International Journal of Innovation and Applied Studies
ISSN 2028-9324 Vol. 47 No. 4 Feb. 2026, pp. 591-598

http://www.ijias.issr-journals.org/

# Characterization of Moringa *(Moringa oleifera L.)* farms in the urban community of Agadez

***Mahamadou Moussa Dit Kalamou[1], Assoumane Boubacar Gouzae[2], Soumana Boubacar[2], and Maharazu Yusuf[3]***

[1]Department of Agriculture in Arid Zones, BP 199 Agadez, University of Agadez, Niger

[2]Department of Rural Economics and Sociology, Faculty of Agronomy BP 10960 Niamey, Abdou Moumouni University, Niger

[3]Department of geography, Kano, Bayero University of Kano, Nigeria



**ABSTRACT:** This article deals with the characterization of moringa (Moringa oleifera Lam., 1785) farms in the urban commune of Agadez. It analyzes the socio-professional activities that generate income for producers and the various production factors involved in moringa production. Moringa production enables producers to generate income throughout the year, with periods of peak profitability during Ramadan and socio-religious events. The aim of the study was to characterize moringa farms in the commune of Agadez. To this end, the survey covered 115 producers, i.e. 25% of the 459 moringa producers counted at six moringa production sites. The sample comprised 83.5% men and 16.5% women. Analysis shows that these producers farm an average of 3.29 ha, with decreases of up to 1.15 ha on average depending on the crop year. 60.9% of farmers surveyed inherited their land, while 13.9% purchased it. These modes of acquisition are followed by loans, gifts and rentals. Farmers engage in several socio-professional activities, the main one being market gardening, practised by 95.7% of those surveyed, with livestock farming coming in second place with 60.9%. Although it is a cash crop, moringa production generates costs for the purchase of agricultural inputs. The statistical correlation test reveals that the costs of fertilizers (-0.081), pesticides (-0.081), working materials (depreciation (-0.047)), permanent (-0.048) and daily (-0.086) employees and family labor (-0.089) were negatively correlated with yield.

**KEYWORDS:** characterization, farm, Moringa, Agadez.

## 1 INTRODUCTION

In the Agadez region, Moringa is grown in the departments of Iferouāne, Bilma Ingall, Djado, Tchirozerine, and Aderbissanat, where it is produced in market gardens. In this region, Moringa production occupies an area of 579 ha, or 5.9% of the national area, with a yield of 28.31% tons per hectare. In 2020-2021, production in this region will be 16391 tonnes, or 5.8% of national production [1]. The commune of Agadez is located on the south-eastern bangs of the Sahara desert, at the southern end of the Aïr massif. It has long been an essential stopover on the eastern trans-Saharan trail, linking the Maghreb to the Sahelian region stretching between the mouth of the Niger River and Lake Chad. [2] Agriculture is an important activity practiced by some of the men and women of the urban commune of Agadez on the edge of the Telwa kori. It is irrigated and spread throughout the year. The market garden perimeters are located on either side of the Telwa kori. The Sahelo-Saharan climate is characterized by a short rainy season lasting a maximum of two (2) months (July to August), with maximum rainfall in August. The soils encountered are crude mineral soils, notably lithosols, made up of all the coarse and fine debris that accumulates at the foot of slopes, and regosols, which are at the origin of regs and fluvial input soils [3]. Soils are silty on the banks of the Kori-Telwa and its tributaries, sandy in their beds and clayey in the southern and western parts of the town.

**Corresponding Author:** Mahamadou Moussa Dit Kalamou

## 2 MATERIALS AND METHODS

The urban district of Agadez is located in the Tchirozerine department, between the mouth of the Irhazer plain and the Air massif. Covering an area of 600 km, the urban commune of Agadez is the regional capital under law no. 2003-35 of August 27, 2003. It is bounded to the east, west and north by the urban commune of Tchirozerine and to the south by the rural commune of Aderbissanat, and lies between latitude 16°56'44" north and longitude 7°57'42" east [2].

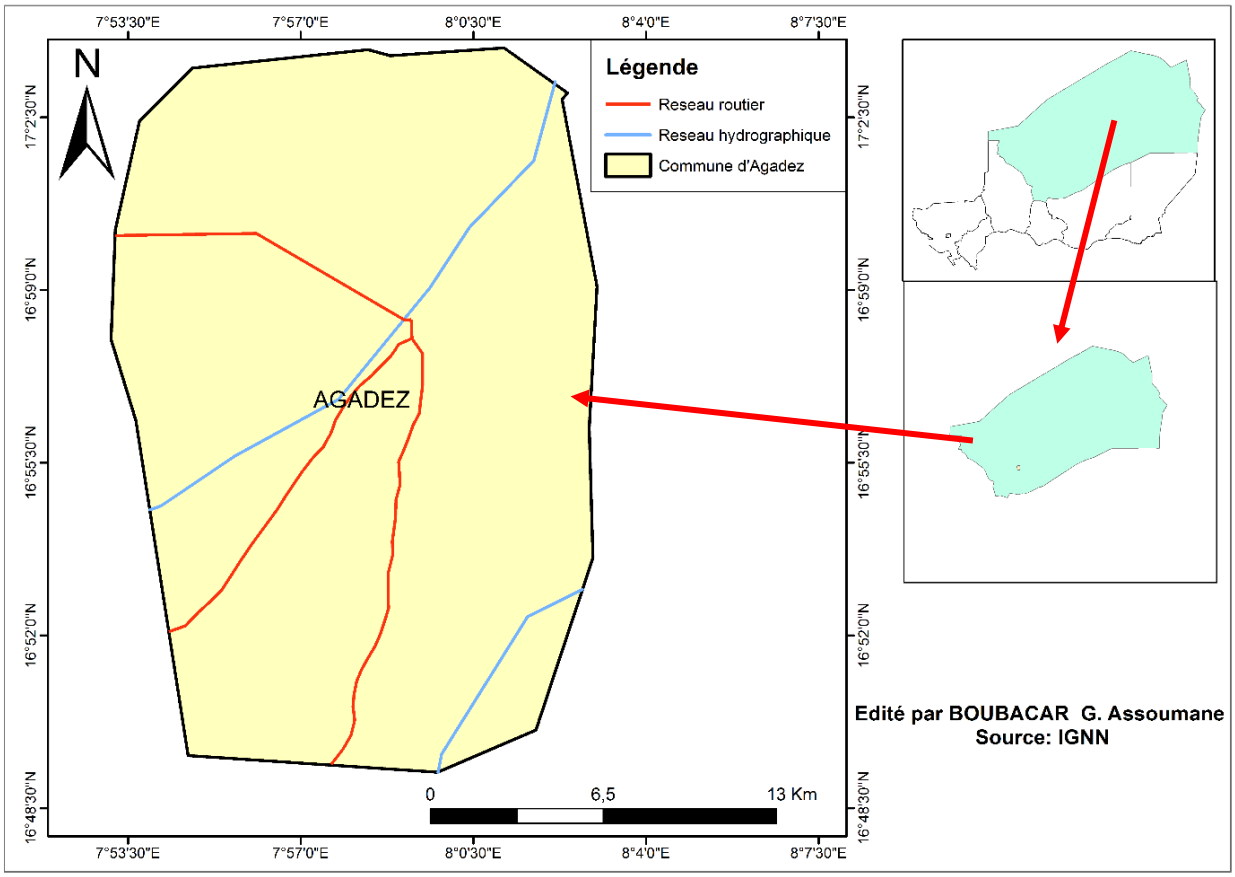


***Fig. 1. Location of Agadez commune***

### 2.1 MATERIALS

The study used materials to collect information. Collection tools appropriate to the field were used. A questionnaire was sent to farmers to collect primary data; a means of transport (a car) was used to visit irrigated moringa-growing sites in the commune of Agadez; a motorcycle was used to obtain additional data; and a camera was used to take photographs. Data processing and analysis were then carried out using software such as SPSS and R for data processing, EXCEL for drawing up figures and tables, and WORD for word processing.

### 2.2 METHODOLOGY

In order to achieve the general objective of the study, which is to better characterize moringa farms in the commune of Agadez, an exploratory survey was carried out to prepare and test the questionnaire, followed by a survey of producers at production sites. This investigation enabled us to gather useful information for the study through individual interviews with farmers. The data collected covered the socio-economic and demographic characteristics of the farmers (gender, age, marital status, level of education, etc.), their farms (surface area, production, yield, etc.) and the expenses incurred by the farm. In addition to these individual interviews, focus groups and observations were carried out with the aim of gathering more information and seeking out other information that was missing or deemed unimportant.

### 2.2.1 SAMPLING

The sampling method applied at each site in this study was carried out in two stages. Firstly, contact was made with the technical services and farmer leaders. With the help of these two experienced agricultural players, who know the area well, we were able to determine the number of Moringa farmers at 459 in 2023 at six sites in the commune of Agadez. Sampling was of the simple random type, with respondents selected from a list by assigning them a number, with each grower having the same probability of being chosen. The objective was to survey at least 25% or 1/4 of the target producers. In this way, data were collected from 115 Moringa growers.

***Table 1. Sampling of survey population***

| Sites | Number of farmers | | | Sampling | | |
|---|---|---|---|---|---|---|
| | Males | Females | Total | Males | Females | Total |
| Azamalan | 72 | 12 | 84 | 18 | 3 | 21 |
| Alikinkin | 41 | 3 | 44 | 10 | 1 | 11 |
| Aladab | 50 | 34 | 84 | 13 | 8 | 21 |
| Toudou | 56 | 4 | 60 | 14 | 1 | 15 |
| Toudou N'Bila | 127 | 20 | 147 | 32 | 5 | 37 |
| Tchiguefene | 40 | 0 | 40 | 10 | 0 | 10 |
| Number | **386** | **73** | **459** | **97** | **18** | **115** |

## 3 RESULTS

### 3.1 SOCIO-ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS OF SURVEYED FARMS

Socio-economic and demographic characteristics were obtained from questions on qualitative and quantitative variables, namely gender, age, marital status, mode of acquisition, soil fertility level, year of experience of farmers, household size and economic activity. Table 2 presents the characteristics of the qualitative and quantitative variables obtained by the study. Analysis of the results (Table 2) shows that, out of 115 farmers surveyed, men (83.5%) predominated over women (16.5%) in the sample. This is due to the fact that women are more involved in moringa processing and marketing than in production. Another reason is that, on the sites visited, there are fewer female farm managers. The table above shows that 65.2% of farm managers surveyed were monogamous married people, with the same proportion (15.7%) polygamous married and single, and 1.7% divorced and widowed. Traditionally, land is acquired by the following means: axe, inheritance, loan, lease, pledge, purchase and gift [4]. The percentages of land acquisition methods are given in Table 2. The table shows that 60.9% of farmers surveyed had inherited their land, while 13.9% had purchased land or taken out a loan, 8.7% had donated land, and 2.6% had rented land. The table shows that more than half (60.9%) of the farmers surveyed have fertile soil, while 1.7% have soil of low fertility. According to these farmers, the level of soil fertility has a significant effect on production, because the higher the level of fertility, the higher the yield. This has a positive effect on the economic profitability of Moringa cultivation. The table shows that the average age of growers is 40 years, with a standard deviation of 12 years, with the youngest respondent aged 18 and the oldest 81. As for the year of experience in the activity, the average is 18 years, with a standard deviation of 11, and the minimum and maximum respectively are 2 years and 55 years in moringa cultivation. The average household size is around 7 people, with a standard deviation of 3. The least populated household has just one (1) person, while the most populated has 16 members. According to the people concerned, the number of people in the household and the number of years of experience count towards profitability.

Analysis of the area farmed (table 2) shows that 1.01 ha is the average area farmed by the market gardeners surveyed in a given year, with a spread of around 0.76 ha. The minimum area cultivated was 0.16 ha, while the maximum was 4 ha.

*Table 2. Descriptive statistics for qualitative and quantitative variables*

| Qualitative variables | Modalities | Number | Frequency |
|---|---|---|---|
| Gender | Male | 96 | 83,5 % |
| | Female | 19 | 16,5 % |
| Marital statuts | Monogamoust groom | 75 | 65,2 % |
| | Married polygamist | 18 | 15,7 % |
| | divorced | 2 | 1,7 % |
| | Widow/ widowed | 2 | 1,7 % |
| | single | 18 | 15,7 % |
| Mode of acquisition | purchase | 16 | 13,9 % |
| | inheritance | 70 | 60,9 % |
| | Loans | 16 | 13,9 % |
| | Rental | 3 | 2,6 % |
| | Donation | 10 | 8,7 % |
| Fertility level | Low | 2 | 1,7 % |
| | Low fertility | 29 | 25,2 % |
| | Fertile | 70 | 60,9 % |
| | Fertile and very fertile | 1 | 0,9 % |
| | Very fertile | 13 | 11,3 % |

| Quantitative variables | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Age | 40 | 12 | 18 | 81 |
| Year of experience | 18 | 11 | 2 | 55 |
| Household size | 7 | 3 | 1 | 16 |
| Area cultivated in rainy season | 1,15 | 0,77 | 0,25 | 4 |
| Area cultivated in dry-cold season | 1,11 | 0,74 | 0,24 | 4 |
| Area cultivated in dry-hot season | 0,78 | 0,79 | 0 | 4 |
| Area cultivated per year | 1,01 | 0,76 | 0,16 | 4 |

Figure 2 below shows that market gardening is the main professional activity with 95.7%. This 95.7% rate is justified by the fact that growers engage in market gardening, which seems to be the activity requiring the fewest constraints and which brings them a significant income.

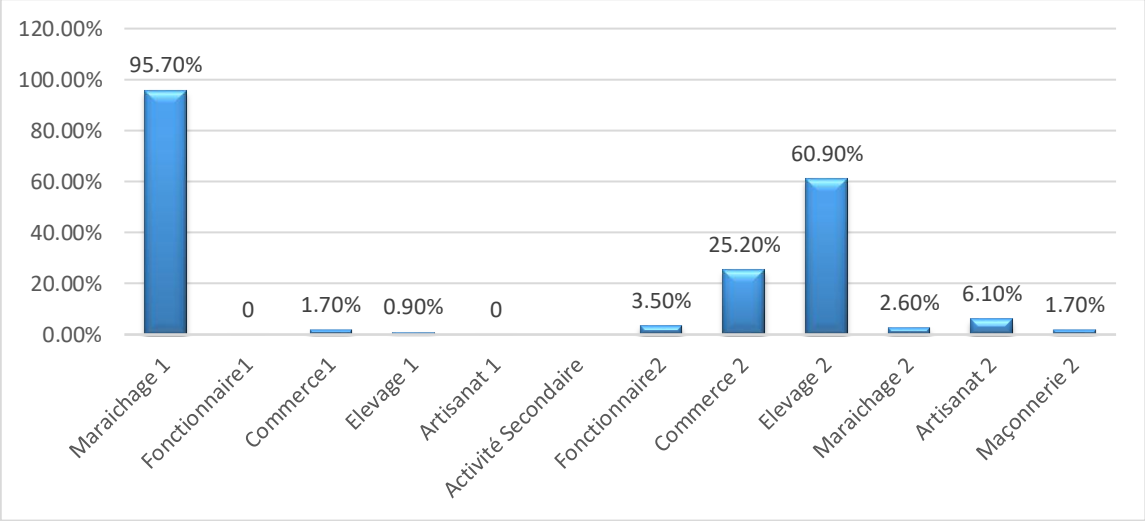


***Fig. 2. Socio-professional activity 1: primary activity 2: secondary activity***

An analysis of secondary activity shows in the figure below that the secondary occupation of this population is livestock rearing (60.9%) and petty trade (25.2%). Livestock rearing makes a major contribution to Moringa cultivation, providing the manure that considerably increases yields.

### 3.2 CROPPING SYSTEM

According to the respondents, the cropping system is the set of processes used to exploit the land in order to produce one or more crops on the same plot. Figure 3 shows the results for farmers practicing the various cropping system procedures.

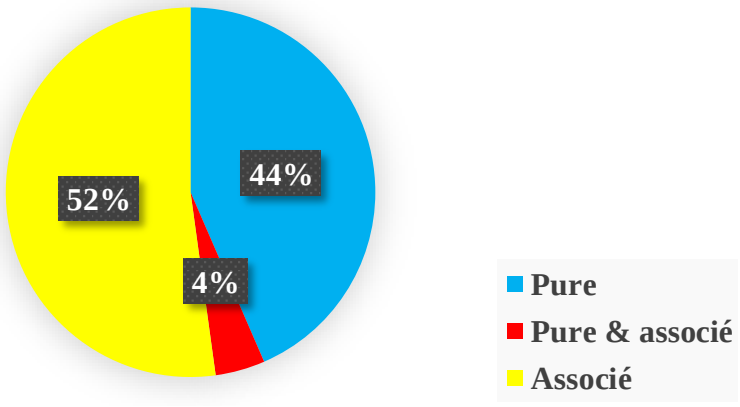


***Fig. 3. Cropping system***

The figure shows that 52% of farmers use the combined cropping system, 44% pure and 4% both. According to the respondents, the main combinations are:

- Rainy season: maize, sorghum, okra, chillies, groundnuts, tomatoes, eggplants, moringa.
- In the dry-cold season: Moringa, tomato, okra, onion, cabbage, garlic, cassava, maize, peanut, sweet potato, soybean, lettuce, eggplant and carrot.
- In the dry-hot season: Moringa, carrot, onion, tomato and okra.

Moringa can also be combined with any other crop, as it can easily be used as a hedge to protect the plot. Moreover, each farmer is free to choose his own crop.

### 3.3 CHARACTERIZATION OF PRODUCTION FACTORS

In production economics, factors of production are the various entities, physical persons or economic objects, whose services are used in production operations. Factors of production are components of the firm [5]. Classically, there are three factors of production on a farm: land, farm capital and labor. According to Bornier (2003) [6], operating capital can be defined as "The first, called material, capital is a collection of objects enabling the productivity of labor and land to be improved. A tractor, a plow, for example, are capital goods, and it's easy to see how such tools can increase productivity. This value or these funds available to the entity contribute to production insofar as they enable the company to remunerate the factors of production, to make them subsist, before selling the product of their actions". Having capital means being able to make advances, to incur expenses that will only later lead to a finished product and sales [7]. In the context of this research, straight-line depreciation is obtained by dividing the acquisition price of material goods by the useful life communicated by producers. Finally, the labor factor is divided into permanent workers, day laborers and family labor (MOF). Table 4 shows the relationship between production factors and yield.

***Table 3. Relationship between production factors and yield***

| Expenes | Independents variables | Dependents variables (Yield) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Moyenne | Standard deviation | Min | Max | Coef. | P-value |
| Variables Expenes | Seeds (FCFA) | 22308 | 27238 | 3333 | 111667 | 0,223** | 0,01 |
| | Fertilizers (FCFA) | 37037 | 32127 | 2833 | 122667 | -0,081 | 0,38 |
| | Pesticides (FCFA) | 23859 | 29930 | 4167 | 46267 | -0,081 | 0,38 |
| | Energy (FCFA) | 57285 | 47268 | 3367 | 160000 | 0,159** | 0,04 |
| | Manure (FCFA) | 4955 | 11736 | 0 | 50400 | 0,008* | 0,93 |
| | Daily wages (FCFA) | 31154 | 41473 | 0 | 148000 | -0,086 | 0,36 |
| | MOF (FCFA) | 80094 | 60565 | 10500 | 232500 | -0,089 | 0,34 |
| Fixed Expenes | Permanent employees (FCFA) | 116609 | 167556 | 0 | 546667 | -0,048 | 0,64 |
| | Depreciation (FCFA) | 104672 | 78388 | 5208 | 304250 | -0,047 | 0,66 |
| | Surface area (ha) | 0,499 | 0,239 | 0,25 | 3 | 0,011** | 0,02 |

**: case of collinearity, Coef: correlation coefficient, **: significance, MOF: family workforce*

## 4 DISCUSSION

Socio-economic and demographic characteristics of the farmers involved in the study: The study revealed that out of 115 farmers surveyed, men (83.5%) predominated over women (16.5%) in the sample. These results are lower than those obtained by IDI (2021) [8] in Maradi, which is 95% male. The same is true of CHERIF (2010) [9] in the Niamey urban community and Chipkaou (2020) [10] in Tillabéry, which had nearly 91% and 89% of men respectively. As many men as women practice moringa cultivation. Analysis shows that 65.2% of the farm managers surveyed were monogamous married people, with the same rate (15.7%) of polygamous married and single people, and 1.7% divorced and widowed. These results are similar to those of Souéba (2018) [11] in the urban community of Niamey and adjacent areas, who found that "more than 90% of married growers cultivate Moringa". These data can be explained by the fact that married people are dominant in the practice of this crop because the bulk of household expenses rest on them. The study shows that the average age of growers is 40, with a standard deviation of 12 years, with the youngest respondent aged 18 and the oldest 81.

As for the year of experience in the activity, the average is 18 years, with a standard deviation of 11, and the minimum and maximum respectively are 2 years and 55 years in moringa cultivation. The average household size is around 7 people, with a standard deviation of 3. The least populated household has just one (1) person, while the most populated has 16 members. According to the people concerned, the number of households and years of experience count in the practice of this crop in order to boost the production of moringa leaves in the households visited. The study reported that market gardening was the main socio-professional activity, accounting for 95.7% (figure 2). This 95.7% rate is justified by the fact that growers engage in market gardening, which seems to be the activity requiring the fewest constraints, and brings them a significant income. These results are in line with those found in PDC-Agadez (2018) [2]. Furthermore, analysis of secondary activity shows that the secondary occupation of this population boils down to livestock farming (60.9%) and petty trade (25.2%). These results are in line with those found in PDC-Agadez (2018) [2]. Livestock farming makes a major contribution to Moringa cultivation, providing the manure that considerably increases yields.

Characterization of farms in surveyed households in the commune of Agadez:

This research shows that, for moringa growers, land is the main physical capital. 60.9% of farmers surveyed inherited their land, while 13.9% bought it as a loan, 8.7% farmed their plots as a gift, and 2.6% rented. These results are better than those found by IDI. O. in 2021 [7] in the Maradi region, where 47% of respondents inherited their land, and inferior to those of Boubacar in 2021 in Bengou (Gaya) [12], where 76.21% of farmers worked inherited land. According to these farmers, in most cases, the respondents with the largest area of land inherited it. In order to produce, a soil must have a certain number of characteristics (physical, chemical or biological) that reflect its production capacity. These different aspects must be taken into account in a production system to ensure sustainable productivity [13]. In the fields of the people surveyed in the commune of Agadez, there is diversity in the level of fertility of their soils. Table 2 shows that more than half (60.9%) of the farmers surveyed had fertile soils, while 1.7% had soils of low fertility. According to these farmers, the level of soil fertility has a significant effect on moringa leaf production, because the higher the level of fertility, the higher the yield. Research (figure 3) shows that 52% of farmers use the associated cropping system, 44% pure and 4% both. There are associations with all crops, as Moringa can easily be used as a living hedge to protect the plot. Analysis of Table 4 reveals that variables such as seed costs, energy consumption costs for irrigation and quality and quantity of cultivated area significantly improve yield, with correlation coefficients (0.223**), (0.159**), (0.011**) and their P-value below (0.05) respectively. While there was a correlation between manure costs and yield, this was not significant, i.e. manure costs had little influence on moringa leaf production. On the other hand, the costs of fertilizers (-0.081), pesticides (-0.081), working materials (depreciation (-0.047), permanent (-0.048) and daily employees (-0.086), family labor (-0.089) were negatively correlated with yield. This is justified by the fact that the increase in the costs of these variables corresponds to the decrease in production yield. This study shows that it was possible to increase the yield of moringa leaf production by farmers by acting on the variables that the effect of location was significant.

## 5 CONCLUSION

In view of the above, it is important to emphasize that the majority of growers are men, although there are also female growers, who account for 16% of the surveys. The average size of the households surveyed is 7 individuals; producers have an average age of 40 and 18 years' experience in market gardening. With regard to production factors, land is acquired by inheritance (70%), although other modes of acquisition exist. The average areas farmed in the rainy, dry, cold and hot seasons are 1.15 ha, 1.11 ha and 0.78 ha respectively. Growers sow an average of 1.01 ha on an average total area of 3.25 ha. Soils appear to be predominantly sandy-clay, and are generally fertile. As for the cropping system, the study revealed that 52% of farmers practiced the associated cropping system, 44% pure and 4% both. Finally, the results of the present study show the extent to which the cultivation of this forest species is an undeniable source of food and income for producers. The statistical correlation test revealed that the costs of fertilizers (-0.081), pesticides (-0.081), working materials (depreciation (-0.047)), permanent (-0.048) and daily (-0.086) employees and family labor (-0.089) were negatively correlated with yield. On the other hand, seed costs, energy consumption costs for irrigation and quality and quantity of cultivated area significantly improved yield, with correlation coefficients of (0.223**), (0.159**), (0.011**) and P-values of less than (0.05) respectively. According to this study, it was possible to increase the yield of moringa leaf production by farmers by acting on the variables that the effect of location was significant.

## REFERENCES

[1] Ministry of Agriculture and Livestock (2020): Stratégies de la petite irrigation du Niger. Niamey, editions Ministère de l'Agriculture. 55p.
[2] PDC., (2018): Communal Development Plan (2018-2022) modified version. 85 P.
[3] CHAIBOU M., Faye B., (2006): Functioning of camel farms in the peri-urban area of Agadez, Niger: typological survey. 11 P.
[4] Mathieu B.Y. and Mahamane L. (1998): Comparative analysis of landscape dynamics between a mid-valley terroir (case of Dollé/Birni N'Konni). Master's thesis, Geography Department, Abdou Moumouni University, Niamey. 37 pages.
[5] PARAÏSO, A., SOSSOU A., YÈGBÉMEY, R. & BIAOU, G. (2012): Economic and financial profitability of cotton production in Ouaké, northwest Benin. Annals of Agronomic Sciences; 16 (1), pp. 91-105, ISSN 1659-5009.
[6] BORNIER (2003): Economics courses. Professional website of Professor Jean Magnan de Bornier. URL: https://docplayer.fr/15360087-3-les-decisions-de-production.html consulted on September 8, 2023.
[7] Paraïso et al., 2010). PARAÏSO, A., SOSSOU, A., YÈGBÉMEY, R. & BIAOU, G. (2010): Analysis of the profitability of fonio (Digitaria exilis) production in the commune of Boukombe, Benin. IVème Journée Scientifique de l'Université de Lomé. Togo, October 25-28, 2010.

[8] Idi, O. A., (2021): Characteristics of Moringa farms in the commune of Jiratawa, Maradi region, Niger, for the general bachelor's degree in agricultural sciences. 33 p.
[9] CHERIF M. (2010): A contribution to the evaluation of the potential of Moringa Oleifera for production, marketing, processing and conservation in the urban community of Niamey. In view of obtaining the diploma of cycle of engineers of agricultural techniques (ITA) at the University Abdou Moumouni of Niamey-faculty of agronomy. 1-42 Pages.
[10] Chipkaou.A. A. (2020): The contribution of Moringa production to household resilience to climate change. (Final dissertation for the Rural Development Technician Diploma) EAU ET FORET, ESIMAD, 34p.
[11] Nana Souéba O.A, (2018): Cultivation and commercialization of Moringa in the Urban Community of Niamey and its adjacent areas (Licence ès-Sciences Agronomiques graduation thesis). University Abdou Moumouni of Niamey, Faculty of Agronomy, 44p.
[12] Boubacar G.A (2021): Soil fertility management methods on market garden sites in the rural commune of Bengou (Gaya-Niger), Diploma in Agronomic Science from the University of Abdou Moumouni, Niamey. 38 p.
[13] Deloye M. (1958): Conserving soil fertility. Doctoral thesis in universal and environmental science, Université Paris-Est CRETEIL, Val et Mame, Paris-France. 166 p.