each group comprised eight to ten discussants randomly selected within each community. Discussions were recorded, translated, and transcribed into English. The content analysis approach was used where the data were categorized into codes and classified into thematic areas. Information on varietal choices, banana seed sourcing, and sharing behavior and constraints in seed sourcing were analyzed to enable triangulation and validation of quantitative results.

3. Results

3.1. Banana production characteristics

Generally, the primary source of income in the studied communities was from agricultural activities for 69.5% of men and 71.7% of women (Table 1). Banana production specifically contributed 18.7% of income for men and 10.6% for women. The annual income from agriculture for men ($1080) was higher than the income of women ($754.1) in both BBTD and non-BBTD areas. Over 70% of men and women farmers in BBTD and non-BBTD areas have cultivated banana for at most 20 years. Overall, men had more experience (20 years) in banana production than women (16 years). Men cultivated an average of 1.7 hectares (range of 0.3–20 ha), while women cultivated 1.2 hectares (range of 0.3–60 ha). In the non-BBTD zone, a larger percentage of men (87.3%) and women (57.0%) cultivated above one hectare, while less than 30% of men and women farmers in the BBTD zone cultivated above one hectare. In 2016, 62.9% of men and 50% of women in the BBTD zone planted > 300 banana seeds (suckers) with a mean of 391 and 307 seeds, respectively. Also, 76% of men and 46.8% of women in the non-BBTD zone planted the > 300 seeds with a mean of 454 and 340 seeds, respectively.

Table 1. Banana production characteristics of farming households

Sites	**BBTD area (150)**		**Non-BBTD area (150)**		**Total (n = 300)**	
Variables	**Male (n = 116)**	**Female (n = 34)**	**Male (n = 71)**	**Female (n = 79)**	**Male (n = 187)**	**Female (n = 113)**
Major source of income (%)						
Banana production	6.9	5.9	38.0	12.7	18.7	10.6
Other agricultural activities	77.6	55.9	56.3	78.5	69.5	71.7
Non-agricultural activities	15.5	38.2	5.6	8.9	11.8	17.7
Estimated annual income from agriculture (%)						
$1–$500	46.6	61.8	19.7	35.4	36.4	43.4

$501–$1000	22.4	20.6	43.7	45.6	30.5	38.1
$1001–$1500	12.9	2.9	19.7	5.1	15.5	4.4
$1501–$2000	5.2	8.8	5.6	11.4	5.3	10.6
$2001–$2500	5.2	2.9	4.2	1.3	4.8	1.8
Above $2500	7.8	2.9	7.0	1.3	7.5	1.8
Mean income from agric. ($)	1116.5	732.3	1290.9	813.5	1080.0	754.1
Years of banana cultivation (%)						
1–10	25.9	38.2	33.8	34.2	28.9	35.4
11–20	37.1	41.2	38.0	43.0	37.4	42.5
21–30	18.1	11.8	21.1	16.5	19.3	15.0
31–40	15.5	8.8	7.0	6.3	12.3	7.1
Above 40	3.4	0.0	0.0	0.0	2.1	0.0
Mean age (years)	21	16	16	16	20	16
Hectares of banana farm (%)						
Less than equal to 1	72.4	82.4	12.7	43.0	49.7	54.9
Above 1–3	25.9	17.6	49.3	48.1	34.8	38.9
Above 3–5	0.9	0.0	28.2	6.3	11.2	4.4
Above 5	0.9	0.0	9.9	2.5	4.3	1.8
Mean farm size (ha)	0.8	0.6	3.2	1.5	1.7	1.2
Quantity of banana seeds planted in 2016 (%)						
Less than equal to 100	13.8	23.5	7.0	22.8	11.2	23.0
Above 100–300	23.3	26.5	16.9	30.4	20.9	29.2
Above 300–500	19.8	23.5	19.7	7.6	19.8	12.4
Above 500	43.1	26.5	56.3	39.2	48.1	35.4
Quantity of banana seeds harvested last season (%)						
Nil/did not harvest	55.2	70.6	56.3	50.6	55.6	56.6
Less than 100 seeds	26.7	23.5	8.5	35.4	19.8	31.9
100–500 seeds	15.5	2.9	5.6	10.1	11.8	8.0
Above 500 seeds	2.6	2.9	29.6	3.8	12.8	3.5
Average seed harvested	70	52	1172	607	489	439
Average seed per location	66		875		473	
Quantity of banana fruits harvested (%)						
1–150 bunches	42.2	50.0	42.3	35.4	42.2	39.8
151–300 bunches	21.6	20.6	38.0	27.8	27.8	25.7
301–450 bunches	16.4	17.6	8.5	17.7	13.4	17.7
451–600 bunches	5.2	8.8	7.0	6.3	5.9	7.1
Above 600 bunches	14.7	2.9	4.2	12.7	10.7	9.7
Average bunches harvested	355	240	376	361	402.	317
Places banana fruit is sold (%)						
On-farm (farm gate)	1.7	0.0	14.1	10.1	6.4	7.1
Market within the community	47.4	47.1	56.3	59.5	50.8	55.8
Market outside the community	45.7	52.9	29.6	27.8	39.6	35.4

Market both within and outside the community	5.2	0.0	0.0	2.5	3.2	1.8

Both men and women farmers were involved in seed harvesting. However, only a small proportion of the farmers interviewed harvested banana planting material in 2016. Men harvested an average of 489 banana seeds, while women harvested an average of 439. An average of 875 banana seeds were harvested in the non-BBD zone compared with an average of 66 banana seeds in the BBTD zone. In terms of harvesting banana fruits, overall, 70% of men and 65.5% of women harvested 300 banana fruits. The average number of fruits harvested in the BBTD zone by men and women farmers was 355 and 240, respectively. While in the non-BBTD zone, men and women farmers harvested 376 and 361 banana fruits, respectively. Overall, 50.8% of men and 55.8% of women farmers sold harvested fruits within the community, while 39.6% of men and 35.4% and women sold their produce outside the community.

3.2. Banana seed sourcing among farming households

Banana seed sourcing among farming households revealed that farmers acquired planting material from several sources for establishing new plantations (Table 2; Figure 2). In total, a higher percentage of men sourced seeds from old fields (33.7%) and neighbors (20.3%), while women sourced seeds from relatives (43.4%) and neighbors (20.4%). In BBTD and non-BBTD areas, women sourced seeds more from relatives (36.6%) and neighbors (48.1%), while men sourced more seeds from old fields (39.7%) and neighbors (36.6%). Responses from FGDs emphasize that seed sourcing practices differ among men and women farmers, an illustration of gendered differentiation in sourcing practices.

> *"It is in banana production I was born, that is where I grew up. My parents were farmers, they cultivate cocoa and banana. It was from my fathers' farm, that I got my first seed. Sometimes I source seeds from co-farmers. If I see a variety that I like, I can just walk into the farm to take it or request for seeds and I will be given." (*Idologun men FGD*).*

> *"We often get seeds from our husband or other close relatives. We as women, we are restricted culturally from entering a stranger's field especially if he is a man. There is a law that one must never enter someone's farm apart from your husband's farm to harvest suckers without prior notice or without asking the owners or taking permission. If such happened, one will be taken to the palace and get punished*." (Odon Women, FGD).

Table 2: Location of seed sourcing and preferred traits

Study locations	**BBTD area (n = 150)**		**Non-BBTD area (n = 150)**		**Total (n = 300)**	
	Male (n = 116)	Female (n = 34)	Male (n = 71)	Female (n = 79)	Male (n = 187)	Female (n = 113)
Location of sourced banana seeds						
Within the community	81.0	73.5	87.3	96.2	83.4	89.4
Outside the community	19.0	26.5	12.7	3.8	16.6	10.6
Preferred traits in banana seed sourcing						

Fruit size of mother plant	39.7	47.1	29.6	21.5	35.8	33.6
Height of mother plant	19.8	14.7	29.6	36.7	23.5	30.1
Appearance/size of seed	21.6	17.7	33.8	40.5	26.2	27.4
Large green leaves of plant	14.7	11.7	7.0	1.3	11.8	5.3
Disease-free seed	4.2	8.8	0.0	0.0	2.7	3.6

Note: All figures are in percentages

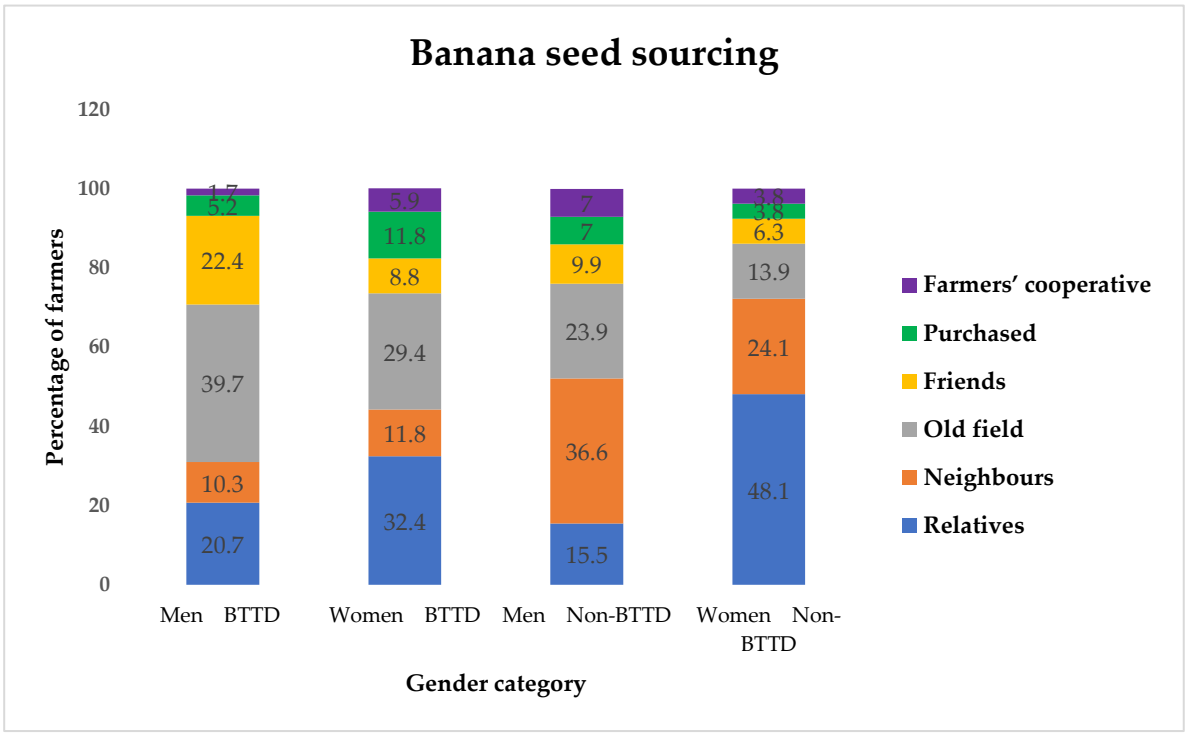


Figure 2. Distribution of respondents by banana seed source

3.3. Preferred traits in banana seed sourcing and sharing

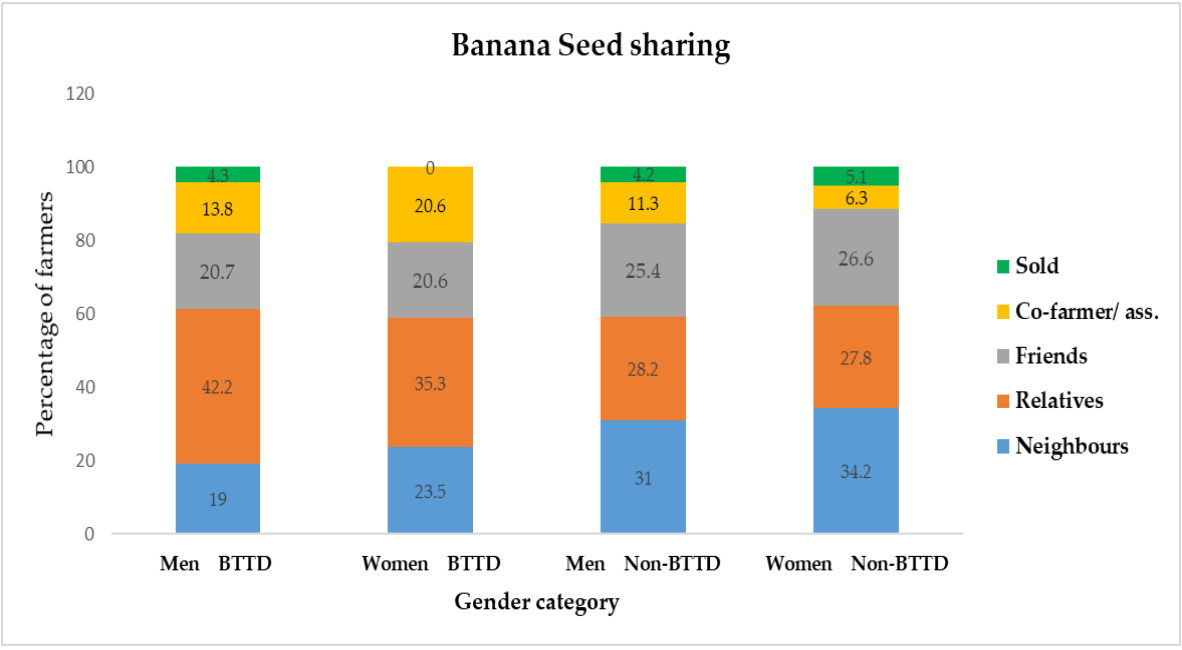
Farmers often sourced banana seed within the community (Table 3, Figure 3). The majority of men (81.0%) and women farmers (73.5%) in the BBTD area sourced their first seed within their communities. Similarly, in the non-BBTD area, 87.3% of men and 96.2% of women sourced their first seed within their communities. Fruit size of the mother plant was the most important trait for 35.8% of men and 33.6% of women, while the size of mother plant was preferred by 23.5% of men and 30.1% of women.

Sharing of banana seed was done within the communities by men (70.6%) and women farmers (76.1%), while 22.5% and 16.8% of men and women farmers, respectively, shared seeds both within and outside the community. Both in BBTD and non-BBTD areas, most men (87.1%) and women (89.0%) shared banana seeds as gifts with 78.7% of men and 82.6% of women farmers getting nothing in exchange, while a few exchange banana seeds for money and farm labor. Men shared banana seeds with relatives (36.9%) and neighbors (23.5%), while women shared seeds with neighbors (31.0%) and relatives (30.1%) (Fig. 3). The disaggregated result reveals that in the BBTD zone and non-BBTD areas, banana seeds were mostly shared among relatives, friends, and neighbors by men and women farmers.

226 **Table 3. Banana seed sharing characteristics among households**

	BBTD area (150)		Non-BBTD area (150)		Total (n = 300)	
	Male (n = 116)	Female (n = 34)	Male (n = 71)	Female (n=79)	Male (n = 187)	Female (n = 113)
Location where seeds are shared						
Within the community	62.1	61.8	84.5	82.3	70.6	76.1
Outside the community	6.0	11.8	8.5	5.1	7.0	7.1
Within and outside the com.	31.9	26.5	7.0	12.7	22.5	16.8
Motivation for sharing seeds						
Gift	88.9	95.5	84.3	87.0	87.1	89.0
To avoid extinction	8.6	4.5	2.0	5.80	6.1	5.5
Exchange for other products	2.5	0	7.8	4.3	4.5	3.3
Pay debts	0	0	5.9	2.9	2.3	2.2
Exchange for banana seeds						
Nothing	76.8	84.0	82.4	82.0	78.7	82.6
Banana seeds in future	6.1	4.0	0	8.2	4.0	7.0
Money	0	0	15.7	6.6	5.3	4.7
Assistance	15.2	8.0	2.0	1.6	10.7	3.5
Other crop seed	2.0	4.0	0	1.6	1.3	2.3

Note: All figures are in percentages



227

228 **Figure 3: Percent distribution of respondents by banana seed sharing**

229 *3.4. Constraints in banana seed sourcing*

230 Several constraints were encountered in banana seed sourcing, which were differenced by gender
231 and location (Table 4). Transport was a main problem for men (39.9%) and women (45.6%) farmers

in banana seed sourcing. The disaggregated result across study locations revealed that in the BBTD area, long-distance seed sourcing was more of a constraint to women (65.4%) than men (42.7%), while in the non-BBTD area, the high cost of transporting seed to the farm was more of a constraint to men (40.4%) than women (28.3%). Seed infection by diseases such as BBTD, black Sigatoka, and nematodes, unavailability of seed in large quantity, and physical stress due to the bulky nature of seeds were other constraints to banana seed sourcing.

> *"Sometimes we get suckers (banana seeds) from long-distance farms, and due to the weight, we cannot trek with them, so we need often need a means of transportation which is always too expensive and sometimes unaffordable." (Olokuta, Women FGD).*

Table 4. Distribution of respondents by constraints in banana seed sourcing

Sites	**BBTD area (n = 150)**		**Non-BBTD area (n= 150)**		**Total (n = 300)**	
Constraints	**Men (n = 116)**	**Women (n = 34)**	**Men (n = 71)**	**Women (n = 79)**	**Men (n = 187)**	**Women (n = 113)**
Long distance from source	42.7	65.4	34.6	35.8	39.9	45.6
High cost of transportation of seed to farm	7.3	7.7	40.4	28.3	18.9	21.5
Disease infection of seed	6.3	0	3.8	7.5	5.4	5.1
High prices of seed	2.1	7.7	9.6	3.8	4.7	5.1
Unavailability of seed in large quantity	7.3	3.8	0	0	4.7	1.3
Stress due to bulky nature of seed	2.1	0	0	1.9	1.4	1.3
Inadequate knowledge of harvesting seed	2.1	0	0	0	1.4	0

Note: All figures are in percentages

4. Discussion

Seeds are sourced and shared between and among different members of the communities through social networks. In most farming communities formal and informal rules influence the ability of men and women to access quality seed differently [4]. Men farmers sourced their first seeds from old fields because they often inherited banana fields from their fathers, and women farmers sourced more of their first seeds from family relatives, especially husbands, because culturally it is considered inappropriate for women to source seeds from strangers and distant places. This is common in many rural communities in Nigeria, where farms are generally willed to male offspring only. The patriarchal power structure favors men in allocating productive resources within the household [18, 23]. A study in Cameroon indicates that men have more access to and control of productive resources such as land than women and are more likely to buy clean seed if sold than women who predominantly used informal seed sharing sources [20]. Similar to seed sourcing, the sharing of banana seeds within the communities was through social networks in exchange for gifts from relatives and neighbors, through bartering with other farmers, or purchasing from local markets [4]. Seeds are rarely sold and often given as gifts to relatives, neighbors, and friends, likely due to small

farm holdings and active social networks among community members. Smallholder farmers usually need smaller quantities of planting material, provided within the informal seed system, where social networks play a significant role [24].

The sharing and sourcing of banana seeds along social networks strengthen communal ties and avoid the extinction of seeds. Hence, seeds are continually available to farmers for little or no cost within the community. Even on rare occasions when bought, these seeds are often bought along with social ties. These observations on banana seed sourcing in Nigeria is similar to the potato seed sourcing in Malawi, where selling and buying potato seed depends on trust and ties [25]. This exchange (give and take) of banana seeds among farmers within the communities increases the access of seed to farmers, even to those with limited purchasing power, as little or nothing is spent purchasing seeds. The acquisition of inputs through non-cash alternatives, as in the informal sector, is preferred by small-scale farmers who are short of cash [26]. However, the exchange of seeds along social ties predisposes women, widows, youth, and other vulnerable groups to the risk of getting fewer seeds or seed of less preferred varieties when the demand is high because there is often a substantial gap between supply and demand, especially for large quantities of preferred varieties [27].

The shortage of seeds often results in higher transportation costs as farmers have to travel long distances to other communities, reduced numbers planted, delayed planting, and sometimes leads to farmers becoming ill due to the increased stress. The constraints in banana seed sourcing are exacerbated by the vegetatively propagated nature of banana, i.e., low multiplication ratio, bulkiness, short shelf life, and difficulties in maintenance, especially during the dry season [21]. Along gender lines, women are most affected by these constraints because, in most communities, they are not allowed to enter men's farms; they hardly have access to motorized transport and will have to trek long distances searching for seeds. A study in Nigeria and Kenya on gender mobility in public spaces showed that women generally are less mobile than men due to norms that limit the spaces where they go as well as the purpose, duration, and time of the day of their travels [28]. Hence women often have to settle for less preferred seed and cultivate smaller farm sizes to cope with their productive and reproductive roles at home [29]. Unlike in Cameroon, where women are predominantly responsible for banana seed sourcing, male farmers in Nigeria were responsible for banana seed harvesting due to the energy and traditional norms involved in harvesting the seeds. Most women only assist their husbands in transporting the harvested seeds to their new fields. However, some women harvest banana seeds by themselves, especially when they have no one to assist and cannot afford labor. In banana production, men harvest a higher number of banana seeds, and men cultivated larger farm sizes than females. Men are often more involved in production (cultivation), while women market the fruits [30, 31]. The land tenure system practiced in most communities in Nigeria favors men over women [32]. Predominately, land accessed by inheritance is often exclusively for males. Hence, most women depend on their husbands for agricultural land. In Nigeria, the differentiated gender roles are manifested in social rights and entitlements in a form that disfavors women equal economic and political opportunities, and in particular, denies women the right to own land [33]. This means that women have less access to land for agricultural purposes [34]. The minimal difference in seeds of preferred varieties among men and women farmers suggests that factors influencing the choice of variety among men and women were similar with the preference for variety based on finger size and local use of each variety such as their medical abilities [35].

Banana seed sharing behaviours in BBTD affected and non-affected communities is quite similar. Generally, in both communities, banana seeds are sourced informally, relying mostly on social networks such as relatives, neighbours, and also from old fields. The informal sharing patterns are linked to social ties with no formal systems or structures. It is no surprise that farm size cultivated and, banana seeds planted and harvested in non-affected BBTD areas are higher than in the BBTD affected areas. However, it is important to ensure that the growers in the BBTD-free areas are aware of the nature of the disease and the management measures in order to prevent the disease spread or limit its spread if it gets into the community. Informal seed sharing patterns between men and women in the communities could exacerbate the spread of BBTD if they are not aware of BBTD symptoms and containment measures. Being both seed- and vector-borne, BBTD quickly limits the production and availability of clean seed in an area. When plants are infected by the virus, they become progressively stunted and ultimately stop producing fruits at the late stage [35]. Farmers often regard BBTD- affected plants as suckers and harvest them for using use as planting material; hence, BBTD is transmitted inadvertently into new fields/areas through sharing of infected seeds from infected plants.

5. Conclusions

The study identified gender-differentiated roles and responsibilities and choices in banana seed selection, sourcing, and distribution between men and women within Nigeria's communities. Both men and women exchange seed predominantly within the communities, whereas men are mostly involved in introducing seed from the far-off places (long-distance movement). The existing seed sourcing practices of both women and men farmers heightens the risk of disease spread with planting material within the communities. However, the risk of BBTD introduction into communities is higher in seed sourcing activities of men because of their role in long-distance movement of seed, which often contributes to the wide dissemination of seed-transmitted diseases such as BBTD [8].

Awareness-raising on the potential spread of diseases through sourcing and sharing of infected seeds should consider the gendered-differentiated roles and social practices to reduce the spread of BBTD along with disease-free planting material within the communities. A reliable, clean seed supply system is crucial for the sustainable management of BBTD and recovery of BBTD-affected communities. The research community and extension agencies should use participatory approaches in all field level activities that engage all stakeholders in management interventions to ensure that the BBTD-free areas remain free of the disease.

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