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Research Paper

Pigeon pea [*Cajanus cajan* (L.) Millsp] cultivation, its major constraints and ethnobotanical status in Southern Benin

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Abstract. Pigeon pea is a minor crop that plays a key role in the daily subsistence of smallholders in Benin. In order to promote its cultivation, this study has been conducted to document the indigenous knowledge related to its production system as well its ethnobotanical importance and cultivation constraints which limit its production in southern Benin. In total, 338 farmers belonging to 5 sociolinguistic groups were surveyed in 23 villages covering the major production areas in the country. In general, pigeon pea is often cultivated in association with other crops. Our results revealed that 94.97% of the farmers surveyed grew pigeon pea in association with other crops while only 5.03% of them cultivate pigeon pea in monocultural system. Regarding the use of agricultural inputs, the majority of the farmers did not use any inputs in pigeon pea production. Nonetheless, in some villages especially in Zou and Collines departments, some farmers used insecticide/pesticide for controlling pest and diseases. According to farmers, the most important factor which limits pigeon pea production in the study areas was the lack of improved varieties. Besides this, pigeon pea production in southern and central Benin suffer from other constraints that are waterlogging, pest and diseases, drought, animal transhumance and lack of land. Several use categories were identified through the study area among which home consumption (as food) was the most widely cited. It is also used as firewood, medicinal, fertilizer, herbicide and fodder. The important ethnobotanical data recorded are useful for pigeon pea breeding program in Benin and in defining appropriate strategies for its valorisation.

Keywords: Pigeon pea, Benin, production system, ethnobotanical importance, cultivation constraints.

INTRODUCTION

Sub-Saharan Africa (SSA) is a region of the world where the food insecurity is chronic and the threats of famine are alarming (Anderson, 2014; Baro and Deubel, 2006). The number of people suffering from hunger in this region is estimated at 239 million and this number could increase in the near future (Sasson, 2012). The people most affected by famine are rural households whose livelihood depends largely on traditional rainfed agriculture (Haile, 2005) which plays a very important role in their daily food security and provides them substantial income (Adoukonou-Sagbadja *et al*., 2006). However, this agriculture sector is facing the direct effects of climate change and poorer developing countries are the most vulnerable. Sustainable solutions to agriculture and food security in Africa must consider more focused research efforts on locally adapted, highly nutritious and stress-tolerant crops alongside with sustainable government support to agricultural research and development (Kaoneka *et al*., 2016). Ironically, most of Africa's native stress-tolerant crops are mainly the least researched worldwide and are thus referred to as "orphan crops" (Naylor *et al*., 2004).

One of such crops with high potential to cope with climate change and providing nutritional food security is pigeon pea (*Cajanus cajan* [L.] Millspaugh). It is a sub-tropical and tropical grain legume that originated in the northern region of the Indian sub-continent, spreading to East Africa at least 4000 years BCE, and then to Southeast Asia, West Africa, Latin America, and the Caribbean. The seed is eaten as a green vegetable and dry pulse and is an important source of protein, vitamin B, carotene, and ascorbic acid (Odeny, 2007; Choudhary *et al*., 2013). The pods and foliage of the plant are used as livestock forage and fodder, the crop is cultivated as a green manure, and its woody stem is used as fuel and construction material (Mallikarjuna *et al.*, 2011). Pigeon pea is a drought tolerant crop (Odeny, 2007), it will continue becoming important for managing food security and nutritional situation in Africa as droughts become common and dry lands expand due to climate change. According to Mutegi and Zingore (2008), pigeon pea is often the only crop that gives some grains during the dry spells, when other grain legumes and cereals wilts and dries up as a result of moisture stress.

In Benin, pigeon pea is also cultivated and represents an important source of income and food security for rural household (Dansi *et al*., 2012). It is generally planted by smallholder farmers in low input, rain-fed conditions. The crop is well suited to a wide range of agricultural systems, including intercropping and no-till farming practices (Ayenan *et al*., 2017a). Cultivation improves soil fertility through biological nitrogen fixation as well as through the solubilization of soil-bound phosphorus (Mallikarjuna *et al*., 2011; Choudhary *et al*., 2013), increasing the yield of intercropped cereals, other pulses, and vegetables (Saxena, 2005; Odeny, 2007), and has been shown to enhance the control of Striga (Odeny, 2007). Pigeon pea is more heat tolerant than the majority of grain legume crops and is regarded as drought-resistant. Despite its importance in food security and poverty alleviation, pigeon pea production in Benin is widely neglected. In terms of production, it is the fifth legume after cowpea (*Vigna unguiculata*), Bambara groundnut (*Voandzeia subterranea*), soybean (*Glycine max*) and groundnut (*Arachis hypogaea*) in Benin. The national production is erratic across years and has never reached 10.000 tons (Dansi *et al*., 2012). Knowing that this crop can play an increasing role in low input production systems, concerted efforts are needed to promote pigeon pea cultivation in Benin.

Increasing the production of a crop depends not only on the genetic performances of the varieties produced but also on the agricultural practices employed by the farmers. According to Kennedy *et al*. (1975), agricultural management practices are measures undertaken by humans which refer to that broad set of management techniques or options which may be manipulated by agricultural producers to achieve their crop production goal which is to get a maximum yield per unit area. These management practises otherwise known as agricultural practices impact positively the production and increase the productivity when they are properly adopted by the producers. But in other hand, the yield somehow is not up to desired levels when poor level of management practices, particularly plant protection measures, high plant density, lack of proper agronomic practices, damage due to drought or heavy rains in rain fed areas, spread of pests and diseases, unbalanced use of fertilizers, lack of awareness on integrated nutrient management and maintenance of soil fertility were observed by the producers (Patil *et al*., 2017)

Pigeon pea production in Benin has remained traditional, with little or low input technology and likely linked with poor agronomic practices. For increasing the production of this important but neglected crop, its production system needed to be investigated in order to have an overview of the impact of different traditional agronomic practices employed by the producer on the pigeon pea production in Benin. The present study aimed to assess farmers' agricultural practices and constraints related to pigeon pea production in Benin.

MATERIALS AND METHODS

Study area

The study was conducted in southern and central parts of Benin Republic (Figure 1), the region with the highest pigeon pea production in the country (National Statistics Data Base). Republic of Benin is located in West-African sub-region between the latitudes 6°10N and 12°25N and longitudes 0°45E and 3°55E. It includes several agroecologies characterized by climate and soils types differences (Adomou *et al*., 2011). The southern and central parts of the country are partitioned into eight administrative departments among which pigeon pea is mainly produced in four including Couffo, Plateau, Zou and Collines. These departments are inhabited by many ethnic groups such as Adja, Fon, Holly, Mahi, Nago, Yoruba, Agnoun etc. The region is characterized by a relatively humid climate with two rainy seasons and a mean annual rainfall varying from 1100 mm to 1400 mm/year (Yabi and Afouda, 2012). The mean annual temperature ranges from 26 to 28°C. The region has semi-deciduous forest or woodland and savannah woodland (Akoegninou *et al*., 2006). In order to sufficiently cover the study area, 23 villages were selected throughout the major departments of production based on national pigeon pea production statistics and were surveyed from September to October 2015. The list of these villages, their administrative locations and the ethnic groups inhabiting them are presented in Table 1.

Ethnobotanical surveys and data collection

Data were collected during expeditions to different sites through the use of participatory research appraisal tools

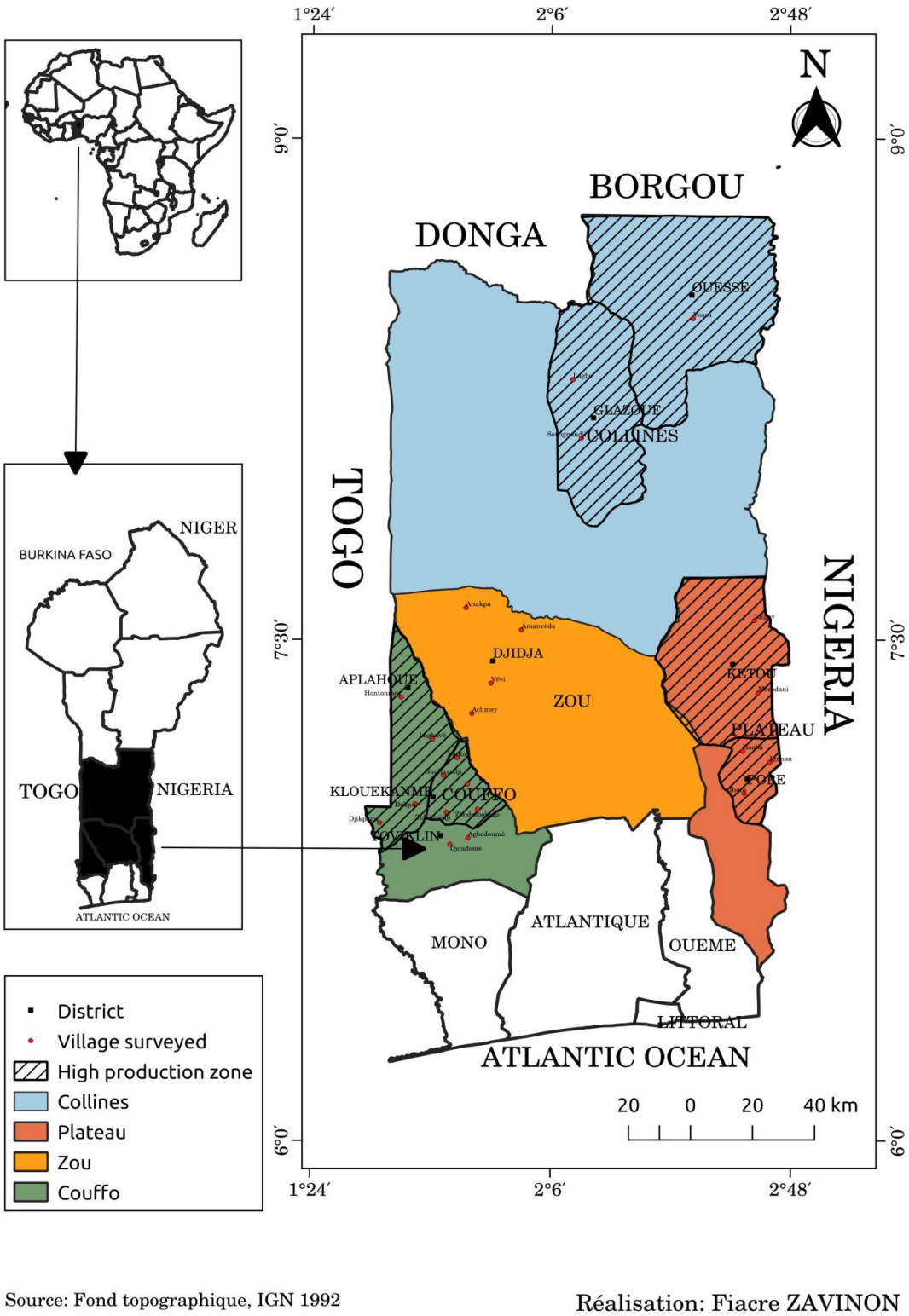

Figure 1. Map of the study area showing Departments and Villages surveyed.

and techniques, such as direct observations, group discussions and field visits using structured questionnaire following Adoukonou-Sagbadja *et al*. (2006). In each village, traditional chiefs and local authorities were involved in the study to facilitate the meetings and data collection. Pigeon pea producers were selected using

Table 1. List of villages surveyed, their administrative locations and ethnic groups.

Villages	Districts	Departments	Ethnic groups
Aclimey	Djidja	Zou	Fon
Agbedoumè	Toviklin	Couffo	Adja
Amanvèda	Djidja	Zou	Fon
Anakpa	Djidja	Zou	Fon
Dékpo	Aplahoue	Couffo	Adja
Djikpamè	Aplahoue	Couffo	Adja
Djoudomè	Toviklin	Couffo	Adja
Ganhayadji	Klouékanmè	Couffo	Adja
Hontonmey	Aplahoué	Couffo	Adja
Idigny	Kétou	Plateau	Nago
Iganan	Pobè	Plateau	Nago, Holli
Ihoro	Pobè	Plateau	Nago, Holli
Issaba	Pobè	Plateau	Holli
Lagbavé	Aplahoué	Couffo	Adja
Lagbo	Glazoué	Collines	Mahi, Fon
Lanta	Klouékanmè	Couffo	Adja, Fon
Morodani	Kétou	Plateau	Holli
Soglonouhoué	Klouékanmè	Couffo	Adja
Sowignandji	Glazoué	Collines	Mahi
Vévi	Djidja	Zou	Fon
Tchanvèdji	Klouekanmè	Couffo	Adja
Vossa	Ouessè	Collines	Mahi
Zondrèbohoué	Klouékanmè	Couffo	Adja

snow ball method (N'Danikou *et al*., 2015). The questionnaire used during the interviews was first pre-tested on a small sample of farmers and latter adjusted. During the surveys, the questionnaire was administered and the interviews were conducted with the help of translators recruited in each sociolinguistic group surveyed. A total of 338 producers were finally interviewed during the study. Through the discussions, the key information documented was related to socio-cultural characteristics of farmers and their traditional knowledge on pigeon pea cultivation and uses in the study area. The sociocultural information collected concerned the age, sex and the ethnic groups of farmers. Considering their traditional knowledge, farmers were first asked to inventory the different factors which limit pigeon pea production in the study area. After that the different agricultural practices linked to pigeon pea production were documented. Other information gathered from the producers was that related to the importance of pigeon pea in the study area.

Data analysis

Data was analysed using descriptive statistics (frequencies, percentages, means, etc.) to generate summaries and tables at different levels (villages, departments, study area) using Minitab 14 software. Importance of the species was assessed in each social group by calculation of the overall ethnobotanical use value (*VUET*) as described in Phillips and Gentry (1993a; 1993b) and Phillips *et al*. (1994) following the formula:

$$VUET = \frac{\sum_{i=1}^{n} VUEi}{N}$$

Where *VUEi* is the total number of pigeon pea uses cited by a person and N total number of people interviewed in a farmer social group.

To determine the factors which limit pigeon pea production, the frequency of each constraint was calculated and taken into account their importance, the major constraints were detected. Finally, through histogram construction, we assessed the difference in agricultural practices in each community.

RESULTS

Socio demographic characteristics of pigeon pea producers

In total, 338 producers have been interviewed during the study. They belonged to five ethnic groups (Adja, Fon, Holli, Nago and Mahi) among which the most represented were Adja (38.76%), Holli (19.23%) and Fon (17.75%).

Table 2. Socio-demographic characteristics of farmers.

Characteristics	Modalities	Percentages			Total
		Zone V	Zone VI	Zone VII	
Sex	Male	49.73	25.31	58.33	45.86
	Female	50.26	74.68	41.66	54.14
Age categories	Young	29.41	37.97	34.72	32.54
	Adult	37.96	36.7	41.66	38.46
	Old	32.62	25.31	23.61	29
Ethnic group	Fon	32.08	-	-	17.75
	Mahi	24.06	-	-	13.31
	Holli	9.62	-	65.27	19.23
	Nago	6.41	-	34.72	10.95
	Adja	27.8	100	-	38.76

Table 3. Constraints of pigeon pea production in Southern and Central Benin.

Constraints	Total (%)	Percentage responses (%) across ethnic groups				
		Adja	Fon	Holli	Mahi	Nago
Transhumance	23	72.72	18.18	4.54	27	2.27
Drought	25	-	51.16	3.48	43.02	2.32
Lack of land	38	100	-	-	-	-
Pest and disease	48.5	-	50	-	65	-
Waterlogging	55.7	-	-	55	-	42
Lack of improved varieties	84	84	85	90	85	76

Pigeon pea was mainly produced by female farmers than male. Among the 338 farmers interviewed, 54.14% were female while 45.86% were male (Table 2). Considering the age categories of the farmers, it was observed that young, adult and old people were interested to pigeon pea cultivation. They represent respectively 32.54, 38.46 and 29% of the total of surveyed farmers (Table 2).

Factors affecting pigeon pea production in southern and central Benin

Based on farmer's responses and perceptions, six constraints hampering pigeon pea production in southern and central Benin was identified (Table 3). The most important constraint cited by the majority of farmers (84%) was the lack of improved varieties. Indeed, almost all pigeon pea producers interviewed have indicated the bad performance of the cultivars and highlighted their undesirable characteristics as the major constraint in the study area. Among the undesirable characteristics cited by the farmers, there were the low grain yield, the late maturity, the bad taste and very long cooking time. Besides the lack of improved varieties, other constraints were cited and their importance varied across ethnic group. In Adja ethnic group, transhumance and lack of land were cited by many producers as pigeon pea constraints. The pest and diseases constraints were mostly reported by Fon and Mahi ethnic group. Some important insects observed in different pigeon pea fields in the study area are shown in Figure 2. The abiotic stress waterlogging had more importance in Nago and Holli ethnic group. According to the farmers in these regions, waterlogging affects more than 40% of pigeon pea field.

Agricultural practices linked to pigeon pea production in southern and central Benin

Agronomic practices are the set of rules to be respected in the establishment and management of crops. They are of paramount importance in optimizing agricultural production and affecting crop yields. The type of crop, the use of agricultural inputs and the density of sowing are the agricultural practices recorded in this study.

Pigeon pea cropping system

In the study zone, two cropping systems were used by the pigeon pea growers: the sole cropping and the mixed

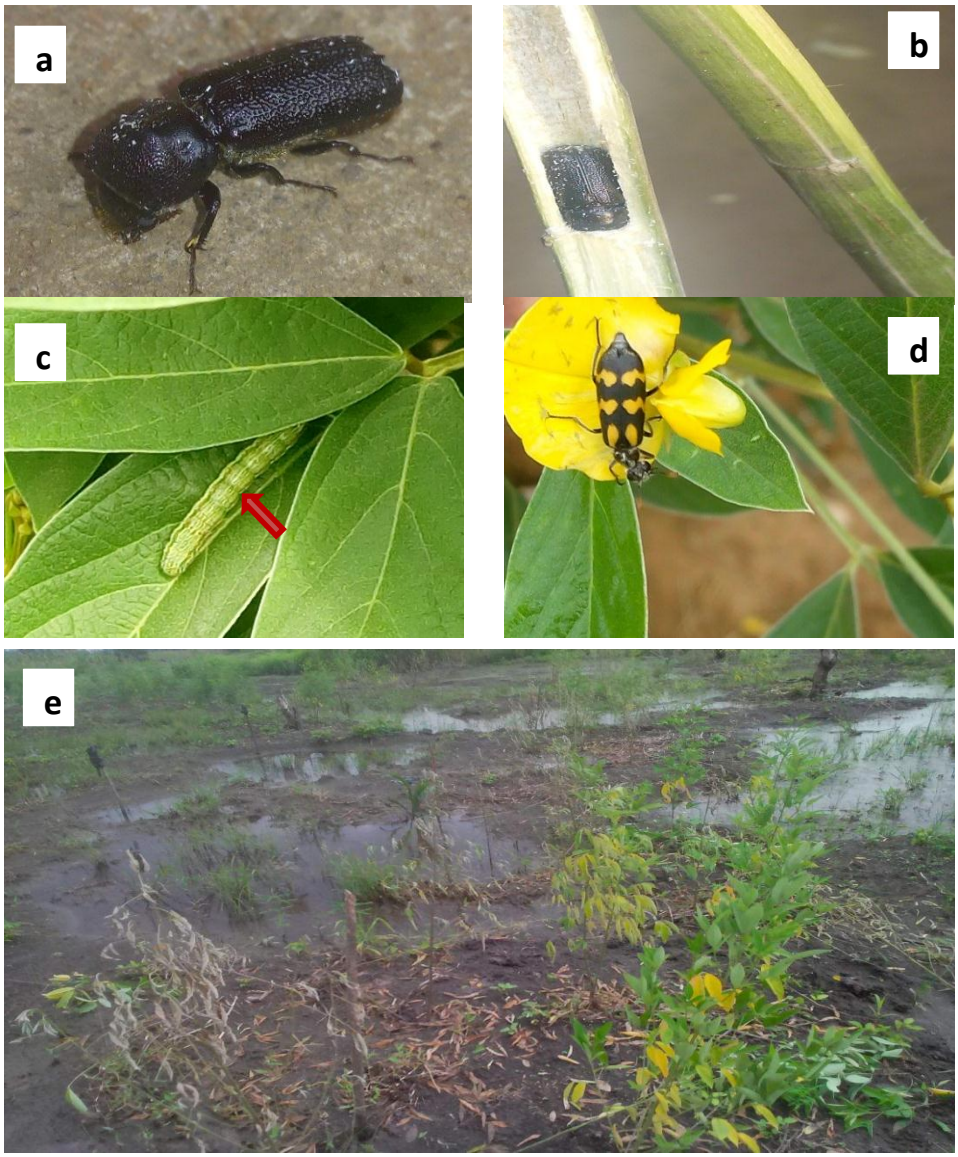

Figure 2. Some important biotic and abiotic stresses observed in the study area. (a) and (b) Stem borer (c) *H. armigera* larva on foliage (d) Beetle feeding on flowers (e) Waterlogging.

cropping. The most common cropping system observed in the area was mixed cropping system. Indeed, about 94% of pigeon pea producers surveyed intercrop pigeon pea with other crops while only about 5.03% of producers grew pigeon pea in sole crop (Figure 3). The results of the survey revealed that production of pigeon pea in pure stand (Monocultural) was most done by the producers from Mahi, Nago and Holli ethnic group. On the orther side, this practice (monocultural) did not observed in Adja sociolinguistic group. All pigeon pea producers interviewed in Adja group grow the species in association with other crops.

The different crops associated with pigeon pea vary according to the ethnic group. In general, pigeon pea is intercropped with maize. This association is predominant in the Nago and Holli cultural area. In Adja, several crops are associated with pigeon pea. They grow up to three species together with pigeon pea such as maize, cassava, tomato and sometimes cowpea.

Use of agricultural inputs

Agricultural inputs are chemical fertilizers used in soil fertilization as well as pesticides (herbicides and insecticides) used to control weeds and pests. The investigation revealed that producers do not use chemical fertilizers in the production of the species. Nevertheless, some producers (7.98%) use chemical fertilizers. Regarding the use of insecticide in the fight against pests, statistics have shown that 29.88% of producers use insecticides against 70.12% who do not use insecticides.

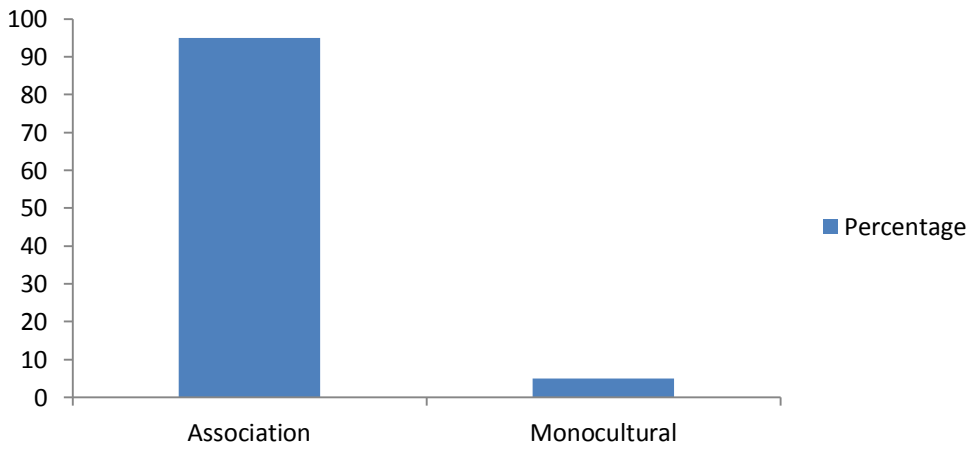

Figure 3. Pigeon pea agricultural systems observed in southern and central Benin.

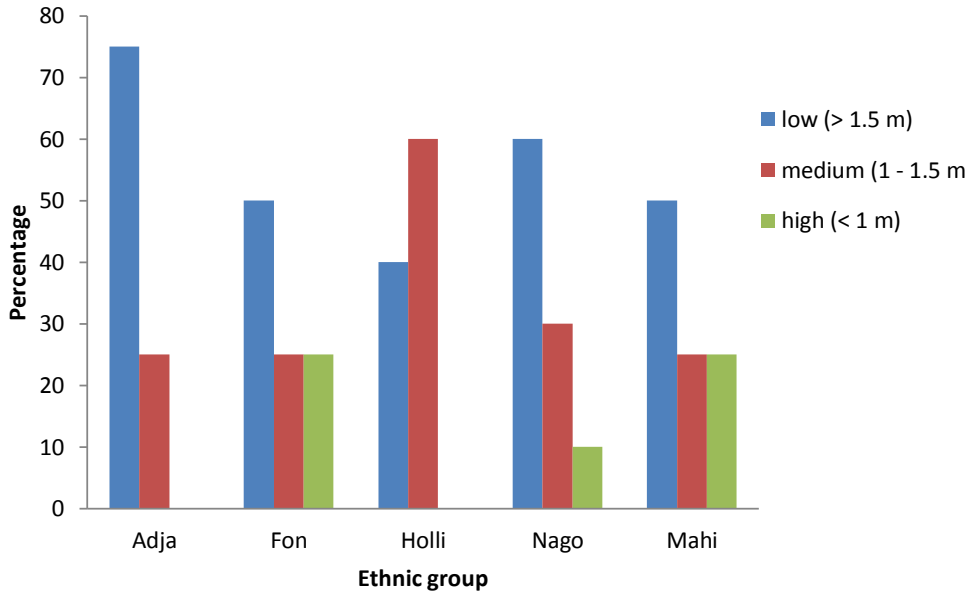

Figure 4. Density of sowing adopted by the pigeon pea producers in the study area.

The high rate of producers using insecticides indicates that there is a high rate of infestation of pigeon pea fields by pests. Insecticide use is very low in the Nago and Holli cultural area where 6.93 and 4.95% of producers were respectively recorded.

Planting density

The spacing adopted for seed sowing is very variable depending on the producers. Distances of less than one meter (high sowing density), between 1 m and 1.5 m (medium spacing) and greater than 1.5 m (low sowing density) are the three types of planting density recorded in the study area. The grouping of producers into ethnic group shows that medium planting density and low planting density are the most adopted by producers (Figure 4). Very few producers adopt a high planting density. Several reasons have been put forward by the producers to justify the seeding spreads adopted. In the Nago and Holli cultural area, when the planting density is high, the plants do not produce enough seeds. On the other hand, in the Adja producers, adoption if high sowing density prevents the normal development of associated crops, so they adopt a wide spacing to space two feet of pigeon pea.

Gender role in pigeon pea production

Men and women contribute differently to pigeon pea production activities (Table 4). In general, the activities of

Table 4. Gender role in pigeon pea production in southern and central Benin.

Activities	Men	Women
Land preparation	High	Low
Labour	High	Low
Sowing	High	Low
weeding	High	Medium
Harvesting	Low	High
Storage	Low	High

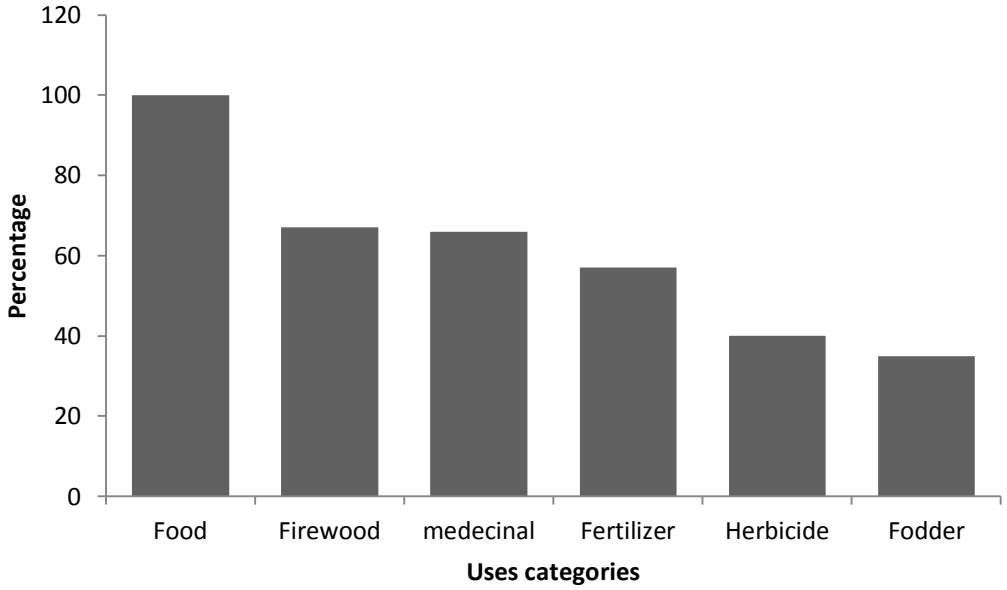

Figure 5. Categories uses of pigeon pea recorded in the study area.

soil preparation, plowing and weeding are mainly carried out by men. While sowing, harvesting and storage are activities exclusively for women. In some ethnic groups such as Adja and Holli women are more involved in the production of pigeon pea than men. In these two ethnic groups, it is found more women producing pigeon pea than men.

Ethno-botanical uses of pigeon pea

Throughout the study area pigeon pea is used for various purposes by the population. Six categories of use (Figure 5) were registered. The commonest category use cited by the all person interviewed was food use (100%). According to farmer the seeds of the species represent an excellent food for human. They generally boiled and consumed in various form. Besides human consumption, the leaves of the species are used as fodder for the animals. This category use was less cited (38%) but it was largely known by the farmers from Mahi ethnic group. For these farmers, pigeon pea field at vegetative stage are sometimes sold to the shepherds for livestock feed. In the study area the excellent properties of the species in traditional medicine are known by the people and about 65% of the person interviewed uses the species for threating some diseases or symptoms. The category use “firewood” was the second category mostly cited in the study area. About 70% of the farmers interviewed reported the use of the dry stems of the species as firewood. Other importance which motivate pigeon pea cultivation in the study area were its capacity to control weeds especially *C. cylindrica* and its role in soil fertilization, About 55 and 40% of farmers interviewed reported the use of pigeon pea as fertilizer and herbicide, respectively.

The overall ethno botanical use values (*VUET*) of the species has been calculated in each social group of the farmers. The results are presented in Table 5. There was a great significant difference in the overall use value across ethnic group (P = 0.000). The highest overall use value was recorded in Mahi sociolinguistic group (*VUET* = 3.93) followed by the Adja sociolinguistic group (*VUET* = 2.89) while the lowest use value of the species was

Table 5. Overall use value of the species across social groups of the farmers.

Social groups	Modalities	*VUET*	Kruskal-Wallis Test
Ethnic group	Adja	2.89	H = 64.49; P = 0.000
	Fon	2.43	
	Holli	2.18	
	Mahi	3.93	
	Nago	2.35	
Age	Adult	2.81	H = 11.71; P = 0.008
	Young	2.46	
	Old	3.00	
Sex	Female	2.66	H = 4.01; P = 0.134
	Male	2.86	

Table 6. List of diseases and symptoms threated by pigeon pea across ethnic group.

Diseases	Adja	Fon	Holli	Mahi	Nago
Malaria	X	X	X	—	X
Measles	X	X	X	X	X
Typhoid	X	X	—	—	—
Eyes ache	—	—	X	—	X
Headache	—	X	—	X	—
Fever	X	X	—	X	—
Constipation	—	—	—	X	—
Total	4	5	3	4	3

recorded in Holli sociolinguistic group. Based on the age category of the farmers, there was a significant difference (P = 0.008) in the overall use value of pigeon pea. Old farmers had cited more uses (*VUET* = 3.00) of the species than cited by adult (*VUET* = 2.81) and young (*VUET* = 2.46) farmers. No significant difference was observed in overall uses of the species considering the gender of the farmer (P = 0.134). However, men cited more uses (*VUET* = 2.86) than women (*VUET* = 2.66).

The number of diseases and symptoms treated by pigeon pea recorded in the study area are diverse. In total, seven (7) major diseases were recorded. These are malaria, measles, typhoid, eyes ache headache, fever and constipation (Table 6). The analysis of the table shows that Fon treat more diseases with pigeon pea than other ethnic groups. The results also showed that all respondents regardless of ethnic group are unanimous about the treatment of measles by pigeon pea.

DISCUSSION

The present study is a contribution to the improvement of pigeon pea production in Benin through an assessment of its production system which has remained traditional (Dansi *et al*., 2012). The species was globally produced in southern and central parts of Benin (Ayenan *et al*., 2017a; Zavinon *et al*., 2018). In the study area, pigeon pea was mostly produced by farmers from Adja, Mahi, Nago and Fon sociolinguistic groups. This finding is in agreement with that reported by Ayenan *et al*. (2017b). However, in contrast to the finding of Ayenan *et al*. (2017b), our sampling showed that pigeon pea was mostly produced by women than men. This could be justified by the lack of market and would be one of the principal reasons of the neglected status of the species in Benin. As explained previously in Zavinon *et al*. (2018) men farmers prefer to grow cash income generation crop. But the fact that the species present a great importance in lain period (Ayenan *et al*., 2017a) could justify the most interest of the women to its cultivation.

In addition to be largely neglected, pigeon pea production was also confronted to many constraints in southern and central Benin. The common constraint affecting pigeon pea production in the study area was the lack of improved varieties. Indeed, according to the producers the majority of varieties cultivated in pigeon pea growing area in Benin were landraces with many undesirable characteristics. This result supports the findings of Odeny *et al*. (2007) that pigeon pea cultivars

produced by African farmers were still landraces. According to Kaoneka *et al*. (2016) pigeon pea cultivars from Africa were characterized by the low grain yield and the late maturity. In addition to these bad agronomic performances of the African cultivars, the farmers interviewed in the study area revealed also some bad culinary performance such as the bad taste and the very long cooking time of the cultivars. Besides this major and common constraint which limits the production of the species, other biotic and abiotic factors affect the production and their importance varied from one sociolinguistic group to another. For instance, due to the nature and the quality of the land in plateau department (inhabited by Nago and Holli farmers) the abiotic stress waterlogging was frequent in this region. According to Singh *et al*. (2016), this stress is important yield constraint as it blocks oxygen supply to roots which hampers root permeability. The species is more vulnerable to waterlogging at germination and early vegetative growth stages than flowering stage (Singh *et al*. 1986). The soil in Plateau department is rich in clay and impermeable. This favours by consequence the waterlogging which affects seriously the pigeon pea production in this region. In contrast to the waterlogging which affects the production in Plateau, Zou and Collines departments (inhabited by the Mahi and Fon sociolinguistic groups) the production was mostly affected by the insect pest and this justifies the frequent uses of insecticides by the farmers from these regions. The high infestation of insect in pigeon pea field in Zou and Collines departments could be explained by the fact that the region is cereal zone. In Couffo department (inhabited by Adja farmers), apart the lack of improved varieties, transhumance and mainly the lack of land were the major constraint in the region. The lack of available land justifies the intercropping practices employed by Adja producers where pigeon pea is cultivated in association with many other crops. Contrary to the biotic stresses *Fusarium wilt* and Sterility Mosaic Disease (SMD) which occur in major pigeon pea growing areas like India (Saxena *et al*. 2017) and some countries in Eastern Africa (Sharma *et al*., 2016), the pigeon pea producers from Benin have never been confronted to these constraints.

Agronomic practices employed by the farmers in a production zone depend on the constraints which they are confronted. Indeed, as revealed in this study, the frequent use of insecticides observed in Zou and Collines departments was linked to insect pest which occurs in these regions. In the similar way, the lack of available land in Adja region justifies the fact that pigeon pea was often cultivated in association with other crops. Even though pigeon pea is generally worldwide cultivated in association with cereal or other leguminous (Manyasa *et al.*, 2009; Silim *et al.*, 2005; Ayenan *et al*., 2017b) due to its slow growth during the 2 to 3 months after sowing (Van der Maesen, 2006), in Adja ethnic group the lack of available land was the main reason of this practice. Ayenan *et al*. (2017b) justify the highest crops combination observed in Adja sociolinguistic group by the degraded soil and a high pressure on agricultural land of the region. The fact that pigeon pea is cultivated in association with other crops affect the planting density. Indeed, plant density is an important factor in increasing crop production (Mula *et al*., 2011). In the study area, three kind of planting density (low, medium and high plant population density) were observed. Low plant population density was mostly employed by the farmers for sowing. According to them, this planting density favours pigeon pea cultivation in association with many other crops and prevent interplant competition. Such explanation corroborates the finding of Patil *et al*. (2017). Indeed, for these authors wider spacing allowed better light interception of light, and air movement within the crop canopy, while reducing interplant competition which helped in improving individual plant performance and harvest index. Some producers in the study area especially farmers from Holli and Nago ethnic groups adopt medium or high plant population density in order to increase seed yield. Such practice even though produces significantly higher seed yield per ha, the individual plants have relatively less biomass (Mula *et al*., 2011).

Despite the neglected status and the traditional production system, pigeon pea is still cultivated in many regions in Benin (Dansi *et al*., 2012; Zavinon *et al*., 2018) due to the crucial role it plays in food security for the rural communities. It was observed in the study area that pigeon pea seed is an excellent human food and its importance during lean season was early reported by Ayena *et al*. (2017a). Besides the importance of the species in human food, other uses were reported by the producers in the study area especially the excellent properties of the plant to treat some diseases. Like other neglected species such as fonio millet (Adoukonou-Sagbadja *et al*., 2006); African bitter yam (Adigoun-Akotegnon *et al*., 2019) some diseases are also reported here to be treated by pigeon pea. These medicinal properties of the species should be deeply investigated and could be one of the reasons of pigeon pea promotion in Benin.

CONCLUSION

Pigeon pea production system in southern and central Benin was assessed in this study. It was found that the major constraint which limits pigeon pea production in the region was the lack of improved varieties. According to the producers, the pigeon pea cultivars in southern and central Benin present many undesirable characteristics such as the late maturity and the very low grain yield of landraces. The species is generally cultivated in association with other crops without significant agricultural inputs. Although pigeon pea is neglected, it is

still produced in many villages of southern and central Benin where it is used as human food, firewood, fertilizers, fodder etc. The different information obtained from this study is essential and will be useful for pigeon pea valorisation in Benin.

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