



Place of Groundnut in the Cropping System, Constraints, Local Taxonomy and Farmers' Criteria for Characterizing Groundnut Cultivars in Niger

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Authors' contributions

This work was carried out in collaboration among all authors. Author NMIG designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MLAI and AT managed the analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

The groundnut is a leguminous, olea-proteaginous, cultivated in all the tropical zones throughout the world. In Niger, groundnut is used both as a cash and food crop and is highly valued for its nutritional and economic qualities. In order to show the local diversity of groundnut and its place in the cultivation system in Niger, a prospecting survey and seed collection was conducted in the regions of Zinder, Maradi, Tahoua and Dosso, which account for more than 90% of the national production. Two hundred and seventeen (217) producers were surveyed, using a quota-oriented technic. It emerged from this study that groundnut is generally grown pure or in association with cereals (millet, sorghum) or other legumes (cowpea, sorrel, sesame). Few producers know the varieties they use (55 437, RRB, JL 24, FLEUR 11); the rest only know the local names of the varieties (El Laray, El Haoussa, MargaMarga, El Dakar, Mai Silbi, Garangagia, Bahaoussa, El Masar, Tsougouné, El Arba'in). This denomination depends on the origin of the variety, its

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morphology and earliness. The seeds are generally sold or used for transformation and the leaves are also either sold or kept for animals. Haulms are mostly given to animals during the dry season. The prices of haulms and seeds are higher during the same period and therefore vary according to the periods. Producers cited several constraints related to groundnut production which are Insufficient fertilizer, diseases and insect pests, insufficient rainfall, and problem of seeds quality.

Keywords: Groundnut; cultural practice; production; Niger.

1. INTRODUCTION

Groundnut is one of the main leguminous crops in the semi-arid tropical zones, cultivated in more than 120 countries in the world on more than 26 million hectares and the production of 43.9 million tons [1,2]. It is the 13th largest crop and the 6th largest oilseed in the world. It is cultivated as a food crop that provides seeds for human consumption and leaves as fodder for livestock [3,4]. The seeds contain about 45-50% lipids, 25-30% protein, 5-12% carbohydrates and 3% fiber [5]. Bi-weekly consumption of peanuts and/or peanut products would improve diets [6]. Groundnut is also a good fuel and additional source of income as cash crop. Groundnut has a particular interest in the concept of sustainable agriculture since its introduction into crop rotation that introduces crop rotation, diversification of production and environmental protection by saving on nitrogen fertilizers, thus reducing the use of chemical fertilizers which are not only costly but also, and above all, harmful to the environment [7]. Groundnuts were cultivated in Niger well before the end of the 19th century [8], some groundnut varieties as 55-437, 476, RRB) were introduced into Niger in the early 1920s through the southern part of the country [9,10], and others selected by research institutes such as the National Institut for Agronomic Research (INRAN) and the International Crops Research Instituts of the Semi- Arid Tropics (ICRISAT). Groundnut was Niger's main export in the early years of independence with the creation of Nigerien society of groundnut trading (SONARA) in 1962, which was responsible for managing, organizing groundnut production and marketing in Niger [9]. Indeed, the largest groundnut production was obtained in 1966-1967 with 312,000 tons exported. Unfortunately, since the discovery of uranium, the 1974 drought and the 1970 famine [11] that have led to a reduction in cultivated areas, a decrease in soil fertility, and the emergence of other crops such as cowpeas for export. There is also competition from peanuts and other vegetable oils imported from Nigeria, the emergence of rosette in 1975 [12] and the liquidation of SONARA in 1989. All of

these factors led to groundnuts ceasing to be Niger's important cash crop in the 1990s [9]. Despite its sharp decline in exports to Niger, groundnuts remain a highly valued product in the country and remain a major source of income for smallholder farmers. It accounts for sixty-six percent (66%) of household cash income in Niger [13]. The second most important legume in Niger after cowpea (1, 953,707 tons), groundnut, with 461,842 tons, is used as both a cash and food crop. It is widely cultivated in the southern part of the country, which accounts for more than 90% of national production [14,15,16]. Several groundnut varieties have been listed in the national catalog [17], selected varieties and those introduced by research institutions like INRAN and ICRISAT), few of which have adapted to Niger's climatic conditions.

In order to promote groundnut cultivation, we propose to make globally an inventory of this crop. Specifically to:(i) inventory the different groundnut cropping systems, (ii) identify the diversity and nomenclature of groundnut ecotypes according to the agrosystems in the surveyed areas of Niger, (iii) analyze the criteria of choice and sources of seed supply among producers, to identify the different constraints and difficulties related to its production, and (v) evaluate the influence of socio-environmental factors on groundnut seed and biomass production.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted in January 2016 in four regions of Niger: Zinder (Mirriah and Magaria departments), Maradi (Madarounfa and Chadakoari departments), Tahoua (Konni and Madaoua departments), and Dosso (Tibiri, Doucthi and Gaya departments) (Fig. 1 and Table 1). All sites are located in the sedentary Sahelian zone with an annual rainfall between 400 and 600 mm and the Sudanian zone with an annual rainfall between 600 and 750 mm [18,19].

These sites were selected on the basis of data collected at the Statistics Directorate of the Ministry of Agriculture and Livestock of Niger, the various departmental directorates of agriculture, and ICRISAT on groundnut production in Niger [20,21]. Thus, these regions in the southern part account for more than 90% of the production [16].

2.2 Survey and Peanut Collection Methods

The regions, communes and villages were chosen in concert with the departmental directors of agriculture or the heads of INRAN stations in the different departments on the basis of the most groundnut-producing areas. A quota-oriented survey was used to select respondents. In each village, 15 producers were randomly selected, corresponding to 30 per department and 60 per region, for a total of 240 respondents. The study focused on the social profile of the respondent, the cropping system, the fodder value of groundnut, its medicinal value, its commercial value, difficulties related to its production, storage of the haulms, diseases, and groundnut insects and pests.

In each village, samples of groundnut ecotypes were collected after each interview, and information was gathered on the origin of the seeds collected, the period of seed selection, the mode of acquisition, the different varieties of groundnut that the farmer is used to growing, and the area occupied by this crop. Each ecotype is labeled for identification with the name of the

commune, the name of the village and the local or scientific name of the ecotype.

2.3 Statistical Analyses

As the questionnaire was codified in advance, all the information collected was entered into the CS Pro 6.2 software. The data were analyzed using IBM SPSS 2011 version 20 software, using simple descriptive analysis techniques (frequencies, percentages). Factor analysis was performed using XLSTAT 2014 software, which described the relationships between the ecotypes named by the producers and constraints related to groundnut production by region. The variation in the production of fodders and seeds was performed as a function of socio-environmental production parameters. The normality test was carried out for each of the two variables. Following the non-normal distribution of the variables, the Kruskal-Wallis test was carried out for this purpose with the software R version 3.6.0. The processing and presentation of certain tables and figures was done in Excel spreadsheet.

3. RESULTS AND DISCUSSION

A total of 217 producers were surveyed.

3.1 Social Situation of the Surveys

The prospecting survey carried out in 16 sixteen villages in Niger enabled the interviewing of 217 peanut producers and transformers, including 140 men and 77 women, with 64.5% and 35.5% respectively (Table 2). In Dosso, the percentage

Table 1. Surveyed villages in study regions

Regions	Departements	Villages
Zinder	Mirriah	Kanya Angoual kourna Rijiya
	Magaria	Galla Rouga Kaqi Mougou
Maradi	Guidan Roumji	Chadakoari Inwala Sarkin Toudou
	Madarounfa	Sarkin Bindiga Djirataoua
Tahoua	Madaoua	Mallamawa Arzarori
	Konni	Cerassa Mangou Cerassa Gouni
Dosso	Gaya	Guwa Guidan Gaaba
	Tibiri	Guiecheme Wassangou

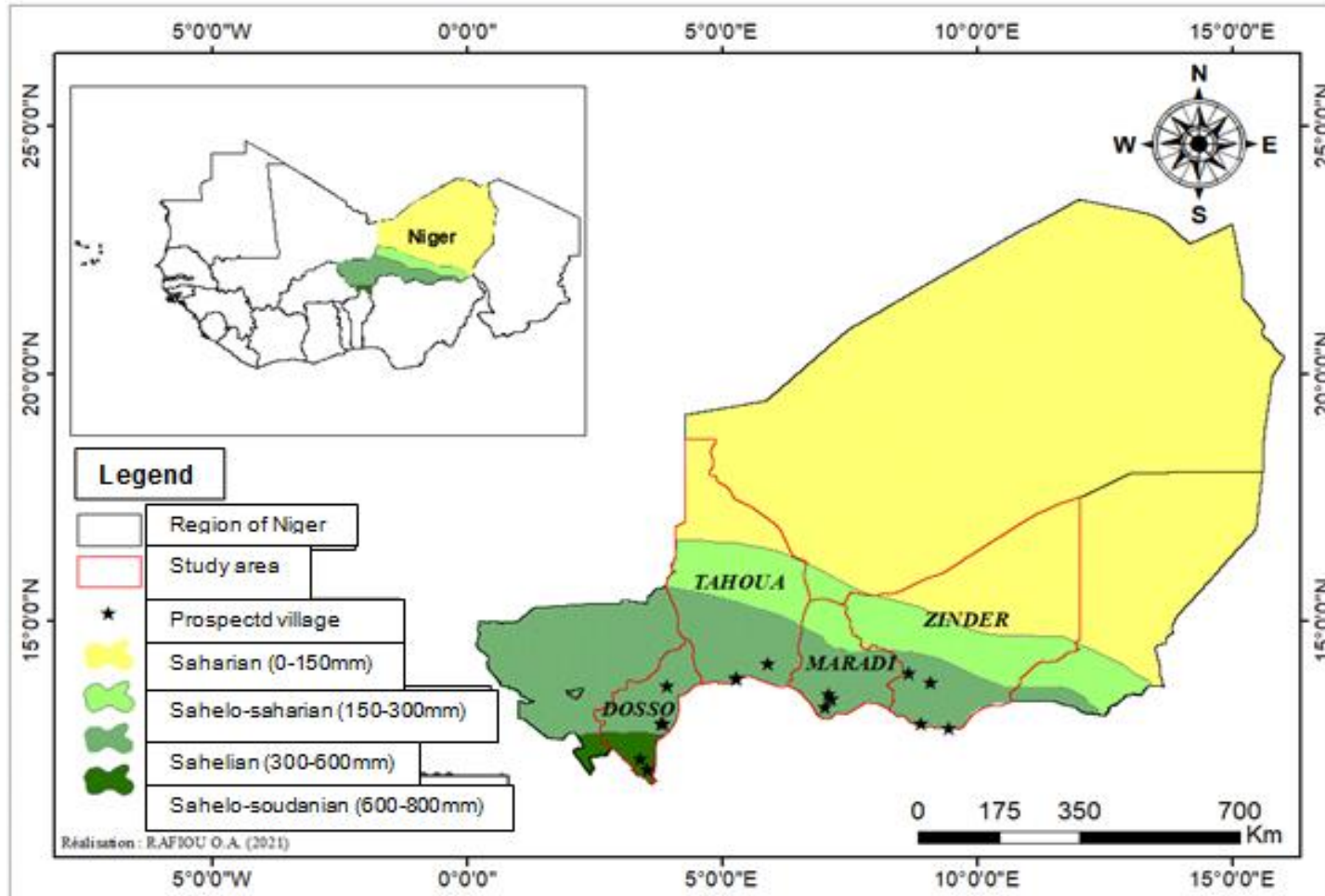


Fig. 1. Location of surveyed sites (Survey data, 2016)

of women interviewed was higher than that of men, 61.01% versus 38.98% (Table 2). The socio-economic characteristics of the respondents play an important role in the creation of awareness and knowledge about their exploitation model [22]. According to the results of the survey, men dominate groundnut production because it is a cash crop. Women also did not remain on the margins and are largely involved in production and especially in processing, as in the Dosso region. The work of [23] has shown that in Africa for cash or cash crops men generally take over from women, even though groundnut is considered as women's crop.

The results show that 54.84% of the respondents were between 40 and 60 years old, compared to 26.27% between 19 and 40 years old (Table 2). Concerning the training of producers, 26.21% are illiterate, 43.78 are literate and the remaining 30% have at least a primary level of education. The respondents are divided into three ethnic groups, 87.6% of those surveyed are of Haussa ethnicity, 7.8% are Tuareg, and 4.61% are Zarma (Table 2). The majority of producers are farmers (88.24%), traders (8.8%), and breeding (0.9%) as their main activities (Table 2).

The majority of respondents belong to the age groups of active producers. Groundnut is not only a food crop, but also a cash crop where young people are more involved in the sale of fodders, which is currently growing in Niger due to the nutritional quality of the fodders. Thus, groundnut is cultivated even on irrigated hydro-agricultural schemes in addition to rainfed cultivation, similar results are found by [24] in 2017 in the study of the Commercialization and nutritional value of fodder in urban centers in Niger: the case of the cities of Maradi and Niamey.

3.2 Peanuts in the Niger Cropping System

In order of crop frequency, groundnut occupies the fourth place (30.9%) after millet (62.20%), sorghum (39.60%), and cowpea (36.4) (Fig. 2). It is therefore the second most important legume after cowpea. These results confirm the national statistics ones which that cowpea 1, 953,707 tons, and groundnut one was 461,842 tons [15].

The area devoted to groundnut cultivation is between 0.5 and 2 ha for 93% of the producers surveyed, with only 7% of respondents cultivating it on more than 3 ha, who are generally large producers (Fig. 3).

Table 2. Social characteristics of respondents in the study areas

Variables	Zinder		Maradi		Tahoua		Dosso		Total	
	N	%	N	%	N	%	N	%	N	%
Sex										
Male	40	78.43	42	68.63	35	75	23	38.98	140	64.5
Female	11	21.57	14	31.37	16	25	36	61.02	77	35.5
Age										
[19 - 40 years]	14	27.45	14	25	14	27.45	15	25.42	57	26.27
[40 - 60 years]	27	52.94	37	66.07	24	47.06	31	52.54	119	54.84
≥ 60years	10	19.61	5	8.93	13	25.49	13	22.03	41	18.89
Ethnic Groups										
Haoussa	36	70.59	54	96.43	50	98.04	50	84.75	190	87.6
Zarma	0	0	1	1.79	0	0	9	15.25	10	4.61
Touareg	15	29.41	1	1.79	1	1.96	0	0	17	7.8
Education level										
Illiterate	6	11.76	10	17.86	13	25.49	28	47.46	57	26.27
Alphabetized	33	64.71	26	46.43	14	27.45	22	37.29	95	43.78
Primary	9	17.65	11	19.64	20	39.22	8	13.56	48	22.12
Secondary	3	5.88	9	16.07	3	5.88	1	1.69	16	7.37
Superior	0	0	0	0	1	1.96	0	0	1	0.46
Main activities										
Agriculture	45	88.24	49	87.5	42	82.35	57	96.61	193	88.9
Breeding	2	3.92	0	0	0	0	0	0	2	0.9
Trade	3	5.88	6	10.71	9	17.65	1	1.69	19	8.8
Transport	1	1.96	0	0	0	0	0	0	1	0.5
Other	0	0	1	1.79	0	0	1	1.69	2	0.9

The results showed that groundnut is grown as a pure crop in approximately 35% of farmers and the larger part (65%) in association with other crops. The main categories associations are: millet, cowpea, sorghum and groundnut (48%); millet, sorghum and groundnut (2%); millet, groundnut and cowpea (4%), groundnut and sesame (3%); groundnut and others (8%) (Fig. 4). Pure groundnut cultivation is generally practiced by large producers, seed producers (seed companies), nongovernmental organizations, and projects working with research institutions for seed production.

In Zinder region, more than 25% of the farmers cultivate groundnuts as pure crop in contrast to Maradi and Dosso, where more than 30% of the farmers cultivate groundnut in association with millet, Cowpea and sorghum (Fig. 5). This association varies according to the crop and the area. It is more diversified in Maradi than in the

other regions, due to the existence of the irrigated perimeter of Djirataoua (spices, voandzou, salad, cabbage, cucumber, papaya, banana).

In Niger, groundnut production varies according to study areas; it is cultivated in association, in rotation or pure. In general, crop rotation and association are intended to diversify and intensify production in order to avoid pest attacks. Groundnut is also highly valued for improving soil fertility [25,26]. This practice is explained by cultural, farming practice and nutritional needs of families. The results of the survey indicated that farmers grow groundnuts more in association than as a pure crop, and this predominance has implications for the type of groundnuts appropriate for the production system. For example, erect types would be more appropriate because most groundnut varieties released and propagated in Niger are of the erect type [14].

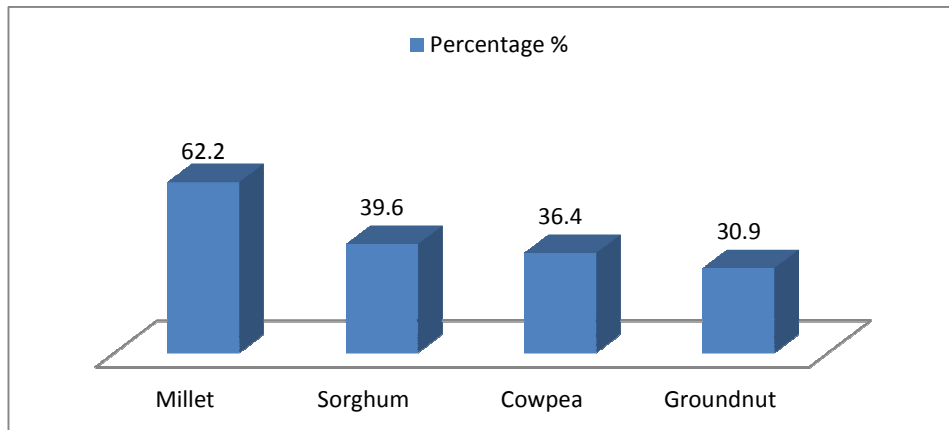


Fig. 2. Place of groundnut in Niger cropping system

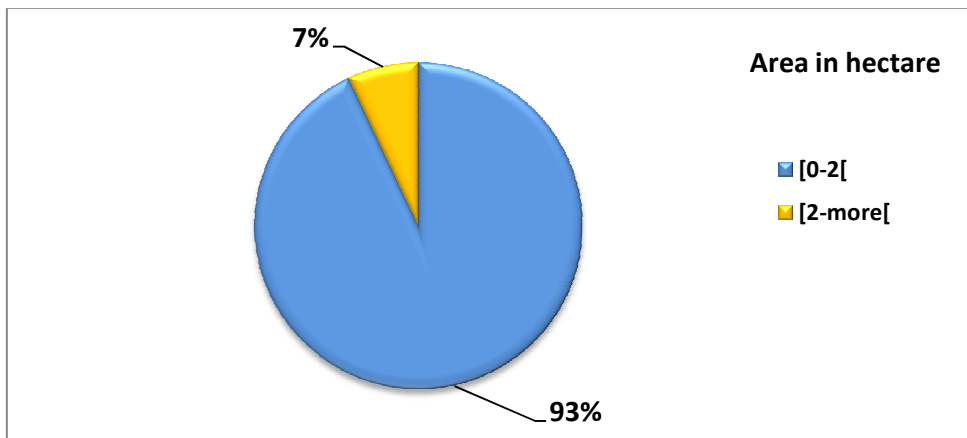


Fig. 3. Area devoted to groundnut in Niger

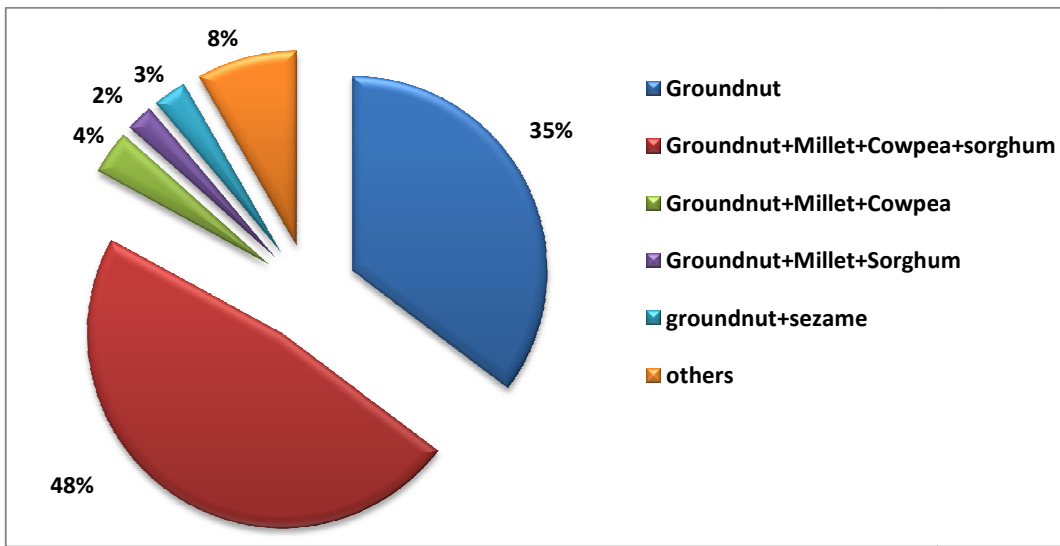


Fig. 4. Crop association with groundnuts

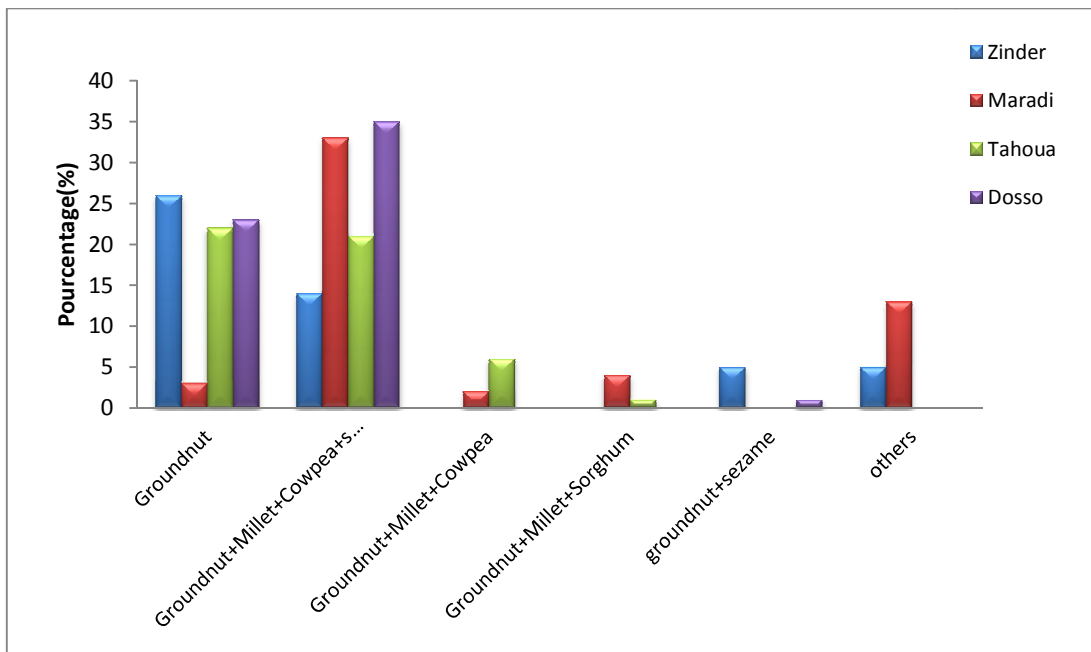


Fig. 5. Crop associations with groundnut by region practiced in the Study Area

3.3 Local nomenclature and diversity of peanut ecotypes grown in Niger

Several vernacular names of ecotypes (33), were inventoried in different peanut production areas. The Goujia and Tsougounne ecotypes are more prevalent in Tahoua and Dosso, Garangagia (Tahoua and Maradi), and Bahaoussa cited more in Maradi and Zinder (Table 3). The results also show that the same ecotype can have different

vernacular names from one site to another and they are considered synonymous, or sometimes the same name can also designate different ecotypes such as the names Goujia and Koalanché. Thus local taxonomy is defined as a classification used by farmers to exploit and maintain the genetic diversity of their area [27,28], and these local names are at the origin of the good knowledge of biological diversity by producers [29]. Table 3, lists the ecotypes names

(local name), the french translation of the local name and its main area of production. In Niger, according to the results of our survey, the number and quality of criteria used by producers to characterize an ecotype vary from one site to another. Several criteria are used to classify groundnut accessions, which are generally the origin of the variety, morphological characteristics, seed color, plant habit, pod shape, or earliness. Thus according to the popular nomenclature of groundnut of Niger some ecotypes are named according to their origin, for example El Dakar, El-Masar, El Paris, El Maradi mean respectively ecotypes coming from Dakar, Egypt, Paris or Maradi. It should be noted that according to the national catalog of

2012, El Dakar is a denomination of the 55 437 which is a senegalese variety introduced in 1927 and which has been widely popularized in Niger [10].

In addition to the origin, producers also associate the origin to name the ecotypes so that the cultivar Bahaoussa or el haoussa represents the variety considered traditional by farmers. Morphological characteristics are also used by producers in naming ecotypes in Niger. The type of the port, Tsougoune and Takontche meaning respectively erect and creeping; the productivity, Garangagia and Koatsama; the color of the seed is not to be neglected in the determination of variety names, thus Djagoujia this name is given

Table 3. List of named ecotypes by region and translation of these names

Names of ecotypes	Translation	Regions				
		Zinder	Maradi	Tahoua	Dosso	Total
Bahaoussa	From Hausa	13	20	0	2	35
Tsougounne	Erect Bearing variety	4	1	10	15	30
Bazanfara	From Zanfara	0	0	5	0	5
EL Arbain	From 40 days	0	10	0	0	10
EL Dakar	From Dakar	4	0	0	0	4
EL Paris	From Paris	1	0	1	5	7
EL Laray	From laray	0	1	0	0	1
EL Koukouma		0	0	7	0	7
EL Madaoua	From Madaoua	0	0	3	0	3
EL Maradi	From Maradi	1	0	3	2	6
EL Massar	From Egypte	0	3	0	0	3
EL Zahi	Early	0	0	1	0	1
Garangagia	Which produces lot	0	20	15	0	35
Fara	white	2	0	0	6	8
Goujia	Name of peanut in Hausa	1	3	28	18	50
Goujia fara	White peanut	0	0	0	1	1
Goujia Ja	Red peanut	4	0	2	8	14
Koatsama	Which produc lot	0	0	3	0	3
Takontche	Crawling variety	0	5	0	7	12
Margamarga	Red and pink blend	0	0	0	5	5
Mota	car	0	0	0	8	8
Babba mota	Large car	0	0	0	5	5
Rrb	RRB	0	0	0	4	4
Tatsaye	Peanut with erect port	0	0	0	2	2
55 437	55 437	0	2	0	2	4
Fleur 11	FLEUR 11	0	0	0	2	2
EL Nigeria	From Nigeria	0	2	0	0	2
JL 24	JL 24	0	2	0	0	2
Mai Yado	Crawling variety	1	0	0	0	1
Mai tsinin baki	Peanut with pronounced beak	0	0	0	2	2
Mai rakoumi	Peanut with long pods	0	0	1	0	1
Ta zamani	Improved peanut variety	0	1	0	0	1
Bagobira	From Gobir	0	0	2	0	2
Koalanche	Name of peanut in Hausa	0	0	0	6	6

to red peanut seed varieties, and Marga Marga is attributed to a mixture of red and pink peanut seed. The earliness is also part of the nominative characterization of ecotypes. The ecotypes El Arba'in and El Zahi, are so called because they are early). The shape of the pods is also one of the criteria used by producers to name peanut ecotypes. Mai Silbi is given to peanut varieties with pods without cross-linking, and Mai tsininbaki is given to those with a very pronounced beak. In view of the importance of diverse naming of species cultivated by farmers, [30,31] have proposed the combination of an ethnobotanical approach and population genetics. The work of [10] also confirmed the existence of more than 15 varieties of groundnut grown in Niger, including 4 modern varieties, and the other varieties with local names given by producers that they could not determine. The number of ecotypes found in this study (33) is more than the one found by [10]. Several studies show the importance of the local names of farmers and the criteria used to designate the majority of species cultivated in Africa: [32,33,34,35] for fonio; [28,36,37] for sorghum; [38,39,40,41] for onion; [19] for sorrel; and [10] for groundnut. The results of the survey show that some producers also grow some known improved varieties (55,437, RRB, JL 24, flower 11, T188-73), which are among the first varieties to be introduced and popularized in Niger. In general, these producers have either worked with non-governmental organizations, programs or research institutions for the introduction tests of new varieties or multi-local tests, or seed producers who belong to farmers' organizations. More than 90% of the producers know the varieties they grow on the basis of the local names assigned to the varieties. It should be noted that the term "local ecotype" refers to varieties that the producers select themselves or varieties selected over generation.

The organization of ecotypes diversity was observed by performing a Factorial Correspondence Analysis (FCA) (Fig. 6). The first two axes explain 78.78% of total information. The projection of ecotypes and regions on the plane formed by the two axes allows structuring the diversity of peanut ecotypes listed by producers in Niger into three groups. The first group is located on the positive part of axis 1 and 2, consists of ecotypes from the Maradi and Zinder regions, the second group is located on the negative part of axes 1 and positive axes 2, that includes ecotypes correlated to the Dosso

region, while the third group which is on the negative part of the two axes, that includes ecotypes specific to the Tahoua region. Thus, a spatial distribution of the peanut ecotypes named by the respondents can be observed. The regions of Maradi and Zinder are not only the main but also the oldest groundnut production areas in Niger. These regions include ecotypes from Egypt (El Masr) and Senegal (El Dakar), where groundnuts are widely grown. According to [42] both regions lie on the axis where groundnuts were reported in the mid-18th and early 19th centuries. In Tahoua there are ecotypes mainly from Maradi, where producers orient their production towards irrigated cultivation, especially for the production of haulm.

3.4 Seed Selection Criteria

The criteria for choosing the seeds used vary according to production objectives of the producers. Indeed, some, prefer varieties that are early and have good seed yield (example of seed sellers), others prefer varieties that produce a lot of haulm even if they do not get enough seed (case of haulm sellers), and processors who prefer varieties that have a good oil performance. The choice can also be based on the variety for seed color (mostly red), or seed size. Farmers' seed management methods, which are the exchange of varieties between farmers, are cause of diversity between crop species [43,44]. Using seeds of lower quality over years, plant material declines its quality and productivity.

3.5 Seed Supply Sources and Transactions

The results of the study (Table 4), show that 75.1% of the groundnut producers use traditional seeds, 19.9% use improved seeds and 5% of the producers use both types of seeds. Among those who use traditional seeds, 74.3% use their own production, 25% buy the seeds at the market and 0.7 get them from donation ; For those who use improved seeds, 47.7% buy the seeds in research institutions like INRAN and ICRISAT, with seed farms, others received them in support by NGOs or programs (54.3%). In Niger the informal sector remains the main supplier of seeds, so when they run out of seeds, producers usually got to other sources such as family, friends or nearby markets [10].

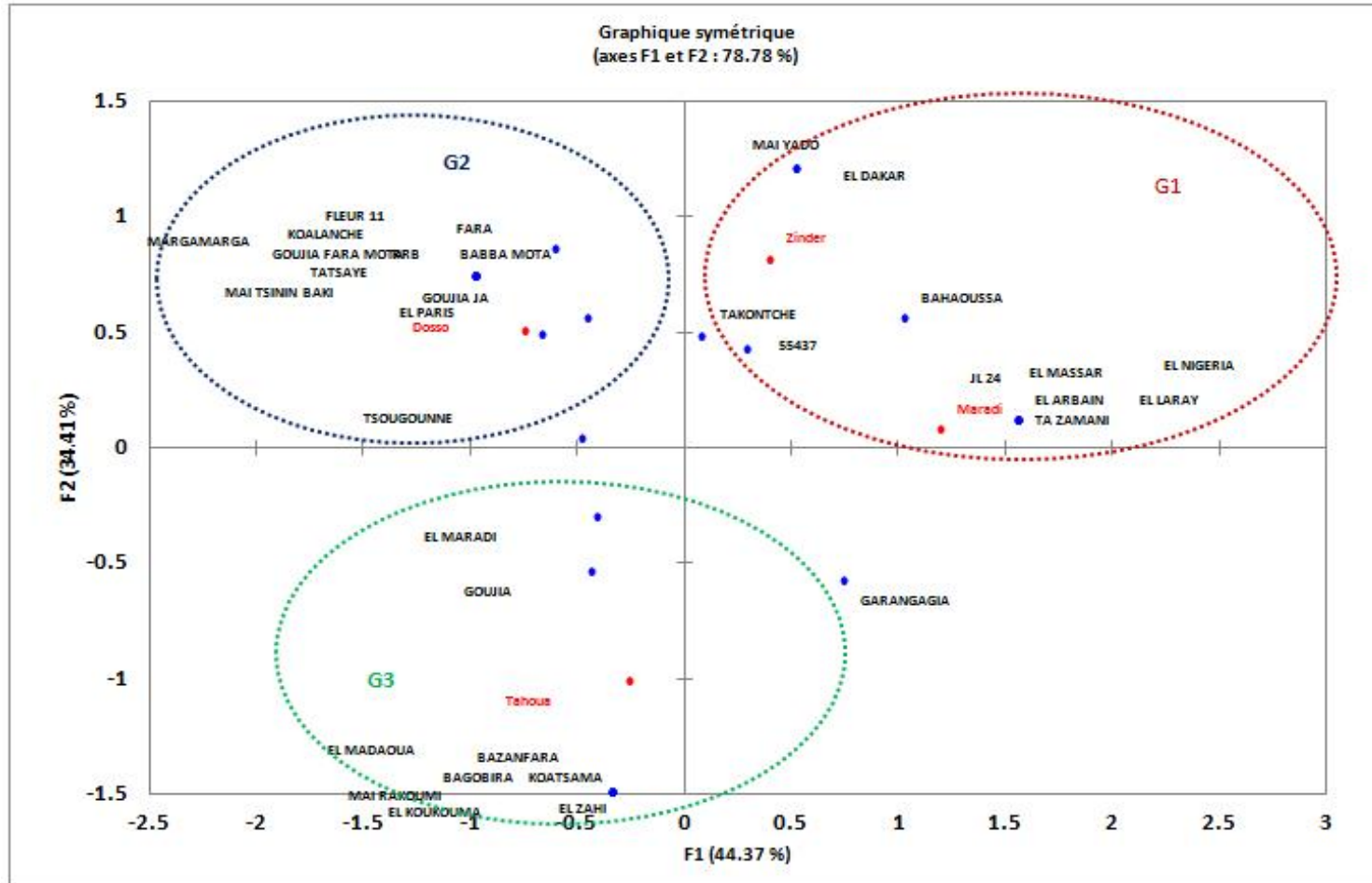


Fig. 6. Graphical representation of ecotypes according to regions

3.6 Peanut Production Products

All producers surveyed (100%) grow groundnuts for seeds and fodders. The produced seeds are generally sold to meet family needs or used for transformation. Similarly the fodders are also kept for livestock and/or sold depending on the produced quantity. In relation to use, the haulms are mainly used to supplement animals, especially during the dry season to fatten them (sheep, dairy cows) or to prepare them for field work during the rainy season. The price of a bag of haulms is higher during this same period, which can reach 3,000 CFA francs per bag in Zinder, while in Dosso the price of haulms is about 1,500 CFA francs. Sale prices vary according to zone and period (Fig. 7).

3.7 Difficulties and Constraints of Groundnut Production

The survey results (Fig. 8) show that the major concerns of groundnut surveyed producers are mainly: insufficient fertilizer 26.47%, diseases and insects 18.95%, followed by insufficient rainfall 17.32%, and inaccessibility to quality seeds 10.78%, financial problems and working tools (11.44%). These constraints influence qualitatively and quantitatively production groundnut. It should be noted that, in general, the

problems related to groundnut production can be summarized in all these constraints only according to zones; the order of these problems can vary. Several studies have shown that disease and insect pests, financial problems and lack of quality seeds are the main constraints of production, in Nigeria by [45,46,47,48] and [22], in Togo by [49] and in Ethiopia by [50].

In order to structure the problems related to groundnut production specific to each region, we conducted a Factorial Correspondence Analysis, the first two axes that take into account 83.19% of the total information (Fig. 9). Axis 1 opposes on the one hand the germination problem, insufficient fertilizer and seed, and on the other hand the soil degradation, marketing problem, working tools and weeding problem, it is positively correlated to the Maradi region. Axis 2 opposes constraints such as insufficient space, insufficient fertilizer, seed and hard work to the problem of poor harvests, while at the same time it opposes the region of Zinder and Dosso. The analysis of the Fig. 9, shows that the constraints are cited in more or less the same regions with some specificities: Maradi: germination; Dosso: marketing, weeding, insufficient working tools; Zinder: hard work; Tahoua: insufficient working tools.

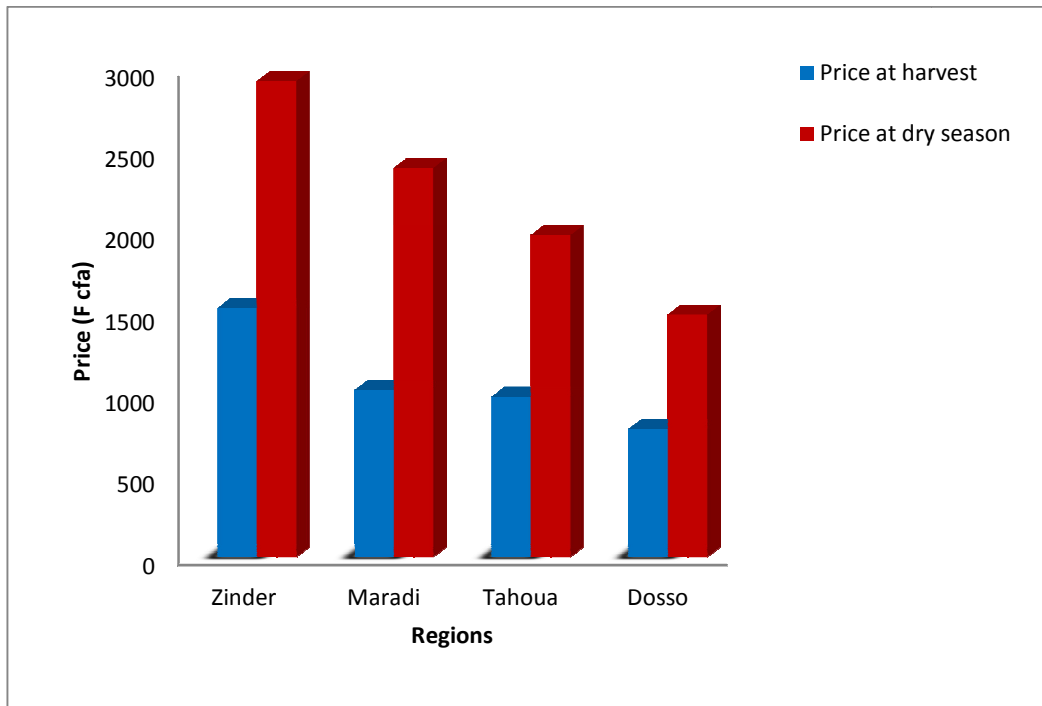


Fig. 7. Average selling price of peanut tops

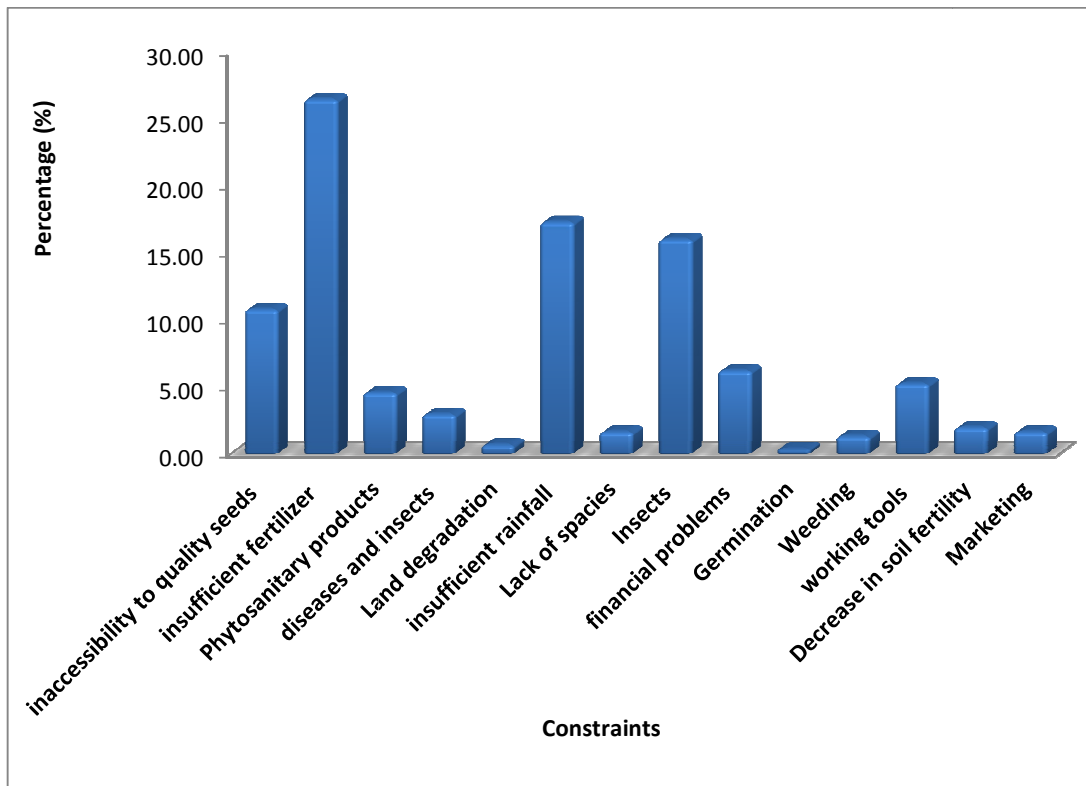


Fig. 8. Constraints to groundnut production in Niger. Source: 2016 survey

Table 4. Source of supply of groundnut seed

Seed types	Percentage (%)	Sources	Percentage (%)
Traditional seeds	75.1	Own	74.3
		Purchass	25.0
		Donation	0.7
Selected variety seeds	19.9	Purchass	45.7
		Support	54.3
Deux	5	-----	-----

3.8 Influence of Socio-Environmental Factors on Seed and Biomass Production

The results (Table 5), showed that among the socio-environmental factors, age (p-value=0.523 and p-value = 0.227), ethnic group (p-value=0.416, and p-value = 0.484), main activity (p-value=0.471 and p-value = 0.476), and level of education (p-value=0.604 and p-value = 0.596), do not influence both groundnut seed and leaf production (p-value giving for biomass and seed production respectively). The non-significant results imply that producers learn the activity by working whether they are young or adult; Haussa, Zarma or Tuareg; farmers, breeders or traders, with or without education. These results

confirm those [51] who have also found that the level of education does not influence groundnut production (p-value= 0.700). Gender has an influence on biomass production (p-value=0.030) because men are in the majority in groundnut production with large areas, and especially producers are placing more and more importance on the marketing of the tops. Climatic zones influence seed production. The factor of regions (p-value=0.000, p-value=0.004), has a very significant effect on the production of both fodders and seeds respectively. These results can be explained by the climatic conditions that vary from a zone to another and a region to another. But also by the difference in types of varieties available, cultivation techniques and soil types, which can vary over regions.

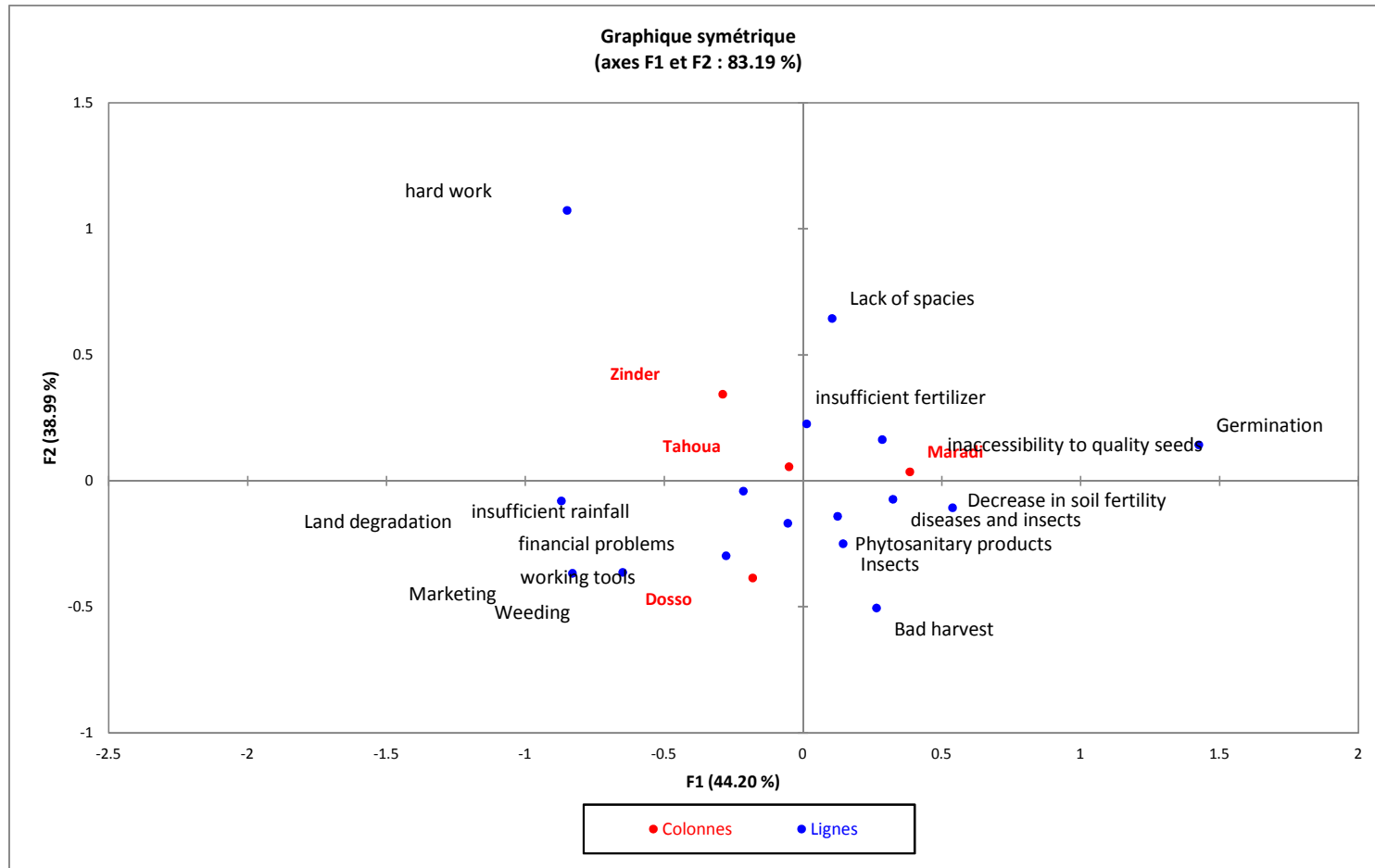


Fig. 9. Groundnut production constraints by region

Table 5. Socio-environmental factors influencing production of groundnut tops and seeds

Factors	Biomass Production (P-value)	Seed Production (P-value)
Gender	0.030 *	0.051 ns
Age	0.523 ns	0.227 ns
Ethnic group	0.416 ns	0.484 ns
Main Activity	0.471 ns	0.476 ns
Grade level	0.604 ns	0.596 ns
Regions	0.000 ***	0.004 **
Climatic zones	0.307 ns	0.001 **

4. CONCLUSION

At the end of this study, the results of the survey show that, the place of groundnuts in the agro-ecosystem of the different villages surveyed and the different criteria used by producers to name the groundnut ecotype in Niger. The used criteria are often, the origin, morphology, type of port. This study shows the existence of a strong diversity within the groundnut crop in Niger. In reality, however, all the used criteria are not sufficient to really distinguish the varieties of groundnut. So, that should be later confirmed by agro-morphological and genetic evaluation, in order to ensure its long-term conservation and avoid genetic erosion of the species.

CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. FAOSTAT, [Food and Agriculture Organization]. Base de données statistiques Agriculture FaO; 2011.
2. FAOSTAT, Food and Agricultural Organization. Base de données statistiques Agricoles; 2015. Available:<http://faostat.fao.org/>. Report-FAOSTAT Production.
3. Larbi A, Dung DD, Olorunju PE, Smith JW, Tanko RJ, Muhammad IR, et al. Groundnut (*Arachis hypogaea* L.) for food and fodder in crop livestock systems: Forage and seed yields, chemical composition and rumen degradation of leaf and stem fractions of 38 cultivars. *Animal Feed Science and Technology*. 1999; 77(1):33-47.
4. Omokanye AT, Onifade OS, Olorunju PE, Adamu AM, Tanko RJ, Balogun RO. The evaluation of dual-purpose groundnut (*Arachis hypogaea*) varieties for fodder and seed production at Shika, Nigeria. *The Journal of Agricultural Science*. 2001; 136(01):75-79.
5. Settaluri VS, Kandala CVK., Puppala N, Sundaram J. Peanuts and their nutritional aspects-A review. *Food Nutr. Sci*. 2012;3(12):1644–1650.
6. Griel AE, Eissenstat B, Juturu V, Hsieh G, ET Kris Etherton PM. Improved diet quality with peanut consumption. *Journal of the American College of Nutrition*. 2004;23: 660-668.
7. Brink M, Belay ET, G. (Editeurs). *Ressources végétales de l'Afrique tropicale 1*. Fondation PROTA, Wageningen, Pays-Bas / CTA, W. 2006;328.
8. Rene Tourte, *Histoire de la recherche agricole en Afrique tropicale francophone volume IV: La période Coloniale et les grands moments des jardins d'essais: 1885/1890- 1914/1918*. Organisation des nations unies pour l'alimentation et l'agriculture (FAO,) Rome. 2005;515.
9. Abdourahmane Idrissa, Samuel Decado, *Historical Dictionary of Niger in 4e Edition*. Scarecrow Press. 2012;541. ISBN: 978-0-8108-7090-1.

10. Ndjeunga J, Ntare BR, Waliyar F, ET Ramouch M. Systemes semenciers d'arachide d'africque de l'ouest. Document technique du FCPB. No 40. PO Box 74656, 1070 BR Amsterdam, The Netherlands: Fonds commun pour les produits et de base; et Patancheru, 502 324, Andhra pradesh, Inde: Institut international de recherche sur les cultures des zones des tropicales semi-arides. 2006;232.
11. Mounkaila A., Groundnut production, Research and research problems in Niger. International Workshop on groundnuts, ICRISAT Patancheru, India. 1980;262-263.
12. Ndunguru, Groundnut agronomic research at ICRISAT Sahelien center. Fisrt regional groundnut meeting for West Africa, Niamey, Niger, 1988. Patancheru 502324, Andhra Pradesh, India. International Crops Research Institut for the Semi-Arid Tropics. 1988;11-14.
13. ICRISAT, International crops research institute for the Semi-Arid tropics sahelian center, 1991. ICRISAT West African Programs Annual Report 1990;2013;21-39. .
14. MAG/EL, Rapport d'évaluation des récoltes 2015 et résultats définitifs de la campagne agricole 2015/2016. République du Niger/Ministère de l'Agriculture/Direction des Statistique; 2016.
15. MAG/EL, Rapport d'évaluation des récoltes 2016 et résultats définitifs de la campagne agricole 2016/2017. République du Niger/Ministère de l'Agriculture et de l'Elevage/Direction des Statistiques. 2017;40.
16. MAG/EL, Rapport d'évaluation de la campagne agricole d'hivernage 2017 et Perspectives Alimentaires. République du Niger/Ministère de l'Agriculture et de l'Elevage/Direction des Statistiques; 2018.
17. Niger, Catalogue National des espèces et variétés végétales(CNEV); Ministère de l'agriculture; 2012.
18. Saadou M, La végétation des milieux drainés nigériens à l'est du fleuve Niger. Thèse présentée à la Faculté des sciences de l'Université de Niamey pour obtenir le grade de Docteur Es-Sciences Naturelles. 1990;395.
19. Bakasso Y, Ressources génétiques des roselles (*Hibiscus sabdariffa* L.) du Niger: Evaluations agromorphologique et génétique. Thèse de Doctorat, Université de Niamey. 2010;109.
20. MDA, DS, Résultats définitifs de la campagne agricole d'Hivernage 2013 et Perspectives Alimentaires. République du Niger/Ministère de l'Agriculture/Direction des Statistiques; 2014.
21. MDA, DS, Rapport d'évaluation des récoltes et résultats définitifs de la Campagne Agricole d'Hivernage 2014. République du Niger/Ministère de l'Agriculture/Direction des Statistiques; 2015.
22. Madaki MJ, Abba IY, Mary, A. Economic analysis of groundnut prouction in Biu local government area of Borno state, Nigeria. International Journal of Information Research and Review. 2016;03 (01):1657-1660.
23. Gerei AA, Dauna Y, Dire B. An economic analysis of groundnut (*Arachis hypogea*) production in Hong Local Government Area of Adamawa State, Nigeria. 2013; 1(6):84-89.
24. Dan Gomma A, Chaibou I, Banoïn M, Schlecht E. Forages trade and nutritive value in urban centers in Niger : Maradi and Niamey cities cases. International Journal of Innovation and Applied Studies. 2017;21:508-521. ISSN: 2028-9324.
25. Ansari MA, Prakash N, Punitha P, Baishya LK. Post-harvest management and value addition of groundnut. Join Dir. ICAR Res. Complex NEH Reg. Manipur Cent. Lamphelpat Imphal- 795004; 2015.
26. Manizan AL, Akaki D, Piro Metayer I, Montet D, Brabet C. ET Koffi-Nevry R. Évaluation des pratiques culturales de l'arachide favorisant la contamination par les aflatoxines dans trois régions de Côte d'Ivoire. Int. J. Biol. Chem. Sci. 2018; 12(4):590-1600.
27. Berlin B. Ethnobiological classification; Principles of Categorization of Plant and Animals in Traditional Societies, New Jersey: Princeton University Press. 1992; 354.
28. Mekbib F. Infra-specific folk taxonomy in sorghum (*Sorghum bicolor* (L.) Moench) in Ethiopia: folk nomenclature, classification, and criteria. Journal of Ethnobiology and Ethnomedicine.2007;3:18. DOI: 10.1186/1746-4269-3-38.
29. Khasbagan ET Soyolt. Indigenos knowledge for plant species diversity: A case study of wild plants folk names used

- by the Mongolans in Ejina desert area, Inner Mongolia, P.R.China. *Journal of Ethnobiology and Ethnomedecine*. 2008; 4(2):6.
DOI: 10.1186/1746-4269-4-2.
30. Péhaut Yves. L'arachide en Afrique occidentale. In: *Cahiers d'outre-mer*. N 179-180 - 45e année. Les plantes américaines à la conquête du monde. 1992;387-406.
DOI:https://www.persee.fr/doc/caoum_037_3-5834_1992_num_45_179_3453.
 31. Leclerc C. ET Coppens D'eeckenbrugge G. Social organization of crop genetic diversity The Gx E x S interaction model. *Diversity* 4. 2012;1-32.
 32. Labeyrie V, Rono B, ET Leclerc C. How social organization shapes crop diversity: an ecological anthropology approach among Tharaka farmers in Kenya. *Agriculture and Human Values*. *Agriculture and Human Values* 31. 2013;97-107.
 33. Porteres R. African cereals: Eleusine, fonio, black fonio, teff, brachiara, paspalum, pennisetum, and african rice, in J.Harlan, J.M.J. de Wet and A.B.L Stemler (eds), *The origins of African plant domestication*, The Hague: Mouton. 1976; 409:52.
 34. Adoukonou Sagbadja H, Wagner C, Dansi A. Genetic diversity and population differentiation of traditional fonio millet (*Digitaria* spp.) landraces from different agroecological zones of West Africa. *Theoretical and Applied Genetics*. 2007;7:917-931.
 35. Cruz JF, Beavogui F, Drame D, Le fonio. Une céréale africaine. *Collection Agricultures tropicales en poche*. Editions. Quae / Cta / Presses agronomiques de Gembloux.Versailles, France. 2011;175.
 36. Sani IS, Yacoubou B, Maman Maarouhi I, Adeline B, Atta S, Mahamane A, et al. Fonio (*Digitaria exilis* (Kippist).Stapf) diversity revealed by farmers and its importance in cropping systems in Niger. *Int.J.Microbiol.App.Sci è*. 2018;12:1046-1057.
 37. Barro Kondombo C, Vom Brocke K, Chantereau J, Sagnard F, Zongo JD. Variabilité phénotypique des sorghos locaux de deux régions agricoles du Burkina Faso : la Boucle du Mouhoun et le Centre-nord. *Cahiers Agricultures*. 2008;17:107-113.
 38. Silué S, Fondio L, Coulibaly MY, ET Magein H. Sélection de variétés d'oignon (*Allium cepa* L.) adaptées au nord de la Côte d'Ivoire. *Tropicicultura*. 2003;21:129-34.
 39. Nabos J. L'amélioration de l'oignon (*Allium cepa* L.) au Niger. *Agronomie tropicale*, Vol XXXI, N°4, IRAT Paris, 1976;387-397.
 40. Currah L. Onions in the Tropics: Cultivars and country reports. In *Allium crop science :Recent advances*, ed. H.D. Rabinowitch and L. Currah, Wallingford, Oxon, UK: CABI Publishing; New York, NY, USA: CABI Publishing. 2002;379-408.
 41. Moumouni, Les effets de la réappropriation de la culture du Violet de Galmi par les producteurs d'oignon de la région de Tahoua – NIGER, sur la dynamique du territoire local, l'organisation sociale et économique, Thèse de doctorat, Université de Toulouse-Le Mirail. 2006;281.
 42. Abdou R, Malice M, Bakasso Y, Saadou M. Taxonomie locale et analyse des critères des paysans pour caractériser les différents écotypes d'oignon (*Allium cepa* L.) du Niger. *Cahiers Agricultures*. 2014; 23:166-176.
DOI : 10.1684/agr.2014.0700.
 43. Mickeye D, Emperaie L, Elias M, Pinton F, Ronert T, Desmouliere S et al. Gestion locales et dynamiques régionales de la diversité variétale du manioc en Amazonie. *Genetic Selection Evolution*, 33. 2001; 465-490.
 44. Delaunay S, Tesca RP, Oualbego A, Vom Brocke K, Lançon J. La culture du coton ne bouleverse pas les échanges traditionnels de semences de sorgho. *Cahiers Agricultures*. 2008;17:189-194.
 45. Alabi OF, Owonibi B, Olafemi SO, Olagunju S. Production analysis of groundnut in Birnin Gwari Local Government Area of Kaduna State. *PAT*. 2013;9(2):102-113.
ISSN: 0794-5213.
 46. Daniel IM, Elizabeth S. Challenges in groundnut production and adoption of groundnut production technology information packages among women farmers. *Agriculture and Biology Journal of North America*. 2014;5(6):252-258.
 47. Taphee GB, Giroh DY, Jongur AAU, Ibrahim Jen, E. Analysis of Profitability of Groundnut Production in Northern Part of Taraba State, Nigeria. *International Journal of Computer Applications* (0975 – 8887). 2015;125(1):34-39.
 48. Gerei AA, Audu SI, Onuk EG, Ismail MZ. Why the economics of groundnut

- processing in Akwanga local Government area, Nasarawa State, Nigeria. Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development. 2016;16(4):103-110.
49. Banta EM, Daniel KD, Beatrice IE, Kwame offei S, Tongoona P, ET Desmae H. Groundnut production constraints and farmer's trait preferences: A pre-breeding study in Togo. Journal of ethnobiology and Ethnomedecin. 2018;14:75.
50. Chala A, Abate B, Taye M, Mohammed A, Alemu A, Skinnes H. Opportunities and constraints of groundnut production in selected drylands of Ethiopi. Drylands Coordination Group Report, Miljøhuset G9, Norway, No.74. March Ethiopia; 2014.
51. Onyuka EO, Keino JK, Gor Co. Socio-economic derterminants of groundnut production in Ndhiwa Sub county, Kenya. International Journal of Agricultural and Food research. 2017;6(1):1-14.

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