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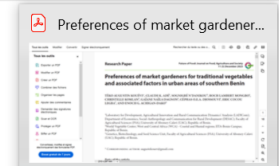
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Preferences of market gardeners for traditional vegetables and associated factors in urban areas of southern Benin

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There is a growing interest in the promotion of the use of traditional vegetables to reduce micronutrient and dietary fibres gaps among food consumers, and to support rural and urban livelihoods in sub-Saharan Africa, including in Benin, because they are considered more nutritious, accessible, and more culturally acceptable for local people than many exotic vegetables. Meanwhile, the extent to which these traditional vegetables are preferred by the target populations, especially by the local market gardeners who supply consumers, is not yet well-known in the context of Benin, specifically in its large cities of Abomey-Calavi and Cotonou. This paper fills this knowledge gap by analysing the preferences and the factors affecting the preferences of market gardeners for traditional vegetables in these cities. To achieve this objective, field visits and observations took place, as well as interviews with managers of market gardeners' organisations, and with market gardeners randomly selected in both cities. Data analysis revealed that a wide range of vegetables is produced in the study areas, including in decreasing order of importance, leafy (5 traditional and 1 exotic), fruit (3 traditional and 1 exotic), flower (0 traditional and 1 exotic), root (0 traditional and 1 exotic), and bulb (1 traditional and 0 exotic) vegetables. It was also noted that the production of traditional vegetables was preferred to that of exotic ones. The logistic regression model executed indicated that "market gardeners group membership", "resistance to pests", and "clients' demands" significantly and positively influence traditional crops' choice by the gardeners. In contrast, "several years of market gardening experience", "land loan", and "profitability" significantly and negatively influence the choice of traditional vegetable production by the surveyed gardeners. Overall, it appeared from the study that economic interests and technical constraints are the main reasons guiding the market gardeners' production preferences and that leafy, fruit, and bulb traditional vegetables are most demanded by consumers. These findings suggest that Cotonou and Abomey-Calavi are relevant places for the promotion of traditional vegetable production.

1. Introduction

This paper analyses the level of preference for traditional African vegetables among market gardeners in Cotonou and Abomey-Calavi, two large cities in Southern Benin. Its final goal is to provide insights to food and nutrition decision-makers about the extent to which they can rely on market gardeners of these cities in their interventions against malnutrition, at least in Southern Benin. By traditional African vegetables, we mean vegetables that originally come from Africa or have become naturalised after decades of local conservation of their seeds, leading to the development of local varieties (Shackleton et al., 2009: 10). Meanwhile, exotic vegetables are those that are not indigenous, or are not originally from Africa and have not been naturalised (Achigan-Dako et al., 2010: 10-11; Shackleton et al., 2009: 10).

Indeed, malnutrition continues affecting many Beninese, and Benin agriculture, food, and nutrition promotion authorities and partners have kept seeking solutions to this plague (Aglinglo et al., 2022). For example, the World Health Organisation (WHO) and EAT-forum respectively recommend 400 grams (WHO, 2023: 22), and 300 grams (Willett *et al.* 2019: 451) of vegetables and fruits (important sources of micronutrients and dietary fibres) per capita per day, but their consumption in Benin still turns around 99.1g per adult per day (<https://globalnutritionreport.org/resources/nutrition-profiles/africa/western-africa/benin/>; Tufts University, 2019), suggesting interventions for closing the gap of 201 to 301 grams per capita per day. To close this gap, some authors advise to more and more rely on traditional African vegetables, because they already play an important role in the fulfilment of daily food and nutrition needs of local populations, not only in rural areas but increasingly in urban areas as well (Sogbohossou et al., 2015: 10). Reasons for this advice are that, not only they would be relevant food to fill nutritional gaps for local consumers, but they would also be helpful to support rural and urban livelihoods in Sub-Saharan Africa, because of their affordability, physical accessibility, and sociocultural acceptability (Achigan-Dako et al., 2011:130; Aglinglo et al., 2022; Herforth, 2010; Pasquini et al., 2014; Shackleton et al., 2009). Adoption is also a matter of preference, however, to date, the extent to which these traditional African vegetables are effectively preferred and valued by market gardeners, vegetable consumers, processors, and traders, remains not well known,

especially in the Republic of Benin. This article fills this knowledge gap, by specifically studying the level of preference for traditional African vegetables by market gardeners in Cotonou and Abomey-Calavi. This study is part of a series aimed at elucidating the preferences of market gardeners, processors, consumers, and traders for traditional African vegetables, for the sake of building later on these preferences to contribute to the reduction of malnutrition in Benin and other Sub-Saharan African countries (Ade, 2022). However, this paper focuses essentially on the preferences of market gardeners to fit the length required by this journal. After this introductory section, we describe the research methods used to reach the study objective, before presenting and discussing the research findings and policy implications.

2. Materials and Methods

This section successively addresses the study areas, the sampling methods, and the data collection and analysis methods.

2.1 Study areas

The study was carried out in the special-status urban municipalities of Abomey-Calavi and Cotonou in southern Benin (see map in Figures 1 and 2 below).

These two cities were selected because they are densely populated urban areas, located in the agricultural development pole number 7, whose major vocations include market gardening. Indeed, the Republic of Benin is subdivided into eight agro-ecological zones based on climatic and agro-pedological parameters, cropping systems, population density, and vegetation. On this basis, the country was split into seven agricultural development poles to support relevant crops with high potential for its economy and food security. The Agricultural Development Pole 7 is composed of four regions or Départements, including the Atlantique Département (which comprises the municipality or Commune of Abomey-Calavi) and the Littoral Département (which comprises the Commune of Cotonou). This pole promotes many commodity or value chains, including market gardening, which is the focus of this paper.

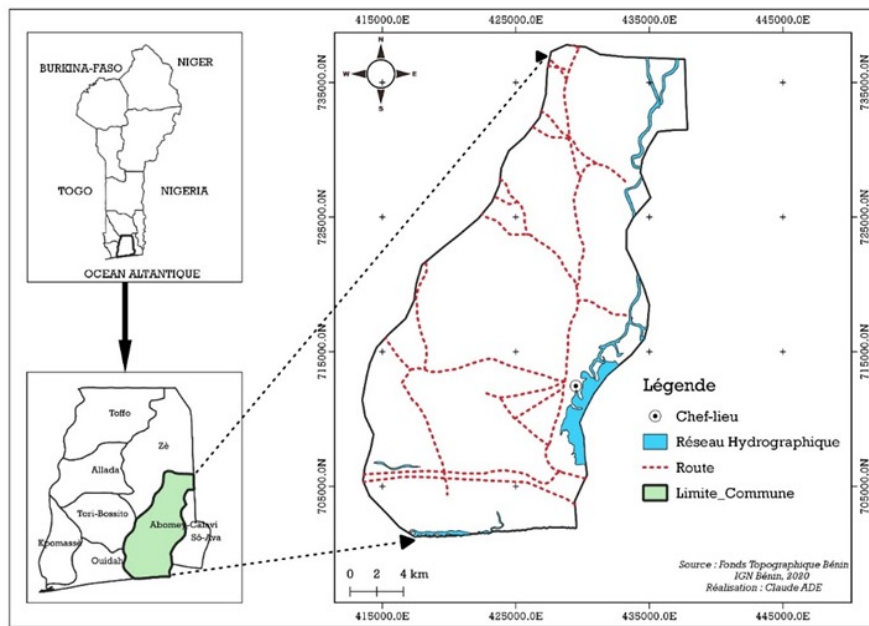


Figure 1. Map of the municipality of Abomey-Calavi

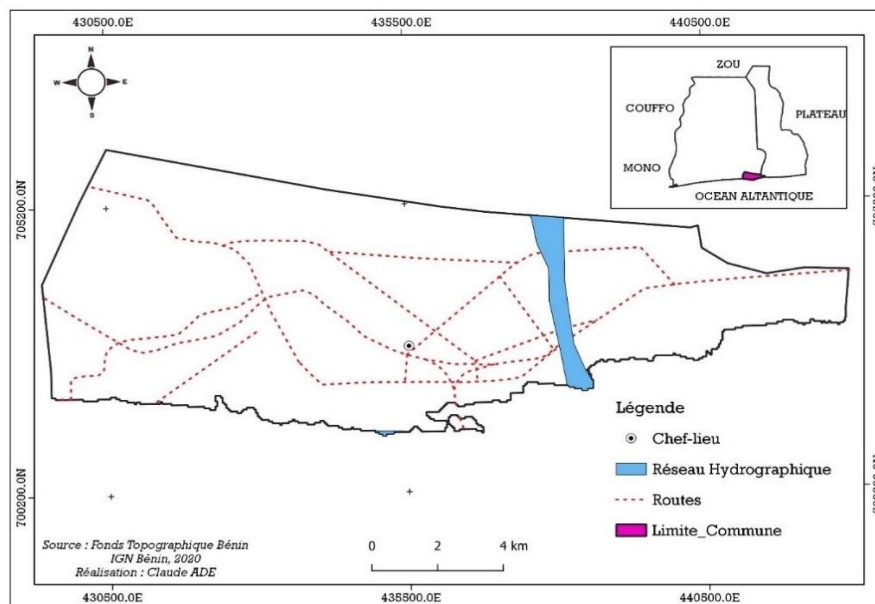


Figure 2. Map of the municipality of Cotonou

2.2 Sampling

Data collection was conducted through two subsequent and complementary phases: an exploratory phase and an in-depth one. During the exploratory phase, the technician in charge of market gardening in the market gardening development project called

Programme d'Appui au Développement du Maraîchage (PADMAR); the two technicians in charge of market gardening in the agricultural development units of the study areas; the presidents and secretaries of the communal unions of market gardeners; and the president of vegetables' traders' association and three other traders; were purposively selected and interviewed.

For the in-depth survey, seventy-four (74) market gardeners, of which twenty-three (23, i.e. 31%) women, were randomly selected from a list of 1,087 (including 599 from Abomey-Calavi, and 488 from Cotonou) market gardeners received from the Agence Territoriale de Développement Agricole (ATDA 7). ATDA 7 is the institution body in charge of the 7th agricultural development pole of Benin. This sample size proportionately comprised 40 and 34 market gardeners respectively from Abomey-Calavi and Cotonou, and is representative of the diversity of the market gardeners' population, considering gender, location, and vegetables produced. It was estimated using the Yamane (1967) sample size calculation formula:

$$n = \frac{N}{1+N(e)^2}$$

where n is the sample size, N is the population size, and e is the threshold of 10%. With this formula and N equal to 1,087, n equalled 92 market gardeners. However, due to budget, time, and interviewees' availability constraints, we could only survey 74 gardeners. The selection consisted of randomly choosing a first gardener from the list and systematically selecting those who were in the fifth position after the last selection until the target sample size was reached. The selection direction was from up to down of the Excel sheet containing the list of the gardeners.

2.3 Data collection methods

As mentioned in the previous sub-section, data collection started with an exploratory phase which consisted of semi-structured interviews with:

the market gardening technician of the PADMAR program, and the two market gardening technicians of the communal agricultural development cells or units (*Cellules Communales*) of Cotonou and Abomey-Calavi: who gave us an overview of the functioning of market gardening in Cotonou and Abomey-Calavi, the main vegetable species produced, and criteria generally used by the gardeners to choose the vegetables grown; the managers (2 presidents and 2 secretaries) of the communal union of market gardeners in Abomey-Calavi and Cotonou: who, in addition to their answers to the same questions as the technicians,

addressed advantages offered to the members of their unions, vegetable species produced, and factors that guide gardeners choices of species; and, four vegetable traders (including the president of the traders' union): who informed on the vegetable species they sell, their supply channels, and species frequently found in the gardens of Cotonou and Abomey-Calavi.

The exploratory data collected helped finalising the design, pretesting, and fine-tuning of the questionnaire subsequently used for the in-depth survey. The exploration also helped to get the list of market gardeners, fine tune the sampling criteria above mentioned, and sample the interviewees. Thus, the subsequent phase consisted of using the questionnaire for structured interviews with the 74 market gardeners sampled. These interviews mainly targeted data on the market gardeners' crop preferences, and factors influencing these preferences.

2.4 Data analysis methods

The data collected were analysed using Stata 15, and Microsoft Office Excel 2013, to generate descriptive statistics, such as frequencies, position parameters (arithmetic mean), and dispersion parameters (standard deviation). These statistics were next used to describe the socio-economic characteristics of the respondents and to identify the main traditional vegetables produced by the market gardeners of Cotonou and Abomey-Calavi. Kruskal Wallis test was used to identify the category (traditional or exotic) of the vegetable species most preferred in the study area. This test helped to assess the significance of the difference between the numbers of traditional and exotic vegetables produced by the gardeners surveyed. To identify technical and socioeconomic factors influencing the market gardeners' preferences for traditional vegetables, a binomial logistic regression was carried out. Preference or not for the production of traditional vegetables was the dependent variable. Independent or explanatory variables, and their expected signs (- or +) or influences on the production or not of traditional vegetables, were selected building on the literature and the study hypotheses. Those technical and socioeconomic variables were targeted because we suspected them to be potentially most influential on the choice of traditional African legumes than others.



2.5 Ethical clearance and study limits

Before starting each interview, interviewees were, as exhaustively as necessary, informed of the study objective and the planned confidentiality measures, as mentioned in the preamble or introduction of the questionnaire. After such information, they were asked about their consent for the interviews. Thus, all interviewees voluntarily participated in the survey.

With more time and financial resources, this study could have reinforced the robustness of its findings by surveying more market gardeners than it could do, and by bringing market gardening stakeholders to be informed of and to validate the findings and the policy recommendations. Taking all these actions could enhance the chance of contributing to practical changes

in the promotion of the use of traditional African vegetables in the study areas, in Benin, and Sub-Saharan Africa.

3. Results

This section mainly presents vegetables produced, the preferences of market gardeners for traditional vegetables, and the reasons behind these preferences.

3.1 Categories, types, and species of vegetables most preferred by market gardeners in Abomey-Calavi and Cotonou

Table 1 below shows the main categories, types, and species of vegetables produced in the study areas.

Table 1. Categories, types, and species of vegetables most preferred by market gardeners in Abomey-Calavi and Cotonou

N°	Vegetables produced				
	Category	Type	Names of the Species in the local language <i>fon</i>	Common names of the species in English	Scientific names of the species
1.	Traditional (69%)	Leafy vegetables (38.5%)	<i>Gboma</i>	African eggplant	<i>Solanum macrocarpon</i>
2.			<i>Tchayo</i>	African basil	<i>Ocimum gratissimum</i>
3.			<i>Amanvivè</i>	<i>Vernonia</i>	<i>Vernonia amygdalina</i>
4.			<i>Fotètè</i>	<i>Amaranth</i>	<i>Amaranthus cruentus</i>
5.			<i>Ninnouwi</i>	Jute mallow	<i>Corchorus olitorius</i>
6.		Fruit vegetables (23.1%)	<i>Tinmantin</i>	Tomato	<i>Lycopersicon esculentum</i>
7.			<i>Atakin</i>	Chilli	<i>Capsicum spp</i>
8.			<i>Févi</i>	Okra	<i>Abelmoschus esculentus</i>
9.		Bulb and Root vegetables (7.7%)	<i>Ayomassa</i>	Onion	<i>Allium cepa</i>
10.	Exotic (31%)	Leafy vegetable (7.7%)	Salada	Lettuce	<i>Lactuca sativa</i>
11.		Fruit vegetables (7.7%)	Concombre	Cucumber	<i>Cucumis sativus</i>
12.		Flower vegetables (7.7%)	Chou	Cabbage	<i>Brassica oleracea</i>
13.		Bulbs and Roots vegetables (7.7%)	Carotte	Carrot	<i>Daucus carota</i>



Table 1 shows that two categories of vegetables are grown in the study areas. It also indicates that thirteen (13) vegetable species are mainly produced in the study areas, including nine (69%) traditional and four (31%) exotic ones. The types and numbers of these vegetable species are: leaves (5 traditional and 1 exotic); fruits (3 traditional and 1 exotic); flower (0 traditional and 1 exotic); root (0 traditional and 1 exotic); and, bulb (1 traditional and 0 exotic). These details highlight that type-wise, exotic vegetables are slightly more diversified (4 types) than traditional ones (3 types). They also shed light on the large place (about 70%) given to traditional vegetables by the market gardeners studied.

3.2 Preference of market gardeners for traditional vegetables in the study areas

Table 2 below presents the results of the Kruskal Wallis test performed to assess the significance of the differences between the numbers of vegetable species cultivated per category by the market gardeners surveyed. According to Table 2, the minimum number of traditional and exotic vegetables produced by the respondents was 0. Meanwhile, the maximum number of traditional and exotic vegetables grown by the gardeners surveyed were respectively 7 and 3. The Kruskal Wallis test reveals that there is a significant difference between the number of traditional and exotic vegetable species produced by the market gardeners surveyed, at the threshold of 1%. It highlights that the gardeners produce an average of 3 (or 75%) traditional vegetables compared to 1 (or 25%) exotic vegetables. Thus,

traditional vegetables are significantly more produced than exotic ones.

This trend is confirmed by Figure 3 below, which shows the overall relative importance or preference given to each category, type, and species of the vegetables grown by the market gardeners of Abomey-Calavi and Cotonou.

Legend:

- TLV=Traditional Leafy Vegetable;
- TFV=Traditional Fruit Vegetable;
- TBV=Traditional Bulb Vegetable;
- ELV=Exotic Leafy Vegetable;
- ERV=Exotic Root Vegetable;
- EFV=Exotic Fruit Vegetable;
- EFwV=Exotic Flower Vegetable.

This figure shows that, overall, traditional vegetable species are more grown (about 76%) than exotic ones (24%). Considering traditional vegetable species, and their preference, *gboma* comes first, and it is respectively and in decreasing order followed by *tchayo*, *vernonia*, *amaranth*, jute mallow, *chilli*, tomato, onion, and okra. Figure 3 also demonstrates that, in all, leafy vegetables are more preferred (78%) than the other types of vegetables (22%). After the leafy vegetables (284/364 including 251/284, i.e. 88% traditional ones), come fruit vegetables (40/364 including 21/40, i.e. 52.5% traditional), exotic root vegetables (22/364), exotic flower vegetables (11/364) and then traditional bulb vegetables (3/364).

Table 2. Significance of the difference between the numbers of traditional and exotic vegetable species produced by market gardeners in Abomey-Calavi and Cotonou (Kruskal Wallis' test)

Parameter	Category of vegetable		Test t Pr (T > t)
	Traditional vegetables	Exotic vegetables	
Minimum	0	0	
Maximum	7	3	
Average number (standard deviation)	3,26 (1,41)	1,02 (0,97)	0,0001***

*** significant at 1%

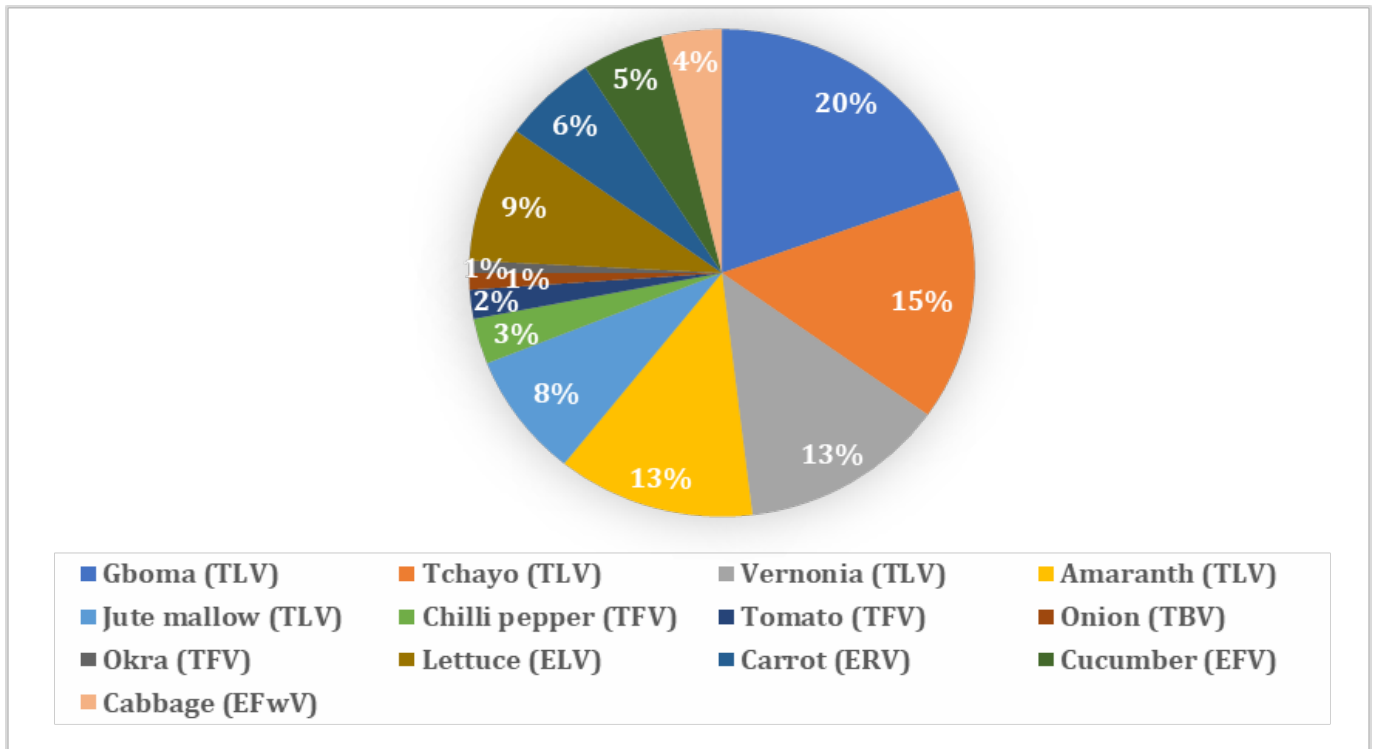


Figure 3. Order of importance and relative proportion of traditional vegetable species produced in Abomey-Calavi and Cotonou (N=364= total frequency of species grown by the 74 gardeners studied)

3.3 Factors significantly influencing market gardeners' preference for traditional vegetables

Table 3 below shows factors that significantly influence market gardeners' choice of traditional vegetables.

According to Table 3, the regression model involved a sample of 74 observations and 34 explanatory or independent variables, with the production or not of traditional vegetables as the dependent variable. The F-test indicates that the model is globally statistically significant, with a probability (Prob>F) of 0.0000. Therefore, the independent variables of the model globally have significant effects on the dependent variable. The adjusted R-squared suggests that the independent variables of the model explain around 62% of the variation of the dependent variable, which highlights that the model is relevant to the data analysed.

According to this model's results, explanatory variables such as "producers' group membership (group_membership)", "resistance to pests (Pest_resistance)", and "high customers' demand (High_demand)" have sig-

nificant and positive influences on the choice of traditional vegetables' production, respectively at 10%, 1%, and 5% thresholds. This means that market gardeners choose the traditional vegetables they produce mainly because they resist pests, they are highly demanded by customers, and they are encouraged to do so by their peers. At the same time, the "number of years of experience (Year_experience)", "land loan (Land_Access_Borrowing)", "profitability", "high market value (high_market_value)", and "vegetable species preferences of traders (Trader_species_preference)" significantly and negatively influence the choice of the traditional vegetables produced, respectively at 1%, 5%, 1%, and 10% thresholds. This means that the more gardeners are experienced, borrow land, seek profit, value market values of vegetables, and value species preferred by traders, the less they are likely to prefer growing traditional vegetables. Overall, the significant explanatory variables in the regression results indicate that traditional vegetables are not produced for their financial profitability, but rather for their resistance to pests and for their high and regular demand, which seem to coincide with the production conditions most preferred by the market gardeners surveyed.



Table 3: Factors influencing the choice of traditional vegetables by market gardeners (Logistic regression result)

Numbers of observations = 74 ; Prob > F = 0,0000 ; R-squared = 0.7960; Adj R-squared = 0,6182 ; Root MSE = .29814						
Dependent_variable (production of traditional vegetable)	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
Region/département	.1260598	.3725539	0.34	0.737	-.6275016	.8796213
District/arrondissement	-.0028897	.0171558	-0.17	0.867	-.0375906	.0318112
Age	.0075464	.0064374	1.17	0.248	-.0054746	.0205673
Gender	-.0230027	.1180222	-0.19	0.846	-.261725	.2157196
Level_Instruction	-.0405666	.0493681	-0.82	0.416	-.140423	.0592899
Household_Size	.0421595	.0261881	1.61	0.115	-.010811	.0951299
Year_Experience	-.0400118	.0118009	-3.39	0.002***	-.0638813	-.0161423
Group membership	.3031456	.1734653	1.75	0.088*	-.0477212	.6540124
Number-vegetable-products	.0308583	.0467145	0.66	0.513	-.0636308	.1253473
Area_ha	-.1762065	.1834427	-0.96	0.343	-.5472544	.1948414
Land_Access_Purchase	.0366861	.1899483	0.19	0.848	-.3475207	.4208929
Land_Access_Heritage	-.3705219	.2847785	-1.30	0.201	-.9465408	.205497
Land_Access_Borrowing	-.3071549	.1145887	-2.68	0.011*	-.5389325	-.0753774
Land_Access_Location	-.0519043	.1542281	-0.34	0.738	-.3638601	.2600514
Cycle_time	.0210176	.1177656	0.18	0.859	-.2171858	.259221
High_productivity	.105814	.1317017	0.80	0.427	-.1605779	.372206
System_rotation	-.1679795	.1359879	-1.24	0.224	-.4430409	.1070819
low_manpower_requirement	-.1806226	.2671948	-0.68	0.503	-.7210751	.3598299
Profitability	-.33865	.1223651	-2.77	0.009***	-.5861568	-.0911432
high_market_value	-.5412491	.186296	-2.91	0.006***	-.9180683	-.1644299
rapidity_obtaining_income	-1020302	.1208207	-0.84	0.404	-.3464132	.1423527
Pest_resistance	.530594	.1660303	3.20	0.003***	.1947659	.8664221
High_demand	.5979721	.251852	2.37	0.023**	.0885534	1.107391
Trader_criterion_Altera	-.7749953	.5163152	-1.50	0.141	-1.819341	.2693508
Trader_criterion_size	.6205934	.5967765	1.04	0.305	-.586501	1.827688
Trader_criterion_fresh	-.2736566	.2294598	-1.19	0.240	-.7377828	.1904696
Trader_criterion_colour	1012958	.1561849	0.65	0.520	-.2146181	.4172096
Trader_species_preference	-.2672779	.136933	-1.95	0.058*	-.5442511	.0096953
Trader_criterion_quantity	.477596	.3397335	1.41	0.168	-.2095799	1.164772
Trader_criterion_price	-1.164376	.7536912	-1.54	0.130	-2.68886	.3601088
Trader_criterion_conservation-time	.0168153	.2417174	0.07	0.945	-.4721044	.505735
Trader_criterion_conservation-facility	-.1114819	.2211401	-0.50	0.617	-.5587799	.3358162
Trader_criterion_cultural-practice	.1011167	.1501436	0.67	0.505	-.2025774	.4048108
Trader_criterion_degree_of_use_chemical_fertiliser	.0295504	.1635859	0.18	0.858	-.3013334	.3604341
_Constant	1.204911	1.026867	1.17	0.248	-.8721224	3.281945

*** significant at 1%; ** significant at 5%; * significant at 10%

4. Discussion and implications

This section discusses and addresses the implications suggested by the study.

4.1 Discussion

The diversity of vegetables produced, the predominance of traditional vegetables, the predominance of traditional leafy vegetables, and factors explaining market gardeners' preferences are the main discussion points addressed in this sub-section.

4.1.1 Relatively high diversity of vegetables produced by the market gardeners of Abomey-Calavi and Cotonou

The study revealed that a wide range of vegetable species of different categories (traditional and exotic) and types are grown throughout the study areas. These types include leafy (*amaranth*, *gboma*, *tchayo*, *vernonia*, jute mallow, and lettuce), fruit (tomato, *chilli*, okra, and cucumber), flower (cabbage), root (carrot) and bulb (onion) vegetables. This varied range of vegetables found in urban and peri-urban market gardening in the Communes of Cotonou and Abomey-Calavi in southern Benin confirms the work of Diao (2004), Madjouma *et al.* (2009) and Ouikoun *et al.* (2019). These authors respectively studied the production systems of market gardeners in the Dakar region of Senegal, the city of Lome in Togo, and the city of Cotonou in Benin, and showed that market gardeners in these cities grow several tens of vegetable species. Such diversity grants market garden vegetable clients with a variety of food and nutrition choice alternatives.

4.1.2 Predominance of traditional vegetable species in market garden production in Abomey-Calavi and Cotonou

According to the study results, traditional vegetable species are produced more often (9 times out of 13 or 3 times out of 4) than exotic ones. This proven production preference for traditional vegetable species could be justified by constraints encountered by market gardeners, which make it more difficult for them to produce exotic vegetable species, which generally have longer production cycles and are much

more input-intensive than traditional ones. These constraints also include unavailability of, or limited access to, quality inputs and other resources such as seeds, fertilisers, and crop protection products; lack of secure land; lack of financial capital; lack of knowledge about technical itineraries of certain crops; and post-harvest losses at certain times of the year. These constraints reduce the productivity of some vegetable farms, sometimes leading some gardeners to refrain from producing certain very sensitive crops such as cabbage or carrots, due to fear of losses. Lack of financial capital and difficult access to land bring some market gardeners to only grow crops with short production cycles to quickly and regularly earn incomes. Due to all these reasons, traditional vegetables, and mainly traditional leafy vegetables, which generally have short production cycles, are more often grown by market gardeners than exotic ones.

4.1.3 Predominance of traditional leafy vegetables in market garden production in Abomey-Calavi and Cotonou

The study also highlighted that traditional leafy vegetables (*gboma*, *tchayo*, *vernonia*, *amaranth*, and jute mallow) are more produced (5/9 or 56%) than the other types of traditional vegetables (44%). The high production of these vegetable types and species is justified by their resistance to pests and their high demand by traders, processors, and consumers. This trend confirms the findings of Assogba-Komlan *et al.* (2007) according to which, leafy vegetables are the most widely consumed of the market garden crops grown in Benin. These results can also be explained by the short production cycles of leafy vegetables and the large number of small market garden farms in precarious situations often with little working capital. According to Hounkponou (2003), urban and peri-urban market gardening are threatened by issues of land insecurity and scarcity resulting from the expansion of residential, commercial, and industrial buildings. Consequently, to regularly secure incomes, market gardeners feel obliged to grow traditional vegetables, which monthly provide them with income. Some market gardeners said that they produce leafy vegetables because they monthly provide them with income throughout the production cycles, but also because, though less profitable than other types and categories of vegetables, they are much more reassuring for

them, in terms of technical and financial security. Respondents also mentioned that, throughout their production cycles, leafy vegetables are easily visible so that they quickly notice issues and remedy to them. This is not the case with root vegetables, for example, whose leaves may visibly grow well but end up having no large roots underneath at the end of production cycles. Furthermore, pest attacks on fruit vegetables, generate losses throughout their production cycles. These findings contradict those of Colin *et al.* (1991) and Sodjinou (2019), who rank tomato as the leading vegetable crop in the whole of southern Benin (which includes the municipalities of Grand-Popo, Sèmè-Kpodji, Ouidah, Kpomassè, and Comè), followed by leafy vegetables. This difference between our results and those of these earlier studies could be justified by the fact that our study covered only two municipalities, which are not the main tomato production basins.

4.1.4 Predominance of socioeconomic and technical variables among factors influencing market gardeners' vegetable choices

Here, the study results evidenced that 7 (88%) out of the 8 influential factors relate to socioeconomy (consumers, processors, and traders' demands, profitability, number of years of experience, group membership, market value, and land borrowing), while only 1 relates to biotechnics (resistance to pests). These findings confirm to some extent those of Ouikoun *et al.* (2019), who found that the main reasons behind the preference for a crop or the land sizes allocated to the various vegetables are: consumers' preferences, sales, vegetative cycles, and relative profitability.

4.2 Implications

This paper highlights:

- the diversity of market garden vegetables produced (13 species, 2 categories [traditional and exotic], and 5 types [leaves, fruits, flower, root, and bulb]);
- the predominance of the production of traditional vegetables (about 70%);
- the predominance of the production of leafy (about 46%), and fruit (about 38.5%) veg-

etables over the other types of vegetables;

- the predominance of the production of traditional leafy vegetables (about 83.33% among the 6 leafy vegetables produced), and traditional fruit vegetables (about 80% among the 5 fruit vegetables produced); and,
- the predominance of socioeconomic (88%) and biotechnical (12%) factors among those explaining market gardeners' choices.

These findings suggest that market garden vegetable traders, processors, and consumers of Cotonou and Abomey-Calavi, are given the possibility to choose among species, categories, and types of vegetables locally produced by market gardeners. Among these vegetables, clients have the opportunity to choose at least 2 traditional out of 3 possible choices. Given the demand-driven nature found for the production of vegetables, one may infer that traditional vegetables are more than 2 times more preferred, demanded, and consumed by traders and consumers than exotic ones. As implications, all relevant initiatives may deserve to be taken to promote quality production of the vegetables inventoried, at least following their relative importance, to support producers, traders, processors, consumers, food and nutrition, and the Benin economy. Such initiatives may be taken by or in the direction of agriculture, food, and nutrition policymakers; and, market garden researchers, extensionists, consumers, input suppliers, traders, and producers.

4.2.1 Implications for agriculture, food and nutrition policymakers

Food and nutrition are important for the biophysical, intellectual, psychological, and socioeconomic development of individuals and countries, and policies shape enabling environments for relevant development initiatives. Therefore, quality agriculture, food, and nutrition are under the responsibility of policymakers, who should shape relevant policies to these ends. This said this study's findings suggest to policymakers in charge of agriculture, food, nutrition, and vegetable promotion in Benin, to create relevant comprehensive policy conditions to support all stakeholders for the production and consumption of enough quality vegetables to contribute to the fulfilment of



consumers' micronutrients and fibres needs. These policy conditions may, for example, qualitatively and proportionately target, lands, inputs (seeds, fertilisers, pesticides, water), infrastructure (irrigation systems, markets, etc.), equipment (for sowing, irrigating, spraying, fertilising, harvesting, storing, processing, etc.), extension, financing, marketing, food and nutrition education, etc., related to vegetables. Based on the findings, traditional vegetables might be given priority compared to exotic ones. Most specifically, processors, and consumers might be encouraged to purchase, process, and cook accordingly, and consume available vegetables to fulfil their relevant food and nutrition needs.

4.2.2 Implications for researchers

Science, technology, and innovation (STI) being keys to any robust development initiative, researchers or scientists are unavoidable in rigorous development processes. Therefore, agriculture, food, nutrition, and vegetable promotion policymakers, and all other stakeholders might rely on researchers to (re)design, perform, monitor, evaluate, learn, and innovate on vegetable promotion initiatives. This consequently means that researchers may develop relevant scientific, technological, and innovation competencies, and effectively contribute to the success of target initiatives. Along this process, the due place might be given to traditional African vegetables as highlighted by this study.

4.2.3 Implications for extensionists

Being information, sensitisation, persuasion, training, and advisory services providers, extensionists may associate themselves or be associated with all vegetables' promotion initiatives, for their success. This means that extensionists should develop due competencies and take due actions to support market garden promotion in and beyond the study areas.

4.2.4 Implications for vegetables' consumers, processors, and traders

According to the study results, the production of market garden vegetables is driven by traders, processors, and consumers' demands. This implies that these clients should encourage gardeners by purchasing local-

ly grown vegetables at equitable prices.

4.2.5 Implications for market gardeners

Given the interest of traders, processors, and consumers in traditional African vegetables, market gardeners may do well by producing enough to keep supplying their clients. This implies also that, from an ethical point of view, gardeners should care for the quality of the vegetable products supplied to their clients, for food safety reasons.

4.2.6 Implications for input suppliers

Growing and supplying enough and quality vegetables to clients, require sufficient and quality inputs. Therefore, input dealers should manage to timely and sufficiently supply market gardeners with specific and quality seeds, fertilisers, pesticides, etc.

5. Conclusion

This article aimed to analyse market gardeners' preferences for traditional vegetables in urban and peri-urban environments in southern Benin, more specifically in the municipalities of Cotonou and Abomey-Calavi. To achieve this, a few resource persons, and 74 randomly selected market gardeners were interviewed and their production sites and practices were visited and observed. Data collected from these market gardeners related to species, types, categories, areas, and quantities of vegetables produced, production cycles and frequencies of each vegetable, and reasons behind the market gardeners' preferences for the vegetables produced. Data analysis revealed that a wide range of vegetables is produced in the study areas, including leafy vegetables (*gboma* or African eggplant, *tchayo* or African basil, *amanvivè* or *vernonia*, *fotètè* or *amaranth*, *ninnounwi* or jute mallow, and lettuce); fruit vegetables (tomato, *chilli* pepper, okra, cucumber); flower vegetables (cabbage); root vegetables (carrot); and bulb vegetables (onion). However, leafy vegetables are produced more than the other types of vegetables. It was also noted that the production of traditional vegetable species (*gboma*, *tchayo*, *amanvivè*, *fotètè*, *Ninnouwi*, *Ayoman*, *févi*, *atakin*, and *tinmatin*) is preferred to that of exotic ones (cucumber, cabbage, carrot, and lettuce). Market gardeners' preferences are mainly determined by "membership of a producer

group”, “resistance to pests”, and “demands”. The predominance of traditional vegetables in the preferences of consumers and market gardeners is encouraging in socio-cultural, dietary, nutritional, and economic terms, as it evidences the socio-cultural rooting of these vegetables in the habits of market gardeners and consumers. The paper recommends that all stakeholders take relevant and proportionate actions to contribute to the promotion of the market garden vegetables produced and consumed in the study areas, for food and nutrition safety. Further studies will address consumers’ and traders’ preferences and the factors influencing such preferences.

Conflict of interest

The authors declare no conflict of interest. The funders

had no role in the design of the study; in the collection, analyses, and interpretation of data; in the writing of the manuscript, and in the decision to publish the study results.

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Appendices



Solanum macrocarpon



Ocimum gratissimum



Vernonia amygdalina



Amaranthus cruentus



Corchorus olitorius



Lycopersicon esculentum



Capsicum spp



Abelmoschus esculentus



Allium cepa



Lactuca sativa



Cucumis sativus



Brassica oleracea



Daucus carota



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