

Farmers' management of peanut (*Arachis hypogaea* L.) diversity, their varietal preference traits and uses in Southern and Central Benin

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Abstract

Background Peanut (*Arachis hypogaea* L.) is one of the major oilseed legumes contributing to food security and poverty reduction in Benin. Unfortunately, several constraints hamper peanut production in Benin leading to a low yield. Knowing that seed is crucial for increase agricultural productivity, a good knowledge of on-farm management of grown peanut diversity and uses that allow its maintenance in traditional Beninese agriculture are prerequisites to establish an efficient breeding and conservation programs. Therefore, this study aim to document peanut varietal diversity, folk nomenclature, seed system, storage constraints, seeds pest management practices, varietal preference criteria, cultural taboos and uses in southern and central Benin.

Methods Two hundred and sixteen (216) farmers were surveyed through 32 villages in southern and central Benin using research tools and techniques of rural appraisal such as field visits, group surveys and individual surveys using a questionnaire.

Results Fifty-four peanut folk varieties grouped into 8 morphotypes based on the seed characteristics were registered in the study area. All local names given to peanut folk varieties by ethnic groups have meaning. The number of folk varieties maintained per village ranged from 1 to 11 (an average of 4) and varied between 1 and 4 per household. Some peanut producers reported the disappearance of some folk varieties. The drop in yield was the main reason of peanut varietal disappearance in the study area. Rodent attacks were the most important constraints of peanut production in the study area. Varietal preference criteria varied from ethnic groups with seed size and many pod/seeds per plant as the main preferred traits. Peanut seed system was mainly informal. For peanut seed conservation, farmers use various storage tools. To alleviate pest problems in stored peanut, producers used plant biocides and synthetic chemicals. Some cultural taboos and various uses (food, feed and medicinal) of peanuts have been recorded in the southern and central Benin.

Conclusions Our results suggest that for boost peanut production in central and southern Benin, breeders must create high yielding peanut varieties. For the adoption of these new varieties, it is important to take in account the preference varietal criteria of each ethnic group. To a good estimation of peanut diversity in the study area, morphological and molecular characterizations were recommended.

Introduction

Peanut (*Arachis hypogaea* L.) also called groundnut is one of the major oilseed, feed and food crop contributing to food security and poverty reduction in Benin. Cultivated for its seeds, peanuts are produced throughout the country with high production in the South and Central Benin. With a national production of 140135 tons in 2017 [1], peanut cultivation in Benin is used to satisfy the food needs of population and supply the local artisanal processing market with oils and cake products [2]. The seeds of this oilseed are very rich in edible oil, and proteins [3, 4]. In addition, peanut seeds are good source of some nutrients such as calcium, phosphorus, and essential vitamins [5]. It is consumed in many forms

(fresh, boiled or roasted), and usually intended for the production of oil used in cooking and soap making [6]. In Benin, peanut farming represents an important source of income through the sale of peanut-based products [7]. In addition, cakes from oil extraction are used for livestock feed [8].

Despite its food and economic importance, peanut production has evolved in a sawtooth way in Benin, decreasing from 154403 tons in 2010 to 140135 tons in 2017 with an increase of 225744 tons in 2018 [1]. This variation in peanut production results from various constraints related to its production and conservation. These constraints remain very little documented in Benin, while their knowledge is an important step for the proposal of sustainable solutions to boost peanut production. Indeed, despite its relative importance in Benin agriculture, peanuts have received little attention from research. As a result, peanut yield in Benin remains very low (998.3 kg/ha) compared to global yield (1611.4 kg/ha) in 2018 [1]. This low yield could be explained by the poor quality of seeds grown in Benin [9] and, the lack of improved varieties [10] as is the case in Tanzania [11]. However, very little information exists on the diversity of peanuts grown in Benin agriculture. While this information is necessary for breeders as a prerequisite for establishing a good peanut breeding program [12]. It is therefore important to document the diversity of peanuts grown in Benin, but also the farmers' criteria of varietal preferences to ensure adoption of improved cultivars by farmers [13]. Moreover, knowing that seed is important to increase agricultural productivity, the documentation of the peanut seed dispersal systems is a necessity.

Attack of peanut stocks by insects is among main constraints of peanut seed conservation [14]. Indeed, seed are very susceptible to insect attacks because of their fragile seed coat and brittle cotyledons [15]. The losses due to these pests can reach more than 50% of the harvests after 4 months of peanut storage [16]. However, very little attention have been given to storage insect pests associated to peanut and their management in Benin. Consequently, farmers' knowledge, damage perception, and traditional management of these storage insect pests are not yet documented. These information are important for the development of integrated pest management strategies that meet farmer needs.

Peanut is a multipurpose oilseed legume, which can be used, as medicine, fodder, and cash crop [17]. The production of this legume in Benin is mainly done for local artisanal processing, which develop some peanut derivative products [18]. It is important to evaluate the pattern of use of peanut through ethnic groups of south and central Benin for the development of conservation strategies of this crop. Therefore, the objectives of this study are to (i) document folk nomenclature, production constraints, farmers varietal preference criteria, seed system, cultural taboos, storage pest management practices, traditional uses of peanuts and reasons of abandonment of peanut varieties grew in south and central Benin; (ii) evaluate peanut varietal diversity and abandoned varieties in the study area.

Material And Methods

Description of the study area

This study was conducted respectively in 33 villages of southern and central Benin chosen manner to cover all ethnic groups and provide good coverage of the study area (Figure 1). The average temperature

in the study area is between 26 and 28 °C and the annual rainfall varies from 800 to 1400 mm in the South and, 800 to 1200 mm in the central region. Vegetation is composed of deciduous or moist forests and wooded savannahs. The South is one of the most complex areas and dominated by ferrallitic soils. In the study area, farmers practice continuous cultivation or short fallows. The main ethnic groups encountered are Adja, Aïzo, Holli, Wémènou (Ouémènou), Tori, Watchi, Xwla, Yoruba, Fon, Mahi, Idaasha, Ifè and Tchabè.

Collection of data

The data was collected in the 32 villages selected through the application of participatory research tools and techniques such as individual interviews and field visits using a questionnaire. The interviews were conducted with the help of guide to facilitate discussions with farmers. After presenting the objectives of the survey to the head of each village and the leaders of farmers organization and obtaining their agreement, 10 households were selected in each village by the transect method described by [19]. A total of 216 peanut farmers belonging to 10 ethnic groups (Mahi, Fon, Idaasha, Nago, Holli, Goun, Adja, Aïzo, Tori and Wémènou) were surveyed. The majority of surveyed farmers (137) were men, and illiterate (149) with an average age of 42.6 ± 0.9 years (Table 1). The years of experience of surveyed farmers in peanut production range from 2 to 68 years with surveyed farmers of central Benin having more experience (Table 1). Household size ranged from 1 to 21 people with an average of 15 persons per household. Farmers of central Benin planted larger areas (an average 1.7 ha) in peanut production compared to those in the South (an average of 1.4 ha). Peanut production is done on small plots (1.4 ± 0.1 ha on average). The data collected based on a semi-structured questionnaire concerned the varietal diversity maintained at the household level, the local nomenclature of peanut folk varieties, abandoned folk varieties, the reasons for their abandonment, the constraints related to peanut farming, the seed system, uses, pests and control methods. After interview, peanut folk varieties listed by farmers were collected and classified using seed's morphological descriptors (coat colour, size, coat pattern, and hilum colour) published by the International Board for Plant Genetic Resources [20].

Data analysis

The data were analysed from the descriptive and multivariate statistics and the results were presented in the form of tables and graphs. Chi-square analysis was used to compare the socio-demographic profile (education and sex parameters), farmer varietal preference criteria, and peanut culinary uses between regions. Before multivariate analysis, the data normality was tested using Levene's test. To achieve normality and homogeneity of variances, data were log-transformed [$\log(x + 1)$]. The transformed data were then subjected to one-way ANOVA analysis to compare age, experience, land size and household size of farmers between the two prospected regions, using the Statistical Package for Social Sciences (IBM SPSS version 23.0). The level of significance was set at 0.05, and means were separated by Student Newman Keuls (SNK) test. To describe the relationship between the culinary uses of peanuts and the ethnic groups of the study area, corresponding data were subjected to Principal Component Analysis (PCA) using Minitab 17 software.

Results

Folk nomenclature

Across the 10 ethnic groups surveyed in the study area, 54 peanut local names were recorded. All local names given to peanut folk varieties have meaning (Table 2). The majority of these names correspond to the pod length (38.5% of producers), seed size (21.6%), number of grains per pod (14.7%), seed origin (12.5%), seed colour (4.7%), growing season (4.5%) and susceptibility to pests (3.5%).

Varietal diversity

The number of peanut folk varieties per village ranged from 1 to 11 with an average of 4. The village Hountongon recorded the smallest number (1) of peanut folk varieties while the village Atchédigbé showed the greatest varietal diversity (11). The peanut diversity maintained in the household level varied from 1 to 4 in the study area; it varied from 1 to 3 in the South and from 1 to 4 in the Central Benin. The number of peanut folk varieties subject to synonymy also varied within ethnic group. The greatest diversity was observed in the Fon ethnic group (25 folk varieties) followed by the Mahi (11), Nago (7), Goun (6), Adja (5), Holli (5), Idaasha (4), Wéménou (4), Tori (4), and Aïzo (3) ethnic groups. Based on the morphological characteristics of the peanut seeds, the 54 folk varieties listed were grouped into 8 morphotypes (Table 3).

Five and fourteen farmers reported the disappearance of peanut varieties in southern and central Benin respectively. The reasons for abandonment listed by the peanut producers were : the drop in yield (47.1%), the lack of rain (5.9%), the drop in the market price (11.7%) and the lack of financial means (35.3%).

Production constraints

Farmers in southern and central Benin face several difficulties related to the peanut production. A total of 9 constraints were recorded in the study area and all of them have been listed by farmers of south Benin (Table 4). While, only 5 production constraints were listed in central Benin. The most important constraints in both region was the rodent attacks (82.6%) followed respectively by the lack of workforce in southern Benin and the difficulties related to the maintenance of fields in central Benin. Only peanut producers in southern Benin have listed transhumance, seed price increases, and decrease in yield as constraints (Table 4).

Thirteen pests were listed by farmers as causing significant damage to the peanut fields in the study area (Table 5). Rats, partridges, centipedes and rabbits were the most important pests registered in the south and central of Benin. However, termites are also reported as major pests in central Benin. Eight pests (rats, partridges, centipedes, greater cane rats, red ants, termites, caterpillars and monkeys) were identified as more damaging during the peanut ripening stage by attacking the pods. While, rabbits, grasshoppers, crickets, snail and sheep have been identified by farmers as attacking the leaves during the vegetative stage. Monkeys have been listed as pests only in central Benin while snail and sheep have been listed only in southern Benin.

Farmers' preference varietal criteria

Surveyed peanut producers reported nine varietal preference criteria (Table 6). These various criteria listed have been grouped into three categories: agronomic (68.9% of responses), culinary (20.1%) and economic (11%). The most important are: the seed size (35.2% of responses), the abundance of pods and seeds per plant (29.3%) and the capacity of the seeds to produce large amount of oil (19.2%). The number and importance of farmers' varietal preference criteria also varied according to ethnic groups (Table 6). For example, the peanut producers of the Fon ethnic group listed nine preference criteria against five preference criteria listed by the Adja, Tori, Nago and Mahi ethnic groups. The Aïzo, Goun, Holli and Wéménou ethnic groups listed only two varietal preference criteria. The production of a large amount of oil is the quality sought by producers of the Idaasha, Mahi and Nago ethnic groups to adopt a variety of peanuts. While for producers of Aïzo, Holli, and Tori ethnic groups the great number of pods and seeds per plant was the main criteria. The peanut seed size was the main varietal preference criteria of farmers of Adja, Fon, and Goun ethnic groups. For farmers of Wéménou ethnic group the peanut seed size and the abundance of pods and seeds per plant were the only most important criteria for the adoption of a variety (Table 6).

Seed system

The peanut seed system in the study area was informal and seed supply structures were not widespread. The majority of producers surveyed (59.1%) were content to buy seeds in local markets from other producers or small traders. Others producers (23.3%) used seeds from previous crops stored. The local extension service ATDA (Territorial Agricultural Development Agencies) represents the only structure dealing with the sale of peanut seeds where some producers (8.3%) get their supplies. In addition, a small number of producers obtained peanut seeds from other countries including the Congo (5.1%), Nigeria (3.2%) and Senegal (1%). The main criteria used by surveyed peanut producers (86.1%) in seed selection were the healthy seed (39.3% of responses), seed colour (27.6%), seed size (14.8%), seed shape (14.5%), seed maturity (2.8%), germination test (0.7%), and seed hardness (0.3%). Producers have listed three constraints: limited access to quality seed (75.6% of responses) was notified as the main constraint followed by increased seed prices (21.3%), and seed conservation (3.1%)

Seed conservation

In the study area, peanut was preserved mainly in unshelled form (90.7% of responses). Only a few producers (9.3%) stored peanut as seeds after shelling. In the study area, 8 different storage tools are used by producers to store seeds. The majority of producers (77.5%) keep the peanut in polyethylene bags. A number of producers have kept peanuts in baskets (10%), cans (5.9%), knitted loincloths (2.7%), calabashes (2.5%), granaries (0.9%), and on the plywood used as ceilings on their roofs where they spread them (0.5%). The peanut storage locations varied from one producer to another. According to the majority of producers (72.3%), they prefer to store their peanuts at home. The other producers keep peanuts in stores (18.5%) and granaries (9.2%). For the majority of the surveyed producers (76.5%), the shelf life of the peanut is between 3 to 6 months (Figure 2a). Majority of producers (96.6% of responses)

indicated the favourable period for peanut seeds to be attacked by storage insects is from the first month of storage (Figure 2b). Seed moisture (61.6% of responses), lack of insecticide (24.2%), seed immaturity (7.1%), storage time (5.1%), seed oil content (1%), and soil moisture (1%) were considered by surveyed producers as factor allowing peanut insect attacks.

Management of peanut storage insect pests

To alleviate pest problems in stored peanut, producers use plant biocides and synthetic chemicals. In the study area, only 13.9% of producers reported that they use biocidal plants to control pests. A total of four plants insect repellents or insecticides were mixed with peanut for their protection. These are fruit of pili pili pepper (53.3%), leaves of neem (20%), orange peel (20%) and leaves of tobacco (6.7%).

Among the surveyed producers, only 11.1% use synthetic chemicals for peanut store protection. Most of the chemicals used are bought in market or in shops selling agricultural products. A total of 4 products are used by the surveyed producers whose three insecticides and one rodenticide. These are rodenticide (8.4% of producers), LAMBDA super (25% of producers), DD force (33.3% of producers) and Sofagrin (33.3% of producers).

Cultural taboos associated to peanut production

For some producers (11.6%), growing peanuts and have a good yield requires some conditions to. These are prohibitions and recommendations. Regarding the bans, some producers (0.93%) of Adja ethnic group have indicated that you should not wear shoes in peanut fields. While for some producers of Fon ethnic group, it is prohibited to sow just after sex (2.78%) and expose grains or pods on cement floors (0.93%). For producers belonging Fon, Wéménou, and Goun ethnic groups it is ban to put salt in contact with the seeds (3.24%). Fon, Goun and Tori ethnic group don't allow women during menstruation to approach the seeds or go into the peanut field (2.31%). Other producers of Fon ethnic group recommend that storage be done by postmenopausal women to reduce insect attacks (0.46%), leave 4 to 6 lines in the field so that the ancestors' blessings are on their field (0, 46%), and pour the hulls on the road for good profitability (1.39%).

Uses

Four reasons justified peanut production in the study area. These are the marketing, consumption, processing and soil fertilization. The main reason is marketing followed by consumption in both south and central Benin (Table 7). In southern Benin, soil fertilization justify peanut production while the main reason of its production in central Benin is processing.

Eight culinary uses of peanuts were identified in the study area. Peanut patty or peanut wafers (21.2% of response), peanut confectionery (17.6%), boiled peanut (14.6%), grilled peanut (14.2%), and peanut donuts (12.4%) were the main culinary uses in the study area. Peanut oil (9.9%), peanut sauce (8.4%), and peanut paste (1.7%) were the less culinary use forms in the study area. Principal component analysis was used to determine the links between culinary habits and the surveyed ethnic groups. The analysis reveals

that the first and second components explain 49.8% and 22.2% of the information, respectively. The projection of the different food uses on the two axes shows that the Adja, Aizo and Goun ethnic groups consume peanuts mainly in the boiled form (Figure 3), while Tori and Wéménou ethnic groups consume peanut mainly in the roasted form. For the Nago and Idaasha ethnic groups, they consume peanuts mainly in the form of pancakes. The consumption of peanuts in the form of sauce and oil is mainly in the Mahi ethnic group. In Fon and Holli ethnic groups, peanuts are eaten respectively in the form of dough or donuts.

In the study area, some farmers use the peanut leaves to feed animals such as sheep (77.1%) and rabbits (5.7%). The seeds destroyed by the storage insects are used to feed pigs (5.7%) and chickens (11.5%). Among the surveyed farmers, only 10.2% use the peanut plant in traditional medicine for the treatment of ailments such as malaria (50%), to revitalize children (27.3%) and to regulate blood pressure (22.7%). These ailments were treated with a decoction of peanut leaves and shells consume in the form of herbal tea.

Discussion

At the community level, each peanut folk variety has a local name by which it is identified as a unit of diversity by farmers. Analysis of the meanings of the vernacular names given to peanut folk varieties in the study area confirms the existence of various scenarios (synonymy, and homonymy). This is common to the local nomenclature of many grain legumes in Benin such as cowpea [21], voandzou [22], Kersting groundnut [23], and common beans [24]. Based on the morphological criteria of peanut seeds, 8 morphotypes were identified corresponding to 54 local names. This shows that there are synonymy problems, which will have to be resolved through agro-morphological and molecular characterizations.

The study revealed the existence of 8 different peanut folk varieties across the study area. This diversity is found to be very low compared to that found in Bolivia (62 distinct landraces) area of peanut origin [25] and higher than those encounter in Togo (4 varieties) [12] and Tanzania (8 varieties) [13]. The loss of peanut diversity in the study area is not alarming. However, it is urgent to set up a national program of in situ and ex situ conservation of peanut genetic resources in order to protect the low productivity varieties, which are likely to be abandoned by producers. The villages of the Fon ethnic groups are recommended for the implementation of in situ conservation programs for peanut varieties. The documented reasons of peanut variety abandonment will oriented breeders to the type of variety to be created. They suggest the creation of high yielding peanut varieties, which are drought resistant.

In opposition to peanut farmers of Uganda [8], Tanzania [13], Ghana [26], Niger [27], Malawi [28], and Togo [12] for which insect pests and, diseases were the main constraints of t production, Beninese farmers perceived rodent attacks as the most constraint. This perception is share by Pakistan farmers, which also mentioned rodents as main constraint of peanut production [29]. Adarsh [30] and Naik et al. [31] notified that rodents could cause 30–40% of damage to peanut seeds at germination, 6–9% of damage at pod maturation and 4–9% of damage to mature pods besides their hoarding. Several rodent

species such as *Bandicota bengalensis* (Gray), *Tatera indica* (Hardwicke), *Mus booduga* (Gray) and *Mus meltada* (Gray) have been identified in Asia as important pest of peanut [32]. Rats, rabbits and greater cane rats were the most important peanut rodent pests in south and central Benin. For the development of efficient rodent management strategies, it is important to identify rodent species and evaluate their population density in peanut fields.

As peanut farmers in India [33, 34] and Malawi [28], Beninese farmers mentioned the lack of workforce, lack of funding, and the difficulties related to the maintenance of fields as other important constraints. Indeed, the harvesting and post-harvest operations such as shelling, lifting, and stripping are labour demanding and time consuming operation. The conception and dissemination of harvest and post-harvest machines for smallholder farmers configured for local varieties and the existing farm conditions are recommended.

Our study identified the preferred traits important for peanut farmers, which should be integrated into future breeding programs. For instance this study showed that peanut seed size, the abundance of pods and seeds per plant and the capacity of the seeds to produce large amount of oil are the most important traits. Peanut farmers in Togo [12], and Ethiopia [35] also mentioned similar preference criteria. It appears from our results that peanut preferred traits varied among ethnic groups. Those differences in peanut preference traits should be taken in account in any further peanut improvement or varietal introduction program.

As in Uganda [8], Tanzania [13], and Togo [12] peanut seed system in southern and central Benin is mostly informal. Most of farmers buy peanut seed in the local market or select their own seed for the next planting. In this context, the seed quality is often of poor quality due to various stresses and poor storage conditions [36]. A grouping of peanut producers in a peasant association and a specialization of certain producers in seed production would boost peanut production in southern and central Benin. The government structures such as ATDA(Territorial Agricultural Development Agencies) was the source of seed supply for few producers. This is probably due to the increased seed prices notified by farmers in the study area. In order to further enhance the performance of the seed sector, a subvention of peanut seed price by the Benin government is recommended.

Like most producers in Niger [27] and Senegal [37], peanut is stored mainly in unshelled form by surveyed farmers. This form of peanut conservation has proven to be an effective approach to reduce insect infestations during storage [14]. In fact, peanut shell can be destroyed by only few insect species [37]. This good storage practice should be promoted in the study area. Several peanut conservation tools have been identified in the study area, of which polyethylene bags being the most used. However, their effectiveness against attacks by storage insects is very limited [38]. Knowing that storing shelled and unshelled groundnuts in hermetic triple layer (Purdue Improved Crop Storage- PICS) bags PICS bags reduce insect attacks [14], the promotion of these storage tools is highly recommended. The grain moisture identified by farmers as the main factor favouring the attack of storage insects is corroborated by Santos et al. [15].

In an effort to properly store peanuts, some peanut producers use chemicals that are very dangerous to health and the environment. In fact, the commercial insecticide called DD force used by certain farmers has as active ingredient the dichlorvos, which is an organophosphorus classified as highly toxic by the World Health Organization [39]. In addition, the commercial insecticide Lambda super used by some farmers is an aberration because it is dedicated to the vegetable crops protection. It is therefore important to find alternatives to the use of chemical pesticides in the protection of groundnut stocks. The use of biocidal plants for stored peanuts protection is an alternative to the use of pesticides and is practiced by some peanut producers in the study area. All of the plants used by peanut farmers in central and southern Benin to protect stored peanuts against pests have proven insecticidal or repellent properties. Indeed, [40] demonstrated the insecticidal effect of Neem (*Azadirachta indica*) against *Plodia interpunctella* (Hubn.) and *Ephestia cautella* (Wlk.) infesting peanuts. In addition, neem plant extracts have showed a negative impact against *Trogoderma granarium* Everts, a pest of stored groundnuts [41]. Aguoru et al. [42] demonstrated biocidal effect of species of pepper against storage pests of peanut. Tobacco powder significantly affected egg development of *Caryedon serratus* Olivier the main pest of stored peanut [43]. Allotey and Azalekor [44] showed the impact of orange peel powder on the reduction of population of *Corcyra cephalonica* Stainton. These biocidal plants must be popularized across the study area.

The cultural taboos associated to peanut production restrict production of peanut to men because is not allow women during menstruation to approach the seeds or go into the peanut field. This taboo associated with the female fertility cycle was also observed in South Africa in traditional leafy vegetables production, which have an impact on availability of labour resources [45]. However, some surveyed farmers believed that, the presence of postmenopausal women in peanut storage permit to reduce insect attacks. These ambiguous cultural taboos towards women was also observed in Malawi concerning Bambara groundnut production [46]. Similarly, to yam production in Nigeria [47], some surveyed farmers believe that ancestors influence peanut productivity. Some farmers prohibited the contact of seeds with salt while some studies showed the insecticidal activity [48, 49] of this inert dust. All the taboos related to peanut production must be taken in account in development of strategies of peanut conservation diversity in southern and central Benin.

In opposition to Botswana where peanut is grown by small-scale farmers exclusively for household consumption [50], in southern and central Benin several uses underpin peanut production. Our results show that the forms of peanut consumption vary according to ethnic groups. Contrary to farmers in Togo [12] for which peanut sauce is one of the most often uses encountered in southern and central Benin peanut wafers locally called "Kluidklui" was the main form of peanut consumption. The variation of peanut culinary forms in function of ethnic groups must oriented breeder on the quality of the varieties to be created and should be introduced into each ethnic group. For example, farmers of Mahi ethnic group will easily adopt peanut varieties with high oil content.

Peanut is used as fodder for several pets but mostly for sheep. A study showed that the fodder of peanut varieties is the good quality and permit a good growth of sheep [51]. The same authors showed that

fodder yield and quality varies significantly in function of the peanut variety. It would therefore be interesting to assess the fodder quality and yield of peanut varieties grown in the southern and central Benin. Thus, peanut breeding programs could consider fodder yield and quality as criteria of selection.

Some medicinal values was attributed to peanut in the study area. This grain legume is used by surveyed farmers mainly to treat malaria. However, in Southeast Nigeria principally in Enugu State, some people believe that the great groundnut consumption is the cause of malaria [52]. It would therefore be interesting to evaluate the effect of peanut infusions on subjects suffering from malaria in order to validate or absolve this use. The bioactive compounds and nutraceuticals in peanuts could explain their use in medicine for the prevention of illnesses such as cardiovascular disease, osteoporosis, and other degenerative diseases [53]. Peanut can be also used for cancer inhibition [54]. The peanut plant is used in Nasarawa state of Nigeria as infusion to treat HIV/AIDS opportunistic infections such as gonorrhoea [55]. The use by surveyed farmers of peanut to revitalize children and to regulate blood pressure deserves to be investigated.

Conclusion

The present work has shown the existence of a variety of peanuts grown in southern and central Benin. These peanut folk varieties were designated by local names, which varied through ethnic groups and leading to synonymy problems. The seed system remains traditional and the sector is less organized. Peanut production is faced with several constraints and cultural taboos which hindering its production. Faced with these constraints, agricultural research in particular breeders must make peanut improvements or variety creations taking into account the varietal preferential traits documented. Storage insect pests were the main constraint of peanut conservation. Awareness of producers on the harms of using synthetic chemical insecticides not suitable for storage is highly recommended. The use of biocidal plants inventoried can be alternative solutions to help the farmers to increase their production and preserve the environment as well as human and animal health. The marketing, consumption, processing and soil fertilization underpin peanut production. To boost peanut production in south and central Benin the subvention of peanut seed price by the Benin government is recommended.

Declarations

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Authors' contributions

LYLE designed and funding the study. OA, HE and GD carried out interview work. LYLE analysed interpreted the data and drafted the manuscript. LYLE, MD, TJ, Z-TM, and DA corrected the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

Raw and treated data generated during study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

All data were collected under previous consent of each participant.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Tables

Due to technical limitations, the tables are only available as a download in the supplemental files section.

Figures

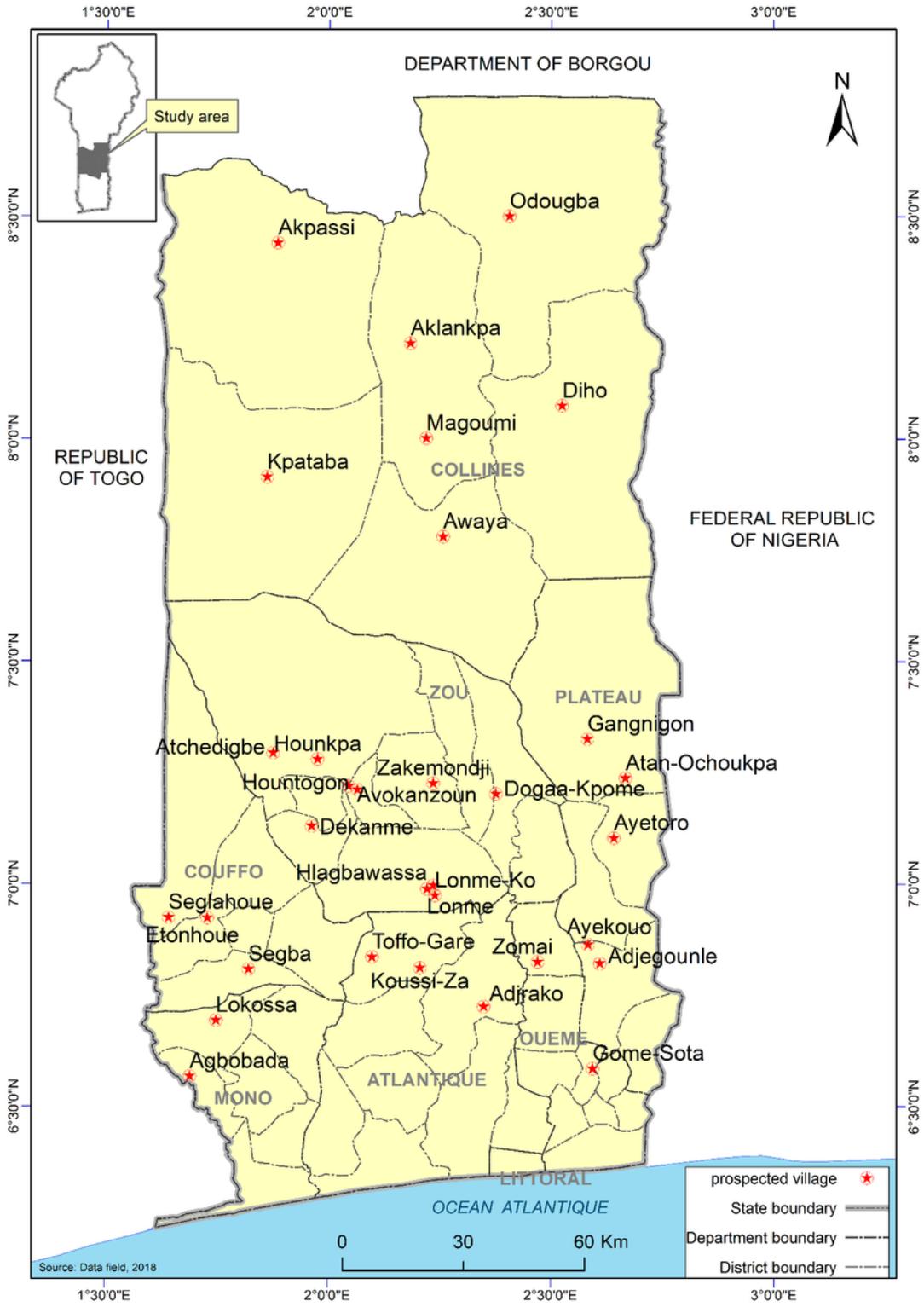


Figure 1

Map of the study area showing the surveyed villages

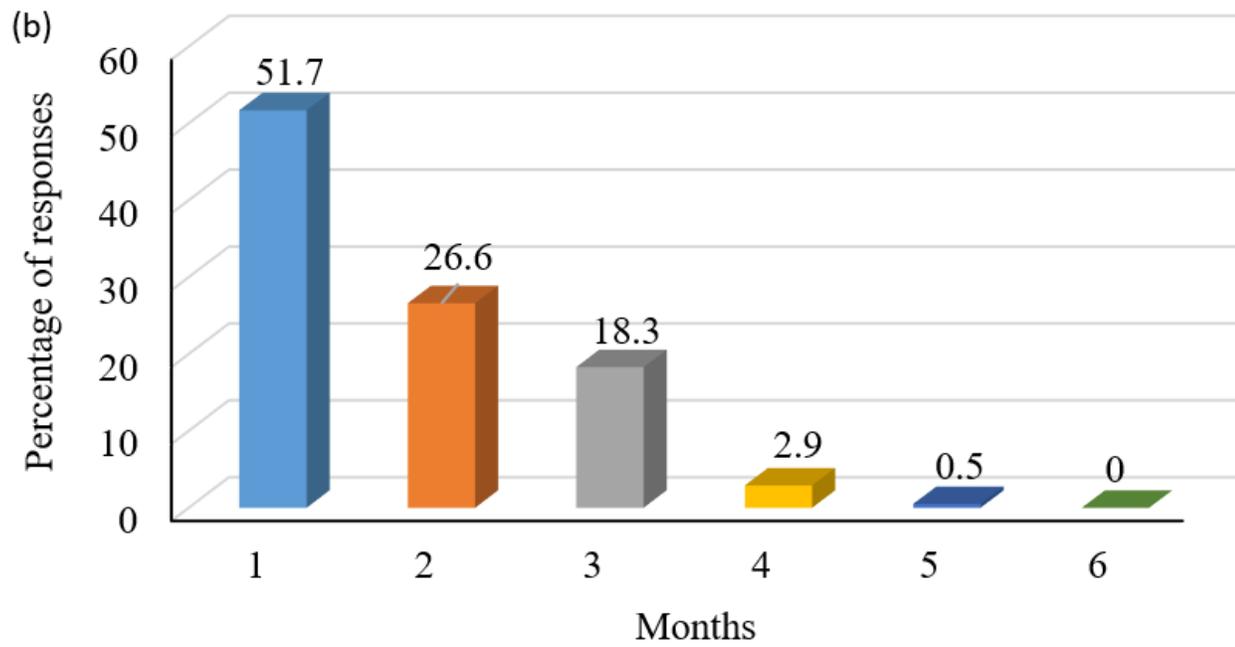
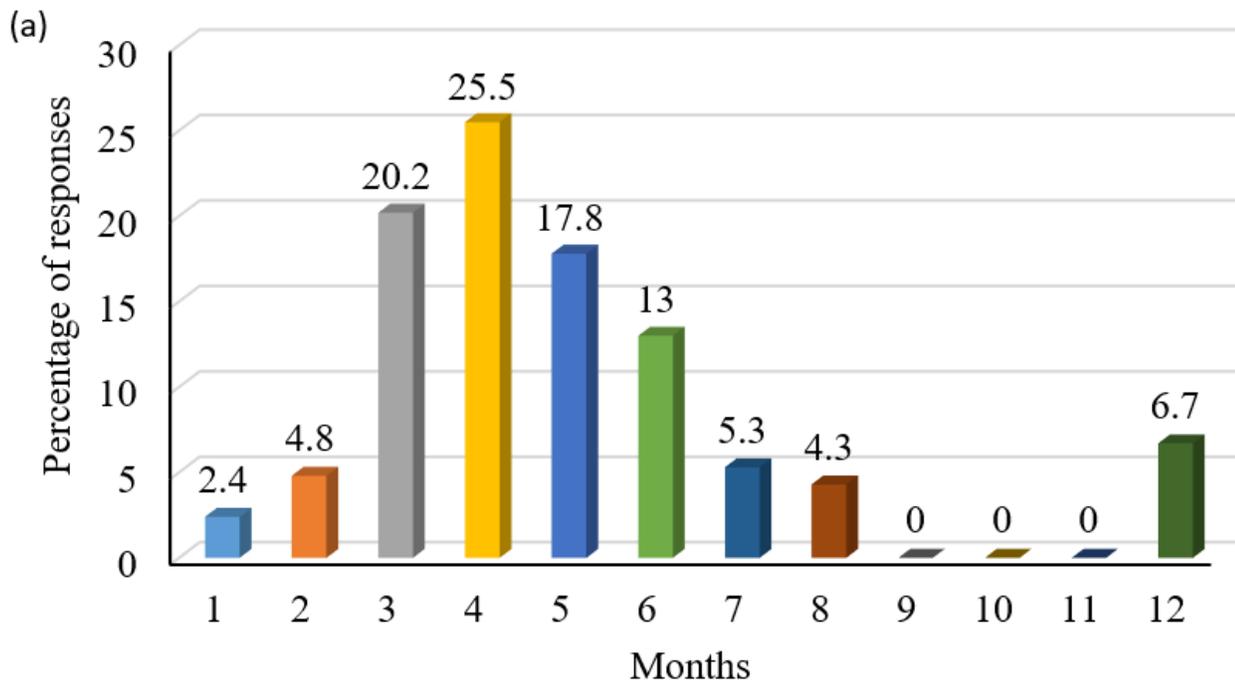


Figure 2

Farmers' perception of (a) the period of peanut conservation, (b) the period of infestation of the peanut by insects.

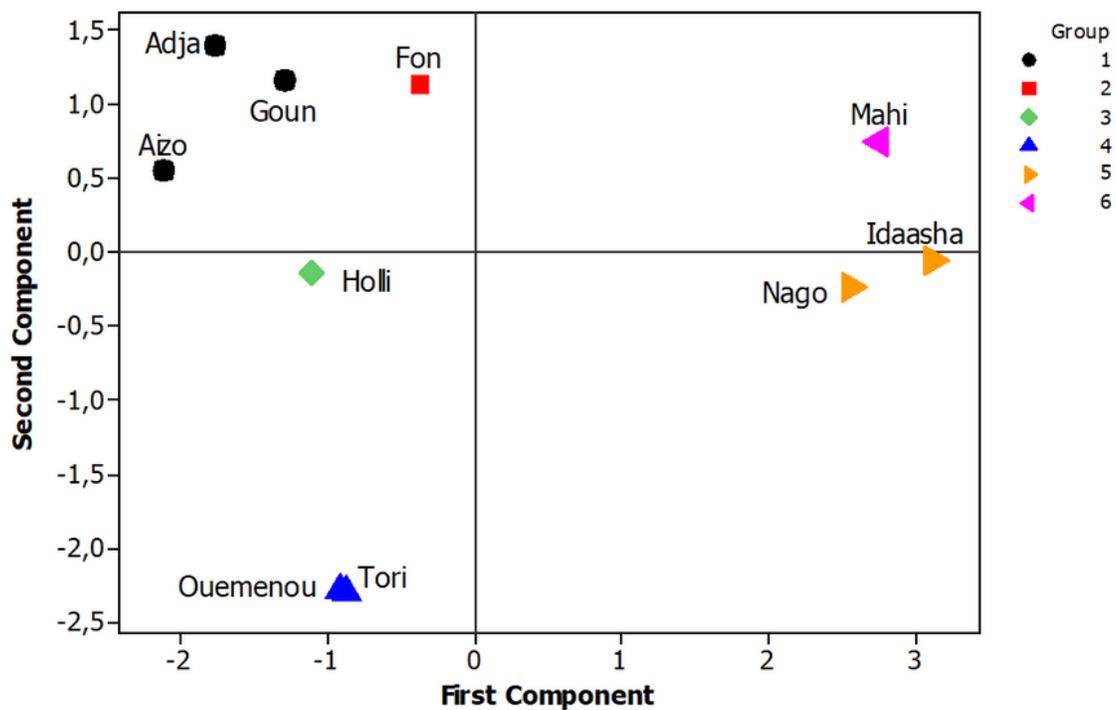
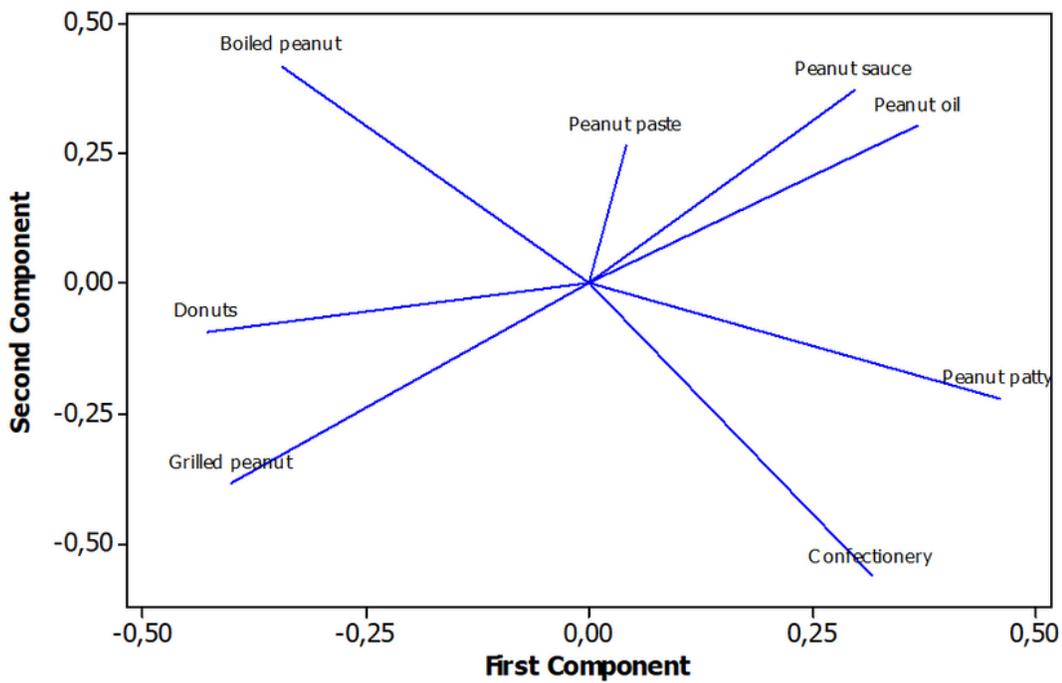


Figure 3

Different types of peanut-based foods according to the surveyed ethnic groups in the study area

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