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Food, Socio-Cultural and Economic Importance of Yam in the North-East of Benin

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Abstract

Despite the strategic importance of yam in food, socio-cultural and economic terms, little attention is given to it in the literature. Thus, this study aims to analyse the different values of this crop, which remains one of the most widespread in Benin and West-Africa. For this purpose, 100 producers were randomly selected. While discourse analysis was used to assess the food and socio-cultural importance of yam, its economic importance was analysed using profitability indicators and a Cobb-Douglas production function. The results showed that the yam embodies not only nutritional importance, but also a sacred value, object of grandiose cultural festivals that only uncontrollable events such as the COVID-19 pandemic can shake. Economically, yam offers a better comparative advantage over maize, which remains the main competing food crop. If due to the scarcity of fertile land, the observed productivity is lower than the national average, it is however possible under current production conditions to increase the yam's production by 0.926%, 0.013% and 0.042% while increasing the cultivated area, family labour and invested capital respectively by 1%. But in order to sustainably increase production and preserve this food and cultural heritage, better consideration of this crop in agricultural research is required.

Keywords: Tuber, Food security, Cultural events, Cash crop, Benin

1. Introduction

One of the most common food crops in tropical countries and especially in Africa remains yam. But if its production extends from east to west through central Africa, it is however the West African region which is with about 96% of total production, the preferred area of yam cultivation. Regionally and globally, the largest producer remains Nigeria, followed by Ghana, Ivory Coast and Benin (Adifon 2019, FAOSTAT 2019). Not only, do these four countries account for the largest share of world production, but they are also the largest consumers with almost the same culinary practices whose best-known expression in the sub-region is pounded yam. Yam is therefore an important food crop in the sustainable fight against food security and household poverty in these countries (Igué, 1974). If in Benin, yam is produced nationwide, it is however in the northern region that it is most widespread and remains a strategic crop in food security and income generation for the populations. The importance of the yam with its two main species, *Dioscorea rotundata* and *Dioscorea alata* in the diet of these populations leads most households to focus their farm around the production of this crop. Over the past decade, the average production is estimated at 2,730,000 tonnes/year nationwide, with an annual growth of 12% (DSA & MAEP, 2017; FAOSTAT, 2019). According to available statistics, the North-East and in particular the departments of Borgou-Alibori, alone annually produces about 37.29% of national production (MAEP, 2015). Beyond its food function, yam has enjoyed for ages in traditional societies in Benin a cultural function which gives it a special value. Yam thus, appears as a sacred food product used in traditional rituals and ceremonies, and also as the object of annual cultural events (Baco, 2007). Consumed in several forms, the most widespread and popular of which is pounded yam, yam is no longer a simple subsistence product but increasingly also a cash crop (Baco et al. 2007; Maliki et al, 2012; Adifon et al. 2019) competing even with cereals. Thus, the yam alone fulfils three essential functions at the same time that no other crop can claim to have.

Despite this special importance, the yam, compared to other crops, has received very little attention in scientific research, so that it is considered as an overlooked subject of research in Benin (Baco et al. 2007, Egah et al. 2012). Among the rare works devoted to yams, there are Adanguidi (2006), Baco (2007) Houedjissin & Koudande (2010), Padonou (2011), Egah et al. (2012), Floquet et al. (2012), and Adifon (2019).

Although these works are relatively recent, none however address both the three functions of the yam but focus either on the ecological or cultural aspect, almost obscuring the economic aspect.

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Therefore, by focusing on the analysis of the food, socio-cultural and economic importance of yam production in north-eastern Benin, this study basically aims to enrich the existing scientific knowledge on this strategic crop for populations in Benin. By doing so, the study could provide a database accessible to researchers and development actors interested in issues of promoting food crops and in particular tubers in Benin and in West Africa.

2. Materials and Methods

2.1. Theoretical framework

According to neoclassical economic theory, the producer is in a production process, supposed to be rational and seeking above all to optimize, under the constraint of production costs, the use of resources, therefore to maximize his profit. The search for profit is therefore fundamental and constitutes the main resource's allocation criterion of the producer to different output alternatives. Thus, the scarce resources available to the producer are allocated only to the activity offering the best comparative advantage in terms of profit. But in reality, although the producer is interested in maximizing his profit, he might as well pursue other objectives, thus questioning the thesis of rationality. Indeed, the goals and objectives of a producer are intimately linked to his psychological characteristics, and the objectives chosen by a given producer may have very little to do with profit maximization (Debertin, 2012). So instead of seeking profit by adopting a production system supposed to be more efficient, he can choose to produce a crop just to limit harvest risks, only ensure food security, honour traditional obligations or even just to perpetuate an ancestral practice.

In the economic literature, this problem of the behaviour of peasants is approached by a certain number of theoretical approaches such as the substantivist approach (Polanyi, 1944; Dalton 1961) rejecting the rationality hypothesis and see the behaviour of households imposed by old customs and institutions, the structuralist approach (De Janvry et al., 1991) considering peasant households as rational but confronted with market failures, and the neo-institutional approach which makes it possible to analyse how, and by what mechanism the choices of peasants are subject to their social structure (He Yong, 1994). This social structure is based on three types of social constraints, bureaucracy, information and uncertainty, as well as customs and tradition that can influence the behaviour of peasants. Faced with these constraints, farmers can rationally abandon the opportunities offered by the markets in favour of choices considered suboptimal. The choice of the production of a crop such as yam in the study area could therefore be better understood through these theoretical and empirical considerations deviating from the thesis of rationality and the search for profit embodied by the neoclassical model.

It is therefore in the light of this theoretical and empirical knowledge that the socio-cultural and economic analysis of yam production was carried out in the study area

2.2. Study area and Database

The study was carried out in the municipality of N'Dali, located in the northeast of Benin between 9°51'39" North and 2°43'05" East. This municipality, which covers an area of 3,748 km², is primarily agricultural and known as one of the regions of high yam production in Benin. The prevailing climate is Sahelo-Sudanese type, characterized by the alternation of a rainy season from May to October and a dry season from November to April, which recent climatic disturbances tend to shift. The soils are generally of tropical ferruginous type, very suitable for agricultural production including that of yam. For the study four villages were selected because of their importance in yam production.

Research units are individual producers, randomly selected from a list of producers provided by the agricultural extension service. Thus, a total of 100 producers were selected at the rate of 25 producers per village.

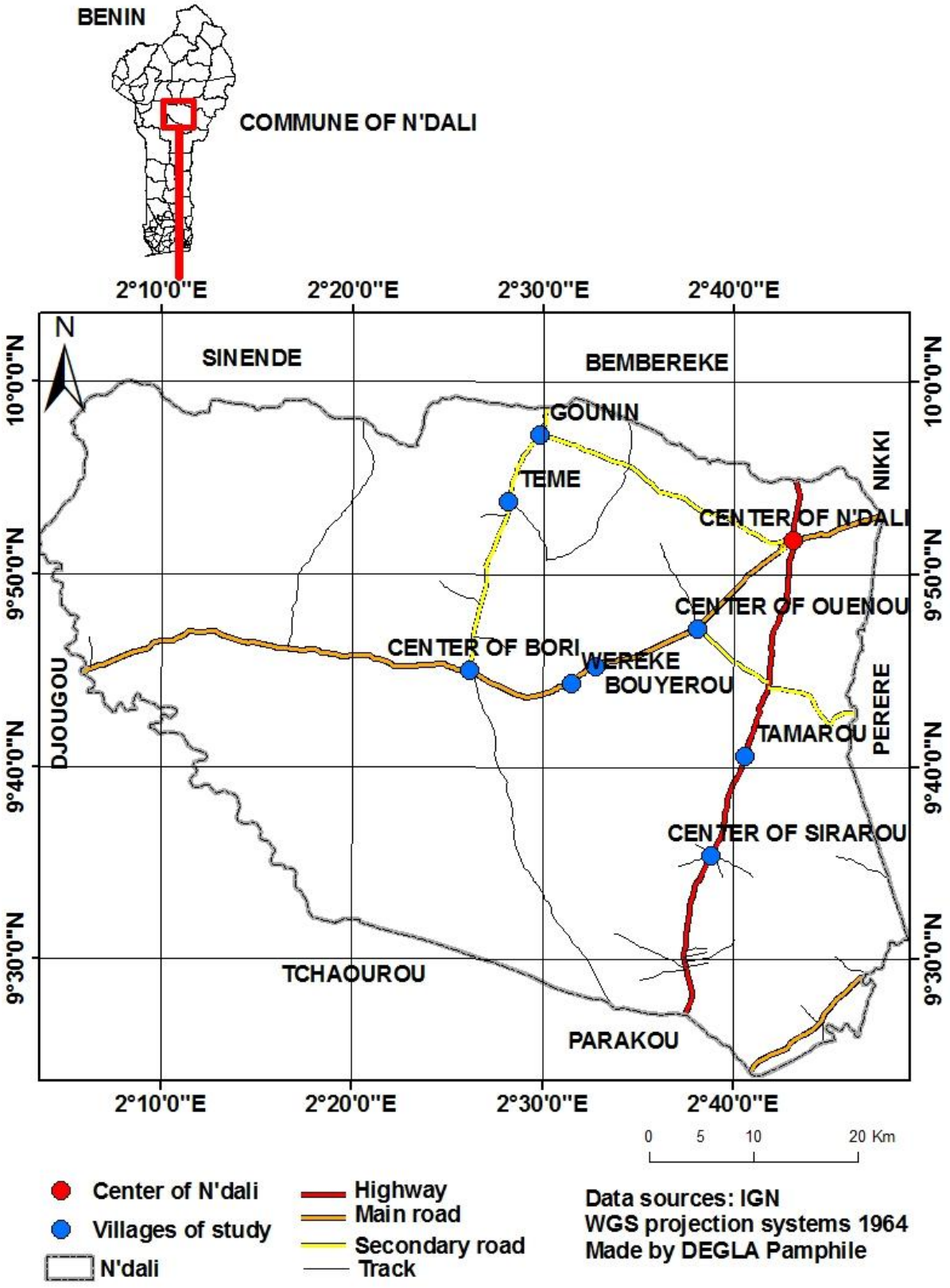

Figure 1: Study aera

2.3. Tools, techniques for data collection and analysis

The main data collected from the selected producers concern their socio-economic characteristics (age, sex, household size, farm size, etc.), the inputs used, the quantities of harvest, their perceptions of yam production, etc. These data were collected through individual surveys and focus groups conducted on the basis of a questionnaire.

The economic importance of production was analysed through a Cobb-Douglas production function and a financial and economic profitability analysis by using various profitability indicators such as net margin (MN), cost-benefit ratio (RBC), internal rate of return (IRR) and average productivity of family labour (PLM) (cf. Yegbemey 2009; Degla 2012). As for the analysis of the food and socio-cultural importance, it was carried out through an analysis of speeches and perceptions of producers.

The theoretical form of the Cobb-Douglas production function used is expressed as follows:

$$y = c.\prod_i x_i^{a_i} \text{ où } c_i, a_i > 0 \quad (1)$$

With x_i corresponding to the factors of production, (labour and capital and others), a_i the coefficients. In its linearized form, the function is as follows:

$$\ln(y) = \ln(c) + \sum_i a_i . \ln(x_i) \quad (2)$$

Based on the main inputs used by the yam's producers (cf. Tab. 2) and on the methodological approach of Audibert (1977), Bravo-Ureta& Pinheiro (1977), and Tewodros (2001) who considers land as an explanatory variable, the empirical model of the Cobb-Douglas function has been specified as follows:

$$\ln(Q\text{Mais}_i) = \beta_0 + \beta_1 \ln(SUP_i) + \beta_2 \ln(\text{SEM}_i) + \beta_3 \ln(\text{ENG}_i) + \beta_4 \ln(\text{PEST}_i) + \beta_5 \ln(\text{CAP}_i) + \beta_6 \ln(MOF_i) + u_i \quad (3)$$

with βi, the coefficients to be estimated, u_i the error terms.

3. Results

3.1. Socio-economic characteristics of producers

In the study area, yam production is, due to its requirement in physical effort, an activity exclusively for men (100%). Most of the producers are married (96%) and have no formal education (59%). While the majority of producers (95%) have regular contact with the extension service, only 44% of them belong to an agricultural group. The average age of the producers is 41(± 12) years and the average area of their farm is 32.75 (± 37.14) ha. As for the labour, the most farmers (52%) primarily used hired labour, while 48% of them preferred the use of family labour (cf. Tab.1).

Table1: Socio-economic characteristics of producers

Qualitative Variables		**Absolute Values**	**Relative frequencies (%)**	
Sex	Male	100	100	
	Female	0	0	
Education	Unschooled	59	59	
	Primary	29	29	
	Secondary	12	12	
Ethnic group	Bariba	93	93	
	Somba	3	3	
	Others	4	4	
Marital status	Married	96	96	
	Single	2	2	
	Widowed	2	2	
Membership of a village group		44	44	
Contact with the extension service		95	95	
Use of hired labour		52	52	
Use of family labour		48	48	
Qualitative Variables	**Means**	**Standard Deviation**	**Minimum**	**Maximum**
Age	41	13	20	75
Active number	10	7	1	28
Farm size	32,75	37,14	2	200
Quantity of Herbicide (L)	4,69	4,38	0	24
Harvest (kg)	10 586,50	11 920,50	1 500	92 000
Self-consumption (kg)	5 619	6261,70	300	37 500
Donation (kg)	620	967,13	0	7500
Quantity of family labour	22,80	21,89	10	110

Source: Survey Data, June August 2019

3.2. Yam growing conditions and varieties in the study area

Yam production is a very difficult farm activity because of its requirement in physical efforts. The most difficult operation is the mound's making whose labour requirement is on average 22 man-days/ha. Then comes the planting of the yam, which is a delicate operation that may require an average of 25 man-days/ha. These two cultivation operations, one very painful and the other very delicate mean that the production of yam is only ensured by men. As the yam is a crop with many specific characteristics (growing cycle, organoleptic quality, resistance to pests, water requirements, productivity) that cannot be found in the same variety at the same time, farmers try to produce several yam varieties during the same season to meet their needs throughout the year. Thus, the early yam varieties are cultivated together with the late varieties to meet the food needs of the household. While the variety "*Laboko*" is the best-known early variety, *Kokoro* (*Dioscorea rotundata*) remains the most common late variety in the study area

3.3. Food importance of yam

In the study area, yams are the staple food for households. No days go by without the yam being consumed in the plundered form, the most common form of consumption. During certain periods of the year, particularly during the periods of abundance just after the harvest, the yam is consumed two to three times a day. Accompanied by various sauces, the yam largely meets the nutritional needs, in particular in fibber, complex carbohydrates and mineral salts of households. Thus, the availability of yam stocks is for most producers (81%) a guarantee of food security. According to these producers, the yam harvest marks the end of the lean season and the elimination of hunger. With 56% of the production devoted to household consumption against 34% for the market, self-consumption remains the major objective of production in the study area. This self-consumption is however increasingly threatened by the low productivity observable nowadays in the production areas and which are attributable to the continuous reduction in soil fertility in these regions. As a result, yam stocks are no longer sufficient for most households. Only the large producers, around 10% of producers, manage to have sufficient stock to cover their needs until the new harvest. For most small producers, yam stocks run out before the new season, forcing them to depend on donations from relatives or allies to meet the rest of their needs.

3.4. Socio-cultural importance of yam

Yam remains the only food crop that has enjoyed a sacred and therefore cultural character for ages in many regions of Benin and particularly in the study area. As highlighted by Baco et al. (2007) and confirmed by old farmers in the study area, many beliefs made yam, in the past a unique crop used through offerings for transmission between the ancestors and the living and whose production was subject to special rites. From planting to harvesting the yam, customary rules were observed to ensure a better yield and avoid unhappiness in the family. So, while certain varieties of yam known as the "queen variety" should not be harvested by both a father and his son, sexual abstinence was required for other varieties the day before sowing and alms were prescribed on the day of planting to avoid cuttings mortality. At the same time, the outgrowths of the vegetative part of some varieties were perceived as signs of occult forces, announcing the imminence of a misfortune in the household. Just like the inheritance of durable goods such as land, yam seed is part of the inheritance of male children.

As a sacred crop, ceremonies and rites related to the yam were organized from the first harvest and remained a prerequisite for its consumption. The ceremonies were major public cultural events led by customary chiefs initiated into ancestral rituals. These events mobilized the entire village community for several days and ended with an important ritual marking the beginning of the yam consumption for the entire population.

Nowadays, the expansion of new religions, the monetization of life and globalization have led to profound transformations in traditional communities and weakened local institutions that guarantee traditional yam beliefs and festivals. The public festivals of the past have thus lost their importance, giving way to scattered individual practices.

Thus, in producer households where beliefs related to yam persist, i.e., 7% of households surveyed, small rituals have developed nowadays both upstream and downstream of production. When sowing, some growers perform rituals to implore gods for help to ensure a successful yam season. At harvest, the first yam is only consumed after an individual ceremony performed by the head of the household or by the head of the family community in the case that the individual households still maintain close family ties between themselves under the authority of a dignitary of this family community.

Although the collective ceremonies of the past have totally disappeared in the study area, similar forms of these festivals still exist in other regions of the country such as the Bariba regions of the municipalities of Bembérékè, Kérou in the north-east of Benin or in the Mahi region in central Benin.

In the Mahi communities, collective yam-related events have even become institutionalized and set up as grandiose annual yam festivals, celebrated every August 15. Even if this grandiose cultural event that has never

been shaken, was this year disrupted by the COVID-19 pandemic, the fact remains that for many other communities in the country, the date of August 15 remains a reference indicating to each the beginning of consumption of the new yam.

The perception that yam is a mystical crop is so ingrained in these communities that even non-producer consumers also engage in individual ceremonies prior to the first consumption of the new yam. Such ceremonies are found especially among people practicing the art of divination or worshiping the deity "*Fâ*". In these communities, the ceremonies generally performed by the head of the family or the customary priest result in the offering of prepared new yam to the deity "Fâ" and at the same time to the ancestors of the family, following by prayers that the new yam brings peace and well-being to the family. It is only after these ceremonies that each member of the family is allowed to consume the new yam. Strict adherence to these traditional practices is based on the belief that any deviance exposes the family to divine sanctions in terms of serious illness or various misfortunes.

All these beliefs and practices make yam a crop of great cultural importance ensuring cohesion, peace in households, and within village communities, and that no other food crop embodies in Benin.

Beyond the cultural and mystical aspect, yam production also has significant social importance in the study area in terms of seasonal employment. Indeed, the arduousness of the work in the yam fields leads the most producers (52%) to use hired labour, made up mainly of people specialized in the mound's making. Thus, by offering these household heads a stable seasonal job, yam production contributes significantly to reducing underemployment and unemployment in rural areas.

3.5. Economic importance of yam

If in the past, yam had only been a food and cultural crop, over time it has acquired a market importance which nowadays also makes it a popular cash crop. Thus, the marketing of a significant production's part has become for most producers a specific objective clearly defined in the overall production strategy at the start of the season. With about 34% of the annual production intended for sale, the yam contributes for a non-negligible part to the total farm income of households in the study area.

Compared to other tubers, roots or cereal crops, yam is consumed in all regions of Benin due to the variety of quick meals offered by its preparation. Thus, the demand for this foodstuff consumed in fried, boiled and above all plundered form is relatively very strong throughout the year, making yam production profitable. The average net margin achieved during the investigation period was 1,076,500 F CFA, while the Profit-Cost Ratio was 18.59, the Internal Rate of Return 5.53 and the average productivity of the family labour was 18,059 F CFA(cf. Tab.2). Based on these results, yam production is financially and economically profitable in the study area, thus constituting a significant source of income for producers.

Table2: Profitability indicators

Profitability indicators	Means	Standard deviation	Minimum	Maximum
Total costs (Fcfa/ha)	162 550	151 705	2 500	378 300
Net margin (Fcfa/ha)	1 076 500	1 447 122	95 000	9 760 000
Cost-Benefit Ratio	18,56	24,26	1,27	125
Internal Return Rate	5,53	6,73	0,25	39
Family labour productivity (Fcfa/Man-day)	18 059	29 896	816,67	195 200

Source: Survey data, June-August 2019

3.6. Determinants of the level of yam production in the study area

The analysis of the yam production function based on the Cobb-Douglas model shows that only the cultivated area, the amount of hired labour and the capital used have an influence on the level of the yam production (cf. Tab 3).

This influence being positive, one can deduce that an increase of 1% in the quantity of each of these factors would induce *ceteris paribus* an increase in production respectively of 0.926, 0.013 and 0.042%. However, a simultaneous increase in all of these factors will not lead to a more than proportional increase in the production's level but rather to a constant return to scale as Wald test shows (cf. Tab. 3)

Table 3: Yam production function

Explanatory variables	Coefficients	Robust standard error	t	p-value
Cultivated area	0,926***	0,059	15,560	0,000
Hired labour	0,013*	0,008	1,670	0,098
Familial labour	-0,013	0,059	-0,230	0,821
Herbicide quantity	0,001	0,006	0,100	0,919
Capital	0,042***	0,011	3,870	0,000
Constant	8,444	0,189	44,650	0,000
Significance and explanatory power of the model: R^2 = 0,82; F(5; 94) = 105,67 ; p-value = 0,000 **Residue normality test**: Residues follow a normal distribution at the 5% level (Chi-2=1,08; ddl=2; p-value=0,41) **Ramsey Reset Specification Test**: Estimated production function is well specified and no explanatory variable has been omitted (F(3 :91) = 1,24 ; p-value=0,42) **Wald test** (F(1 :94)=0,20 ; p-value=0,66				

Source: Survey Data, June August 2019

3.7. Constraints related to yam production in the study area

Because of its requirement for fertile land, yam is most often cultivated at the head of the rotation following the clearing of forests or long-term fallows. The disappearance of forests and the degradation of available land is nowadays a major constraint by most producers (50%). The lack of labour and the climate change effects are also perceived by 22% and 17% of producers respectively as being major constraints for yam production in the study area (cf. Tab. 4).

Tableau4: Main constraints related to yam production according to producers' perceptions

Main Constraints Identified	Absolute frequency	Relative frequency (%)
Lack of fertile land	50	50
Lack of labour	22	22
Climate change effects	17	17
Lack of seed system	6	6
Parasitic attack	5	5

Source: Survey Data, June August 2019

4. Discussion

Among the food crops embodying several functions of great importance at the same time, yam is prominent. Thus, carrying food, socio-cultural and economic value, yam remains a widely used crop in Benin and especially in the northern and central region of the country. In terms of food, yam is considered as a pledge of household food security in these regions, so that its production always remains a major objective in the family farm. From a simple crop intended exclusively for self-consumption, yam has nowadays also acquired a market value making it a cash crop whose competitiveness with cereals, other tubers and roots continues to grow. The multiplicity of yam varieties ranging from early to late varieties gives this crop a permanent supply throughout the year capable of meeting an almost permanent demand from the many consumers existing in all regions of the country.

This strong demand for yam on the market contributes to its profitability as shown by the average net margin of 1,076,500 FCFA/ ha achieved by the producers and which suggests that the value of the yam produced manages to cover all costs engaged in production at the farm level. Regarding the benefit-cost ratio (RBC) of an average value of 18.56, people can deduce that one franc invested in yam production brings in average 18.56 francs to the producer. By referring to the internal rate of return (IRR) of an average value of 5.53,

yam production is on the other hand not profitable given that this rate is lower than the interest rate of 12% applied by financial institutions in the study area.

This shows that producers would have difficulty meeting debt service if production was based on external financing. But from the average productivity of family labor with a value of 18,059 FCFA /main-days, it results that the production of yam highly remunerates family labor since the wage rate in the study area is only 7,000 FCFA /man-days for the yam production. This suggests that it is more profitable for producers to devote their labor to their own yam farm than to allocate it to other farms.

Compared to the economic performance of maize production, which remains the main food crop competing with yam in the study area and highlighted by Degla et al. (2020), it appears that the production of yam is economically and financially more profitable than that of maize according to all the indicators used. This therefore gives yams a better comparative advantage which could also explain the relative importance that households place on yams in the farms where these two main crops are involved.

In addition to the food and economic importance of yam and the dependence on this crop of many populations in the country and in the West African sub-region, as shown by Vernier and Dansi, (2006), Olufemi et al., (2016) and Adifon et al. (2019) in their respective studies, the particularity of the yam lies in the great socio-cultural value that it embodies. In fact, no other food crop in so many parts of the country enjoy such a sacred character that could be the subject of grandiose cultural events such as yam.

The mystical considerations attributed to the yam had existed for ages and were even found in other communities around the world as evidenced by ancient works by Perrot (1998) about the Akan in Ivory Coast and by Paita (1998) in New Caledonia. But, if today these mystical considerations have lost their former importance in places, with a disappearance of collective cultural festivals in the study area, individual beliefs linked to the sacredness of the yam still persist in some households in the northeast of Benin. On the other hand, among the Mahi in central Benin, these beliefs have been reinforced and give rise to institutionalized collective celebrations of a national holiday character, the annual holding of which on August 15 can only be shaken by uncontrollable events such as the pandemic of COVID -19.

Because of this well-known food, socio-cultural and economic importance, yam production generates particular interest from both producers and consumers. So, each year the new yam harvest is eagerly awaited by the populations. But as the fertile land required for a good yam production increasingly becomes a limiting factor, productivity resulting is also more and more low, as shown by the average yield of 6.5 tonnes / ha obtained by the households in the study area. Compared to the average yield of 10 tonnes / ha reported nationally by Floquet et al. (2012), productivity in the study area is relatively very low. However, under current production conditions, it is possible to increase the production's level by acting on the cultivated area, family labour and invested capital as shown by the analysis of the used Cobb-Douglas production function. But for a sustainable improvement in production, the interest of agronomic research in Benin for this particular crop must be increasingly evident in the search for varieties or seeds that are resilient to the current constraints linked to yam production in the country.

5. Conclusion

Far from being only a strategic crop for rural households because of its food and economic importance, yam also remains a crop of high socio-cultural value on which many communities in Benin depend. By embodying these three different functions at the same time, yam represents a special plant that no other food crop can claim to match in the country. Even against cereals such as maize which is one of the most widespread food crops in the country, yam offers a better comparative advantage giving it a particular interest in family farms.

The peculiarity of the yam, however, lies not only in the values it embodies, but also in the requirements linked to its production. Indeed, absolutely requiring fertile land, yam cultivation is most often at the head of the rotation following the clearing of new forests or long-term fallows. But the continued disappearance of virgin forests nowadays leads producers to use degraded land of low productivity as shown by the 6.5 tonnes/ha obtained by households in the study area and which are far lower than the national average of 10 tonnes/ha.

This low productivity and other constraints such as the lack of an effective seed storage system and parasitic attacks challenge agronomic research in Benin to invest more in the search for solutions likely to ensure the sustainable production of this high-value crop on which not only producers but also many consumers in the country depend.

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