

## Sweet potato farming systems and main constraints to farmer, trader and consumer in Niger and Nigeria

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### Abstract

Sweetpotato is an important food, feed and vegetable crop in most tropical developing countries. The decision to adopt a new cultivar is complexly related to field and yield performance as well as consumer taste acceptability. The objective of this study was to identify sweetpotato management system and constraints to farmers, traders and consumers in Niger and Nigeria. The study was carried out for both Focus Group Discussion (FGD) and Semi-Structured Questionnaire (SSQ) in Niger and Nigeria. Data was collected using established Participatory Rural Appraisal (PRA) tools and was analysed using "R" software version 3.1.5. The results revealed that in Niger, sweetpotato is men crop, while it is women crop in Nigeria mostly in South-East part. The main top five production constraints in Niger were sweetpotato weevil (*Cylaspuncticolis*) (61.11%), caterpillar (44.44%), drought stress (40.00%), post-harvest storage (35.55%), and low price (33.33%). In Nigeria the first five top constraints were sweetpotato weevil (*Cylasformicarus*) (33.33%), SPVD (30%), caterpillar (24.44%), price fluctuation (27.77%), and drought tolerant (21.11%). The main consumption constraint in both countries was constipation. In the difference with Nigeria, in Niger low sugar is a constraint, while high sugar content limited sweetpotato consumption in Nigeria.

**Key words:** sweetpotato, constraint, end used, Niger, Nigeria

### Résumé

La patate douce est une culture vivrière, fourragère et légumière dans la plupart des pays tropicaux en développement. L'adoption d'un nouveau cultivar est complexe et est liée à la performance au champ et au rendement ainsi qu'à l'acceptabilité gustative des consommateurs. L'objectif de ce travail est d'étudier le système de production de la patate douce aussi bien d'identifier les contraintes liées à la production, à la commercialisation et à la consommation au Niger et au Nigeria. L'étude a été réalisée à la fois en administrant le focus groupe et le questionnaire semi-structuré individuel au Niger et au Nigeria. Les données ont été collectées à l'aide d'outils établis d'évaluation rurale participative (ERP) au Niger et au Nigeria et ont été analysées à l'aide du logiciel "R" version 3.1.5. Les résultats ont révélé qu'au Niger, la patate douce est cultivée et commercialisée par les hommes, alors qu'elle est cultivée et commercialisée par les femmes au Nigeria, principalement dans la partie Sud-Est. Les cinq principales contraintes de production au Niger étaient le charançon de la patate douce (*Cylaspuncticolis*) (61,11%), la chenille (44,44%), le stress hydrique (40,00%), le stockage après récolte (35,55%) et le bas prix (33,33%). Au Nigeria, les cinq premières principales contraintes étaient le charançon de la patate douce (*Cylasformicarus*) (33,33 %), la maladie virale de la patate douce (30 %), la chenille (24,44 %), la fluctuation des prix (27,77 %) et le stress hydrique (21,11 %). La principale contrainte de consommation dans les deux pays était la constipation. A la différence du Nigeria, au Niger, la faible teneur en sucre est une contrainte, tandis qu'une forte teneur en sucre limite la consommation de la patate douce au Nigeria.

**Mots clés:** patate douce, contrainte, producteur, revendeur, consommateur, Niger, Nigeria

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## **I. Introduction**

Sweetpotato [*Ipomoea batatas*(L.) Lam] is a perennial plant cultivated as annual crop (Tairoet al.,2009) and is dicotyledonous belonging to morning glory family Convolvulaceae (Tairoet al.,2009; Lebot, 2010). Sweetpotato worldwide production of 2020 was 89,487,835tons, with area of production 7,400,472 ha (FAOSTAT, 2022). Asia being the largest producer, produced 62.6%,followed by Africa 32.2% (FAOSTAT, 2022). China is the largest country global producer with 48,949,495 tons, followed by Malawi, Tanzania and Nigeria with respective values of 6,918,420; 4,435,063 and 3,867,871 tons (FAOSTAT, 2021). In West Africa, Nigeria was the first sweetpotato producer (3,867,871 tons), while Niger ranks Forth (209,864 tons) (FAOSTAT, 2022).Sweetpotato is an important food, feed and vegetable crop in most tropical developing countries. The storage roots of sweetpotato are rich in carbohydrate and its leaves are rich in proteins. Orange fleshed sweetpotato varieties are rich in Beta-carotene, a precursor of vitamin A, while purple-fleshed sweetpotato varieties contain anthocyanin, which is a powerful anti-oxidant (Lebot, 2009). The most frequently mentioned sweetpotato constraints, contributing to yield gaps, are drought, poor access to planting material, pests and pathogens, and poor soil fertility (Low J. W.et al., 2020). In Niger, one of the sweetpotato problem is a large number of pests that attack the crop in the field as well as at conservation, and the most important pest are sweetpotato weevil and viruses (Doummaet al.,2008). In Nigeria, weevil has been reported as one of the responsible of the most significant damage to the root (Uwaidem et al., 2018), but in Southern Nigeria, the economic damage was caused by sweetpotato butterfly, leaf folders, sweetpotato army worms and white plume months.Considering the perception, preference and constraint of farmer and end user in sweetpotato production and utilization; breeding program should involve the client to meet their need for easy adoption of new released variety. This can be addressed through participatory plant breeding(PPB) (Tufan et al., 2018; Ceccarelli and Grando, 2019); participatory variety selection (PVS), and participatory rural appraisal (PRA) (Gibson et al., 2007; Gasura et al., 2008). Therefore, this study was conducted through PRA to identify constraints to sweetpotato production and management system in Niger and Nigeria.

## **II. Materials and Methods**

### **2.1 Study area**

The study was carried out for both Focus Group Discussion (FGD) and Semi-Structured Questionnaire (SSQ) in Niger (Tahoua, Dosso and Tillaberi) and Nigeria (Ebonyi, Abia and Kaduna) across three selected regions each. In each country, nine villages selected from three districts were concerned except some. A total of 18 villages were the study areas and are known as sweetpotato production areas. The location of each village was presented in **Figure 1**.

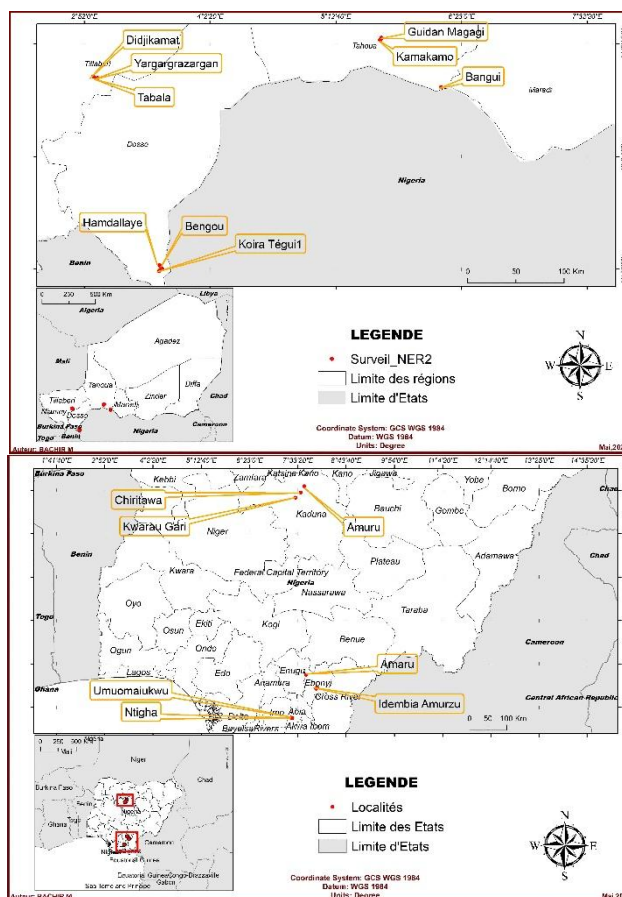


Figure 1: Position of the 18 villages where the study was conducted in Niger and Nigeria

## 2.2 Focus group discussion (FGD) nature of respondents

FGD was established in nine villages from Niger and nine from Nigeria too. A total of 246 persons have attended the meeting which varied from 5 to 40 participants (Table 1). Farmers, traders, consumers and agricultural extension agents are the nature of the participants. The lower number is due to the restriction during COVID-19 in both countries. However, there were 135 participants in Niger against 111 in Nigeria. The highest number (40 participants) in Niger was gotten before the restriction of COVID-19 started.

Table 1: Number of participants per village during focus group discussion

Country	State	Local government	District	Village	Male	Female	Total
Niger	Tahoua	Malbaza	Dogaraoua	GuidanMagagi	15	0	15
Niger	Tahoua	Malbaza	Dogaraoua	Kamakamo	40	0	40
Niger	Tahoua	Madaoua	Bangui	Bangui	12	3	15
Niger	Dosso	Gaya	Bengou	Hamdallaye	16	1	17
Niger	Dosso	Gaya	Bengou	Bengou	9	0	9
Niger	Dosso	Gaya	Bengou	KoaraTagui 1	15	0	15
Niger	Tillabéri	Balleyara	Tagazar	Tabala	6	0	6
Niger	Tillabéri	Balleyara	Tagazar	Didjikamat	12	0	12
Niger	Tillabéri	Balleyara	Tagazar	Yargargrazargan	6	0	6
Nigeria	Ebonyi	Ezza Sought		Amurzu	0	7	7
Nigeria	Ebonyi	Ezza Sought		Idembia	1	12	13
Nigeria	Ebonyi	Ishielu	Nkalagu	Amaru	8	0	8
Nigeria	Abia	IsialaNgwa North	Ama-Asa	Umuakwu	5	10	15
Nigeria	Abia	IsialaNgwa North	Amasa-Ntigha	Ntigha	2	7	9
Nigeria	Abia	IsialaNgwa North	Nsulu	Agburuike	0	5	5
Nigeria	Kaduna	Zaria		Amuru	7	7	14

Nigeria	Kaduna	Igabi	Kwarau	Kwarau Gari	25	0	25
Nigeria	Kaduna	Igabi	Furukwai	Chiritawa	15	0	15
<b>Total</b>					<b>194</b>	<b>52</b>	<b>246</b>

### 2.3 FGD data collection

Data was collected in Niger from March to May 2020 and in Nigeria from January to February 2021. An open discussion based on checklist (sweetpotato production system, variety and crop management, preferred traits and main constraints) was conducted for good interaction. This was done by a team where agricultural extension agent was present when necessary and local person as resource person was also part in case of language barrier.

### 2.4 Nature of respondents and sampling procedure during SSQ

Participants were selected from sweetpotato stakeholders, namely farmers, traders and consumers. A multistage sampling was used. In fact, three states in each country were sampled, then 1 to 2 district(s) were subsampled. In each district 1 to 3 village(s) were sub subsampled in order to get 3 villages per state. This provided 180 farmers (10 from each village), 180 consumers (10 from each village) and 60 traders (10 from each state) for SSQ.

### 2.5 Data collection for SSQ

Date was collected from March to May 2020 in Niger and from January to February 2021 in Nigeria. It was collected using established PRA tools. Administration of a SSQ was addressed through PRA (Gibson et al., 2007; Gasuraet al.,2008). The following data were collected from farmers: participant identification information, sweetpotato production and management, sweetpotato harvesting and conservation, sweetpotato preferred traits and major constraints. From consumers and marketers, data were collected on identification information, sweetpotato preferred traits and constraints in consumption, cooking as well as root conservation.

### 2.6 Data analysis

Data were first converted to numerical values for both FGD and SSQ, then analyzed using “R” software version 3.1.5. Results were summarized into frequencies and percentages and represented in tables and graphs for discussion. Barplot simple and barchart group were constructed by R using lattice and ggplot2 packages. Data were analyzed in different forms: across countries and across states.

## III. Results

### 3.1 Experiences of the community in sweetpotato production based on FGD

In both countries, only one state (Abia state in Nigeria) out of 6 received training. This training was in root production, seed production, seed multiplication and pest management. However, all studied areas need training on a particular aspect according to their constraints (**Table 2**). For planting materials, in Niger, 4 villages out of 9 received recently (on November 2019) orange fleshed sweetpotato from National Institute of Agricultural Research of Niger (INRAN) and one village from agricultural extension office. In Nigeria the three villages of Abia state received 2 improved varieties (Mother Delight and Butter Milk) from National Root Crop Research Institute of Nigeria (NRCRI).

**Table2:** Training needed by farmers and varieties received from national research institute or agricultural extension

Country code	Villages	Varieties received from institution/agricultural extension	Training received	Training needed
NER1	GuidanMagagi	Yes, Bera	Yes	Techniques of planting, spaces and storage.
NER2	Kamakamo	No	No	Techniques of planting, planting date, choice of varieties and disease symptoms and its control
NER3	Bangui	No	No	Training on SP preferred soil, choice of varieties, nursery, planting and management.
NER4	Hamdallaye	Yellow fleshed from INRAN in November 2019	No	Training on making ridges, management and storage technique
NER5	Bengou	No	No	Training on pests and diseases control, storage technique and marketing
NER6	KoaraTagui 1	3 varieties from INRAN in November 2019	No	Choice of varieties, fertilization and irrigation technique, storage technique
NER7	Tabala	No	No	Training on pests control and storage technique
NER8	Didjikamat	From INRAN in November 2019	No	Training on pests and diseases control

NER9	Yargargrazargan	From INRAN in November 2019	No	Training on production, pests and diseases control, storage techniques
NGA1	Amurzu	No	No	Training on how to improve yield
NGA2	Idembia	No	No	Training on best cultivation practices for maximum production
NGA3	Amaru	No	No	Training on best method on expansion and financial involvement
NGA4	Umuakwu	Mother Delight and Butter Milk	Root and seed production, seed multiplication and pest management	Pest management and technic of transformation
NGA5	Ntigha	Mother Delight and Butter Milk	Root and seedproduction, seed multiplication and pest management	Root transformation and conservation
NGA6	Agburuike	Mother Delight	Root production	Seed production
NGA7	Amuru	No	No	Pest and disease management
NGA8	Kwarau Gari	No	No	Pest and disease management and technic of conservation
NGA9	Chiritawa	No	No	Production under rain

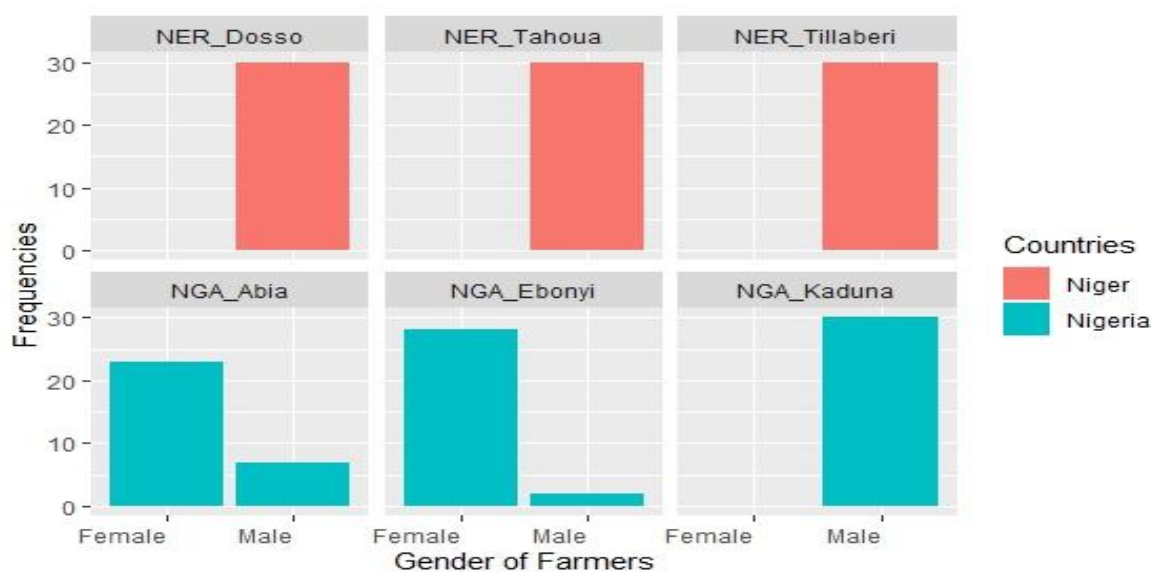
NER = Niger and NGA = Nigeria

### 3.2 Demography profile and socio-economic characteristics

All the Ninety farmers interviewed in Niger are males. However, in Nigeria, 56.66% are female. Kaduna located in northern part of Nigeria; farmers are all male making difference with the South-East with 85% female as producers (**Figure 3**). Only less than 1 respondent is below 20 years old in both countries. In Niger 78.88% are above 40 years old while in Nigeria 52.22% are between 20 to 40 years old.

In Niger, the raw or boiled sweetpotato is selling in the market by male, but young females could be sellers after buying it from the wholesalers. In Nigeria, Kaduna, state presented the same figure like in Niger but in the contrary, the eastern part, female (70% in Abia and 100% in Ebonyi) are the sellers with 85% (**Figure 4**). The age of traders above 40 years old highly accounted for 76.66 and 66.66% in Niger and Nigeria respectively. Only 2 sellers age below 20 years were registered in Nigeria.

For consumers, in Niger as well as in Nigeria, sweetpotato consumption is not related to sex or group age. All group age are consuming sweetpotato (**Figures5**). Meanwhile the tendency of male or female from one state to another were due to their availability and or the management of the crop in such area. Example of Kaduna (100% male and Abia 96.66% female). In Niger, 38.88% of females have been interviewed against 61.12% of males, while in Nigeria 61.12% females against 38.88% males.



**Figure 2:** Farmer's gender in Niger and Nigeria

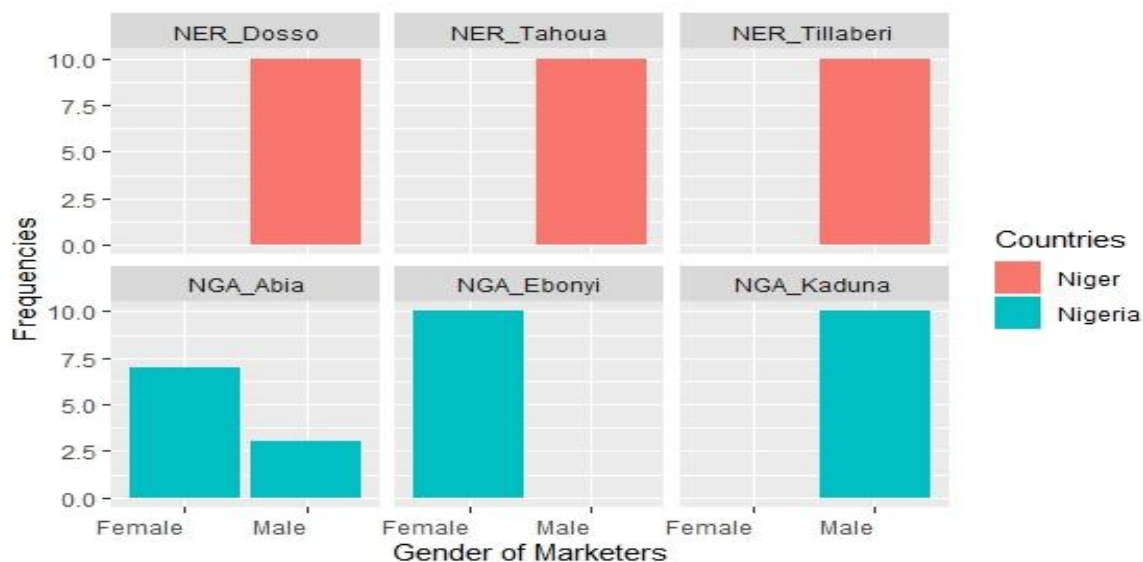


Figure 3: Sweetpotato trader gender in Niger and Nigeria

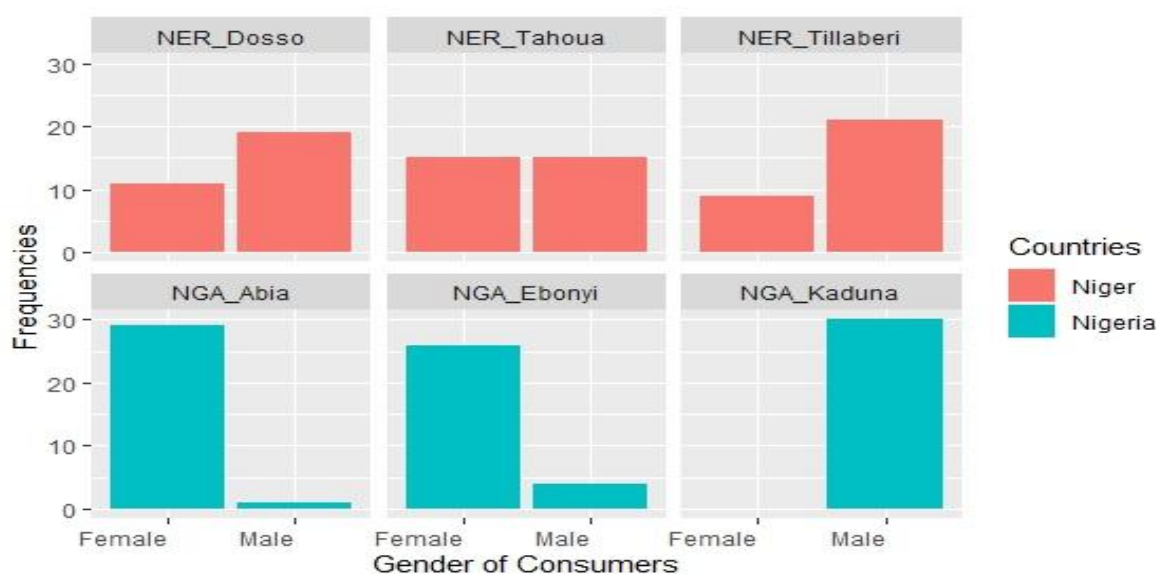


Figure 4: Consumer gender in Niger and Nigeria

### 3.4 Production management

Monocrop is highly practiced in Niger (72.22%) across the three states while in Nigeria mixed crop is preponderant with 72.22%. In Nigeria, mixed cropping is done with cassava, yam, maize and vegetable in Ebonyi and Abia states and with millet, sorghum, tomato and yam in Kaduna. In Niger, it is mixed with maize, cowpea, sesame, and soybean in Tahoua, with sorrel, sugar cane, sorghum (when high land), maize in Dosso, and with cassava and maize in Tillaberi (Table 3).

In Niger, sweetpotato is grown under irrigation by 65.55%, under rain fed by 14.45%, and under both rain and irrigation by 20.00%. Difference with Niger, in Nigeria almost all the producers are growing sweetpotato under rain fed with 92.22%.

100% of varieties cultivated in Niger are local varieties while 12.22% are improved in Nigeria. The 12.22% of the improved varieties used in Nigeria was from the Eastern part of the country.

The main source of planting material in both countries was summarized by proper (45.55% in Niger and 26.66% in Nigeria), local market (28.88% in Niger and 20.00% in Nigeria) and from neighbor (16.66% each country). Some farmers complained of the high cost of planting material from the sellers.

Compound fertilizer (NPK) and Urea are the most used in Niger and Nigeria with 47.77 and 23.33% respectively. 17.77% do not apply fertilizer in Niger and 26.66% in Nigeria.

Land preparation depends on the practice in the community. In fact, in Niger, in Tahoua and Dosso 100% of the farmers are making ridges while the 100% of Tillaberi are making beds. In Nigeria, 100% of

farmers in Kaduna use ridges for sweetpotato cultivation while 86.66% of farmers in Ebonyi and 87.77% of farmers in Abia make Mounds. 87.77% and 100% of farmers are harvesting by hand hoe in Niger and Nigeria respectively. Piecemeal harvesting is the usual harvesting procedure by 86.66% in Niger and 84.44% in Nigeria. This method was used to preserve storage root conservation underground in the field 86.66% of farmers in Niger and 82.22% of farmers in Nigeria.

**Table 3:** Characteristics of crop farming management in Niger and Nigeria

Crop management	Respondents									
	Tahou a	Dosso o	Tillaberi i	T NER	NER %	Ebonyi i	Abia a	Kaduna a	T NGA	NGA %
<b>Cropping methods</b>										
Momocrop	22	21	22	65	72.22	6	0	19	25	27.77
Mixed crop	8	8	6	22	24.44	24	30	11	65	72.22
Both	0	1	2	3	3.33	0	0	0	0	0
<b>Source of water</b>										
Rain fed	0	13	0	13	14.44	30	30	23	83	92.22
Irrigation	29	3	27	59	65.55	0	0	4	4	4.44
Both	1	14	3	18	20	0	0	3	3	3.33
<b>Status</b>										
Local	30	30	30	90	100	19	7	30	56	62.22
Improved	0	0	0	0	0	3	8	0	11	12.22
Both	0	0	0	0	0	8	15	0	23	25.55
<b>Source of PM</b>										
Own	12	18	11	41	45.55	7	3	14	24	26.66
Neighbour	6	4	5	15	16.66	0	8	7	15	16.66
Local market	11	8	7	26	28.28	9	4	5	18	20
Own and neighbour	0	0	1	1	1.11	1	0	2	3	3.33
Own and market	0	0	4	4	4.44	13	0	0	13	14.44
Neighbour and Market	0	0	1	1	1.11	0	0	2	2	2.22
Own, neighbour and market	0	0	1	1	1.11	0	0	0	0	0
Cooperative	1	0	0	1	1.11	0	0	0	0	0
Agricultural/Research institute	0	0	0	0	0	0	15	0	15	16.66
<b>Storage of PM</b>										
In situ	10	18	18	46	51.11	8	3	15	26	28.88
Ex situ	3	1	0	4	4.44	11	2	5	18	20
None	17	11	12	40	44.44	11	25	10	46	51.11
<b>Planting method</b>										
Ridge	30	30	0	60	66.66	3	5	30	38	42.22
Bed/Mound	0	0	30	30	33.33	27	25	0	52	57.77
<b>Type of fertilizer</b>										
NPK	2	1	13	16	17.77	8	9	4	21	23.33
Urea	10	5	0	15	16.66	0	4	12	16	17.77
DAP	0	0	0	0	0	0	0	1	1	1.11
Organic manure	0	0	0	0	0	5	2	0	7	7.77
Mixed	5	21	17	43	47.77	3	5	13	21	23.33
None	13	3	0	16	17.77	14	10	0	24	26.66
<b>Harvest method</b>										
Dig by hand hoe	29	20	30	79	87.77	30	30	30	90	100
Plough with animal	1	4	0	5	5.55	0	0	0	0	0
Mixed	0	6	0	6	6.66	0	0	0	0	0
<b>Harvest procedure</b>										
Piecemeal	25	23	30	78	86.66	29	27	20	76	84.44
All at once	3	5	0	8	8.88	0	3	5	8	8.88
Both	2	2	0	4	4.44	1	0	5	6	6.66
<b>SR conservation method</b>										
In the field underground	25	23	30	78	86.66	29	27	20	76	84.44
In the hole at farm	3	0	0	3	3.33	0	0	0	0	0
None	2	7	0	9	10	1	3	10	14	15.55

NER = Niger, NGA = Nigeria, PM = planting material, SR = storage root, T = total

### 3.5 Major constraints of sweetpotato production by farmers in Niger and Nigeria

Addressing a semi-structure questionnaire has revealed various constraints to sweetpotato production. A total of 90 respondent farmers in each country have been interviewed on sweetpotato production constraints. The main top five production constraints in Niger (**Figure 5**) were sweetpotato weevil (*Cylaspuncticolis*) (61.11%), caterpillar (44.44%), drought stress (40.00%), post-harvest storage (35.55%), and low price (33.33%). Across the states (**Figure 6**), in Tahoua farmers prioritized shortage of planting material, drought and low price. In Dosso, sweetpotato weevil, caterpillar and lack of storage facilities were considered as the main constraints



while in Tillaberi, sweetpotato weevil, caterpillar and drought were reported. In Nigeria the first five top constraints were sweetpotato weevil (*Cylasformicarus*) (33.33%), SPVD (30%), caterpillar (24.44%), price fluctuation (27.77%), and drought stress (21.11%). In Nigeria, the first three constraints summarized into biotic constraints. Across states, in Ebonyi, sweetpotao weevil, price fluctuation and lack of capital were regarded as main sweetpotato production constraints. In Abia, SPVD, white fly and low price were reported as first three constraints and in Kaduna caterpillar, weevil and drought stress were the major ones. Farmer did not give the name of the SPVD, but explained clearly the symptom as leaf chlorosis and stunting. Other traits could be considered across both countries like high cost of planting material, rotting during storage and lack of buyers.

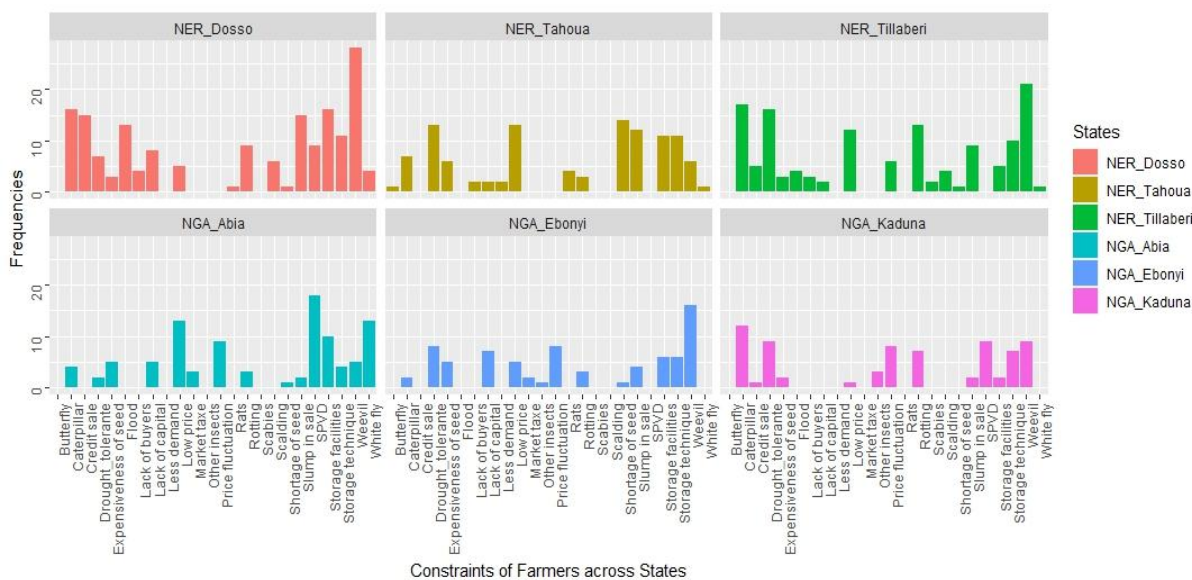


Figure 5: Farmer constraints across states in Niger and Nigeria

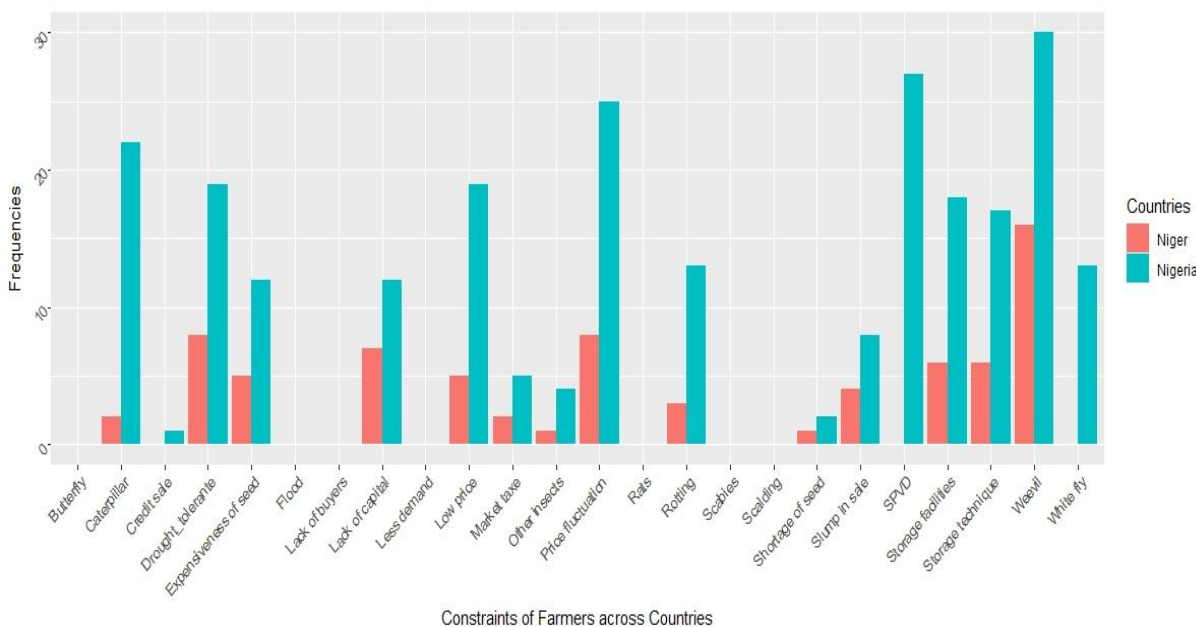


Figure 6: Farmer constraints across countries

### 3.6 Traders main constraints in sweetpotato market in Niger and Nigeria

Thirty traders in each country were the subjects of this study through SSQ. In Niger, low price (50%), slump in sale (46.66%) and rotting (40%) lead frequently as the three top trader constraints. Across Niger states, the order remained the same but with variation of the position in ranking. However, rotting was not mentioned in Dosso (Figure 7). In Nigeria, price fluctuation (36.66%), rotting (33.33%) and low price (30%) were considered high in rank as the main marketing constrains. Across Nigeria states (Figure 7), it was recorded respectively in



Ebonyi (low price, market tax and price fluctuation), in Abia (price fluctuation, low price and rotting) and in Kaduna (price fluctuation, rotting and low price). Other constraints could be considered like credit in sale.

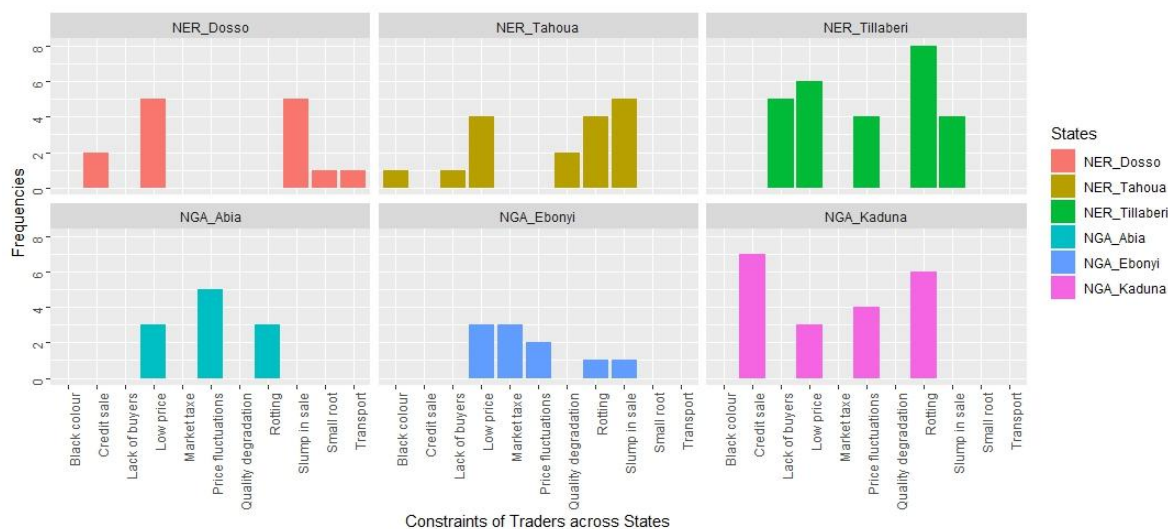


Figure 7: Sweetpotato trader constraints across states in Niger and Nigeria

### 3.7 Consumers' constraints in Sweetpotato consumption in Niger and Nigeria

Ninety sweetpotato consumers were interviewed in each country. In Niger, 14.44% interviewed reported constipation, low sugar (8.88%) and too soft (7.77%) as the three important consumer constraints but all with less than 15%. Taking individual state (Figure 8), Tahoua mentioned tasteless, too much soft and fiber. In Dosso, they reported constipation, too much soft and provoke ulcer and in Tillaberi constipation (10%) and low sugar (4.44%) only. In Nigeria, 12.22% of the consumers reported constipation, high sugar (11.11%) and too much soft (3.33%). Most of consumers claimed no consumption constraints in both countries. Although, many consumers claimed no consumption constraint, constipation came out as most important consumption constraints in Niger and Nigeria.

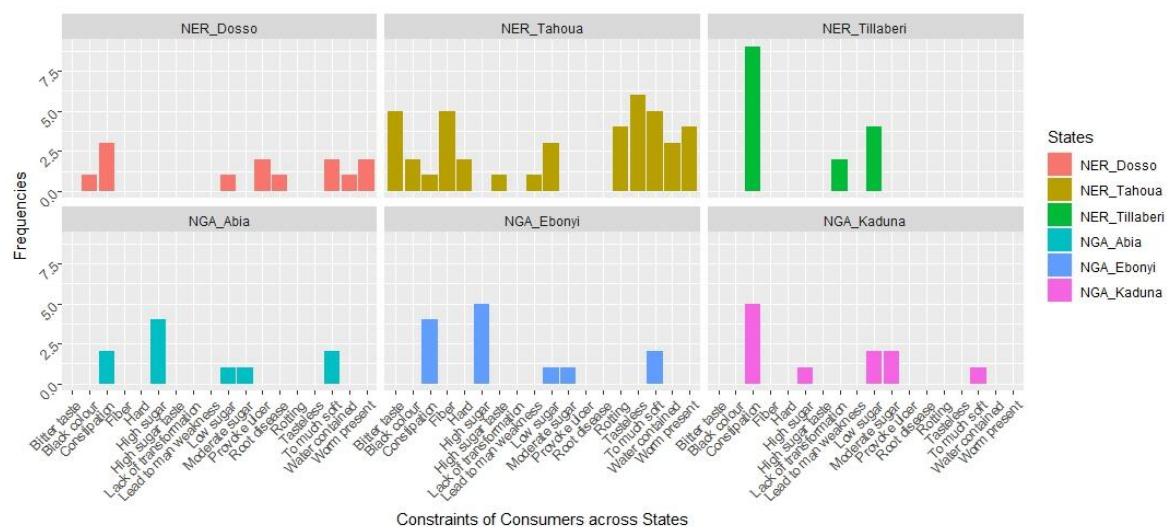


Figure 8: Sweetpotato consumer constraints across states in Niger and Nigeria

## IV. Discussions

In Niger, sweetpotato farmers are working alone and left in their own fate. The used of only local varieties, the lack of training and advice, indicated the absent of sweetpotato breeding programme in Niger. Gruneberget al.(2015) reported that there are only three sweetpotato breeding programs in West Africa: the Council for Scientific and Industrial Research-Crop Research Institute (CSIR-CRI) in Ghana, the National Root Crop Research Institute (NRCRI) Umudikein Nigeria, and the Environment and Agricultural Research Institute (INERA) in Burkina Faso. Amadou et al. (2015) in their study in three local governments (Ayerou, Gaya and Balleyara) in Niger, stated that the farmers are practicing inappropriate application of insecticide, the diseases

are bad controlled and doing some practice that favorable to the development of pests like termite. The training and improved varieties received by Abia state villages in Nigeria could be explained by the presence of NRCRI in this state (South-East) Nigeria.

In Niger sweetpotato management was man business in term of production and marketing since it requires too much labour and financial resources. Due to large area of cultivation by farmers and production for cash in all villages, sweetpotato is men's crop in Niger. Also in Niger, the raw or boiled sweetpotato is sold in the market by males, but young females could be sellers after buying it from the wholesalers. In Nigeria, Kaduna looks like Niger because of the huge production and purpose production that is to export to Lagos for other uses. In the South-East of Nigeria, women are more willing producers and marketers because it is produced as food and considered as women crop when men are more occupied by yam and cassava production which are the main cash and food crops. This suggested a relatively greater importance by women in sweetpotato production in South-East of Nigeria. However, Olagungu et al. (2013) reported more participant of men than women in sweetpotato production in whole Nigeria. Stathers et al. (2013) grouped gender roles and their responsibilities in sweetpotato production chain into three categories, namely sweetpotato as i) a male's crop with few or no women growing it, ii) as a female's crop with few or no men growing it, and iii) sweetpotato grown by both men and women on individually or family-owned plots. Moreover, increasing role of sweetpotato as cash crop in Sought Nyanza in Kenya has attracted male involvement in sweetpotato production (Low, 2004) and Stephan et al. (2016) added that increased sweetpotato market demand has brought changes in the roles and responsibilities of gender in Eastern Tanzania; therefore, market demand can greatly influence man participation in sweetpotato production. For consumers, in Niger as well as in Nigeria, sweetpotato consumption is not related to sex or group age. All group ages consumes sweetpotato in both countries. However, the tendency of males or females from one state to another was due to their availability during the questionnaire administration and or the management of the crop in such area.

Monocrop in Niger as well as in Kaduna (Nigeria) could be explained based on the fact that the crop is mainly for cash, therefore there is need to increase the productivity. However, in Eastern part of Nigeria, mixed cropping as the crop is used as food as well as cash, therefore evaluating productivity is neglected. Sweetpotato production under rain fed in Nigeria could be explained by the fact that the crop is among rainy season crops while among market gardening in Niger republic. Although sweetpotato is considered as drought tolerant crop, late planting does result in yield losses, which is related to water stress during the root initiation and bulking periods (van-Vugt and Franke, 2018). The lack of improved sweetpotato varieties in Niger was due to the lack of sweetpotato breeding centre in Niger. Amadou et al. (2015) inventoried 36 varieties used by farmers in Western Niger that are all locals. The 12.22% improved varieties in Nigeria was due because of the existence of sweetpotato breeding centre in Nigeria at NRCRI located in Sought-Eastern. Farmer's field, local market and neighbour are the main sources of planting material. This corroborated with the findings of Stephan et al. (2016) in Eastern Tanzania who reported that farmer's own fields (66%) and neighbours (29%) are the main source of planting material. This leads the farmers using local and low-yielding sweetpotato landrace (Tairo et al., 2004; Stephan et al., 2016). Local market and from neighbour as source of planting materials could be explained by the difficulty of sweetpotato seed maintenance and conservation. High percent of fertilizer application in Niger is due to the crop is cash, therefore farmers' objective is to increase the productivity in order to get benefit; despite that, Amadou et al. (2015) reported that sweetpotato is managed in inappropriate way in Niger. The high percentage of farmers using fertilizer in Nigeria is mainly in the northern part, since the crop is cultivated as cash crop. Forty percent (40%) of farmers in the south-East part of the country are not applying fertilizer. This suggested that the crop is mainly used as food with little interest. Planting method is due to the habit of farmers to practice and manage easily the crop as well as watering method. High percentage of hoe hand digging could be explained by the acreage cultivated by farmers. Piecemeal harvesting procedure is due to not only by the fluctuation of price at harvesting time but also for conservation of the roots underground. Amadou et al. (2015) reported this method of conservation in the field in Niger which consist to delay harvesting for 2 months.

In Niger sweetpotato weevil, caterpillar, drought stress, post-harvest storage and low price were the major top 5 production constraints. Sweetpotato weevil (*Cylaspuncticolis*) and viruses are the most sweetpotato pests and disease in Niger (Doumaet et al., 2008). Shortage of planting material in Tahoua (Malbaza) is due to new farmers involved in sweetpotato production with assistance of ONAHA (Office National des Aménagements Hydro-Agricoles du Niger). Drought remained as main abiotic constraints because sweetpotato is cultivated under irrigation by most of the farmers in Niger (Table 3); therefore, this is the reason that drives farmer toward drought tolerant variety in order to increase yield, save time and labour for irrigation and money for fuel purchase. Low price, slump in sales, credit in sales are market complexity and it is because the harvesting period coincide with most of the farmers harvest period of other crops/intense farming activity and those who try to store have had problem of rotting due to inappropriate storage facilities and techniques. This has as consequence in Tillaberithat farmers trend to reduce or to abandon sweetpotato production in profit of other crops like cabbage, potato, tomato and moringa that have higher market value. Sweetpotato weevil (*Cylasformucarius*), SPVD, caterpillar, price fluctuation and drought stress were the most important constraints

cited by farmers in Nigeria. *Cylaspuncticolis* has been reported as the most significant pest that cause damage to sweetpotato root in Nigeria (Uwaidemet *et al.*, 2018). In some parts of Nigeria, the storage root yield loss caused by *Cylasp* ranges from 90 to 100% (Munyuliet *et al.*, 2017). Virus and weevil infected plants also become susceptible to other pests and diseases and can suffer up to 100% yield loss (Atekaet *et al.*, 2004). Lack of capital in Ebony state was due to no specific budget for sweetpotato compared to yam and cassava since it is managed by women. Drought stress in Kaduna is due to the production under irrigation which required labour, time and money for fuel. Several studies in SSA have mentioned these constraints reported in Niger and Nigeria. The most frequently mentioned sweetpotato constraints, contributing to yield gaps, are drought, poor access to planting material, pests and pathogens, and poor soil fertility (Low J. W. *et al.*, 2020). Damien *et al.* (2020) added that pests, diseases, shortage of planting material and drought were the major sweetpotato constraints in Rwanda.

Low price, slump in sale and rotting were the most important constraints of traders in Niger, while, in Nigeria, they were price fluctuation, rotting and low price. Except rotting, in both countries these constraints are all related to market complexity. This could be explained first by the fact that harvest is done at the same time by farmers, and this drives to market competition since it cannot be conserved for long term. Some genotypes can be stored for two months compare to other, example of “Tarho” variety in Niger (Tahoua/Bangui). To solve this problem, the breeding program has to have a look on storage aspect on one hand, and in other hand initiate people into transformation processing.

Constipation, level of sugar content and too much soft were the major consumption constraints in both countries. Constipation as the main constraint, many consumers reported that it depends on persons’ body make-up and it causes constipation when the root was eaten raw or too much. Eating raw root lead to fart too much. In contrast with Nigeria, Niger consumers preferred too much sugar content. This could be explained as sweetpotato is not staple food in Niger. In Nigeria, the low sugar is preferred in South-East where the crop is among the staple food. This confirmed the findings of Ernest *et al.* (2015) who reported that sweetness as major constraint, causes people to turn away from the crop as staple food. Too much soft can be due either to the present of insects in the root mostly weevil or cooking problem. This gave bitterness in tasting as claimed some consumers. Bitter taste can be due to water, insect attack, worm attack and long storage. It becomes dough. Several women in Ebonyi state, claimed that sweetpotato can be cooked in 2 mn with little quantity of water. The large amount of water present in boiling method causes greater starch solubility, facilitating its loss to aqueous milieu (Regianeet *et al.*, 2020). Cooking methods such as backed, boiled, fried and cooking in the microwave alter chemical and nutritional characteristics of sweetpotato (Regianeet *et al.*, 2020). According to Sugriet *et al.* (2012), the method of cooking and the form of utilization have critical influence on taste and consumptive quality. Changes in sweetpotato texture generally reduce acceptability by consumers (Terueet *et al.*, 2015; Yang *et al.*, 2016; Regianeet *et al.*, 2020). The fried root has the highest sensory acceptability by consumers and the highest nutritional content, but it is the least suitable process for human consumption since it increases the fat and energy content of the product (Regianeet *et al.*, 2020).

## V. Conclusion

Sweetpotato is among staple food in South-east of Nigeria in difference with Niger. The study revealed that in Niger, sweetpotato is men crop; while it is women crop in Nigeria mostly in South-east. Farmers’ constraints in Niger summarized into sweetpotato weevil, caterpillar, drought stress, post-harvest storage, and low price, while in Nigeria they were weevil infestation, SPVD, caterpillar, price fluctuation, and drought stress. Traders in Niger and Nigeria mentioned low price, slump in sale and rotting as mains constraints. Consumers interviewed in Niger reported constipation, low sugar, and too much soft as the most important consumer constraints, and in Nigeria, consumption problem were constipation, high sugar and too much soft. Therefore, there is a need of integrated sweetpotato breeding program, agricultural extension, farmer, market and transformation processing.

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