

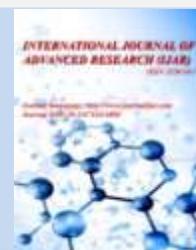


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RESEARCH ARTICLE

ANALYSIS OF THE ECONOMIC PROFITABILITY OF MORINGA FARMING IN THE URBAN COMMUNE OF AGADEZ

Moussa Dit Kalamou Mahamadou¹, Boubacar Gouzae Assoumane² and Soumana Boubacar²

1. Department of Agriculture in Arid Zones, University of Agadez, Agadez, Niger.
2. Department of Rural Economics and Sociology, Abdou Moumouni University, Faculty of Agronomy of Niamey, Niger.

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Abstract

Moringa plays an important socio-economic role in Niger. It produces edible leaves used in human consumption, which also constitute a source of income for producers. Therefore, this study aims to analyze the economic profitability of Moringa farms in the Agadez commune by highlighting the factors influencing profitability levels. It was conducted using a database compiled from a survey carried out in the study area with 115 Moringa producers . The methodological approach adopted was, firstly, a descriptive and differential analysis of the socio-economic characteristics of the farms and producers, the operating accounts, and economic profitability. The analyses show that 95.7% of the farmers surveyed consider market gardening to be their main activity, although nearly 84% of the respondents did not receive any support or guidance. The results of this study have demonstrated the significant source of food and income for producers of this plant, with an average net income of 391,569 FCFA/ha. The profitability rate achieved for producers is 92.7 % , meaning that income exceeds expenses. For example, if a Moringa producer invests 5 FCFA, they should receive a profit of 4,635 FCFA. Therefore, Moringa farming is economically viable in the study area.

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Introduction:-

Moringa farms contribute significantly to improving household living conditions, particularly through harvesting, leaf sales (generating income), and self-consumption. It has a direct impact on diet, malnutrition prevention, improved livelihoods, and water quality (ACH-NIGER, 2010). In Niger, Moringa oleifera is primarily cultivated for leaf production and human consumption. Thus, Moringa leaves contribute to the resilience of many households against food and economic vulnerability. This plant is cultivated under irrigation in market gardens, either as a monoculture or in association with other plants, and its main production areas are the city of Niamey and its surroundings, the Maradi region, and Tillabéry(Manzo et al ., 2016). According to a 2015 study by the National Institute of Statistics (INS), the share of revenue from Moringa sales in a farmer's total income is estimated at 29.92%. This share is estimated at 42.8%, 34.0%, 33.3%, 23.1%, and 16.4% respectively in Niamey, Maradi,

Corresponding Author:- Boubacar Gouzae Assoumane

Address:- Department of Rural Economics and Sociology, Abdou Moumouni University, Faculty of Agronomy of Niamey, Niger.

Tillabéry, Tahoua, and Dosso, representing less than one-third of total income on average. The remaining two-thirds come largely from the sale of vegetables and food crops grown between rows of Moringa trees in agroforestry systems and in monocultures of cereals and food crops, as well as from livestock sales. A 2021 study by the High Commission for the 3N Initiative reveals that the Moringa value chain represents 1.1% of the national GDP and 2.5% of the agricultural GDP. In the municipality of Agadez, given the importance of Moringa, particularly its contribution to improving household income and food security, as well as its other uses, this study was conducted to thoroughly analyze the profitability of this crop as well as its contribution to household income.

Materials and Methods:-

Study Area:-

The urban commune of Agadez is located in the department of Tchirozerine and lies between the mouth of the Irhazer plain and the Aïr massif. With an area of 600 km², the urban commune of Agadez is the regional capital according to Law No. 2003-35 of August 27, 2003. It is bordered to the east, west, and north by the urban commune of Tchirozerine and to the south by the rural commune of Aderbissanat, and is situated between 16°56'44" North latitude and 7°57'42" East longitude (PDC, 2018).

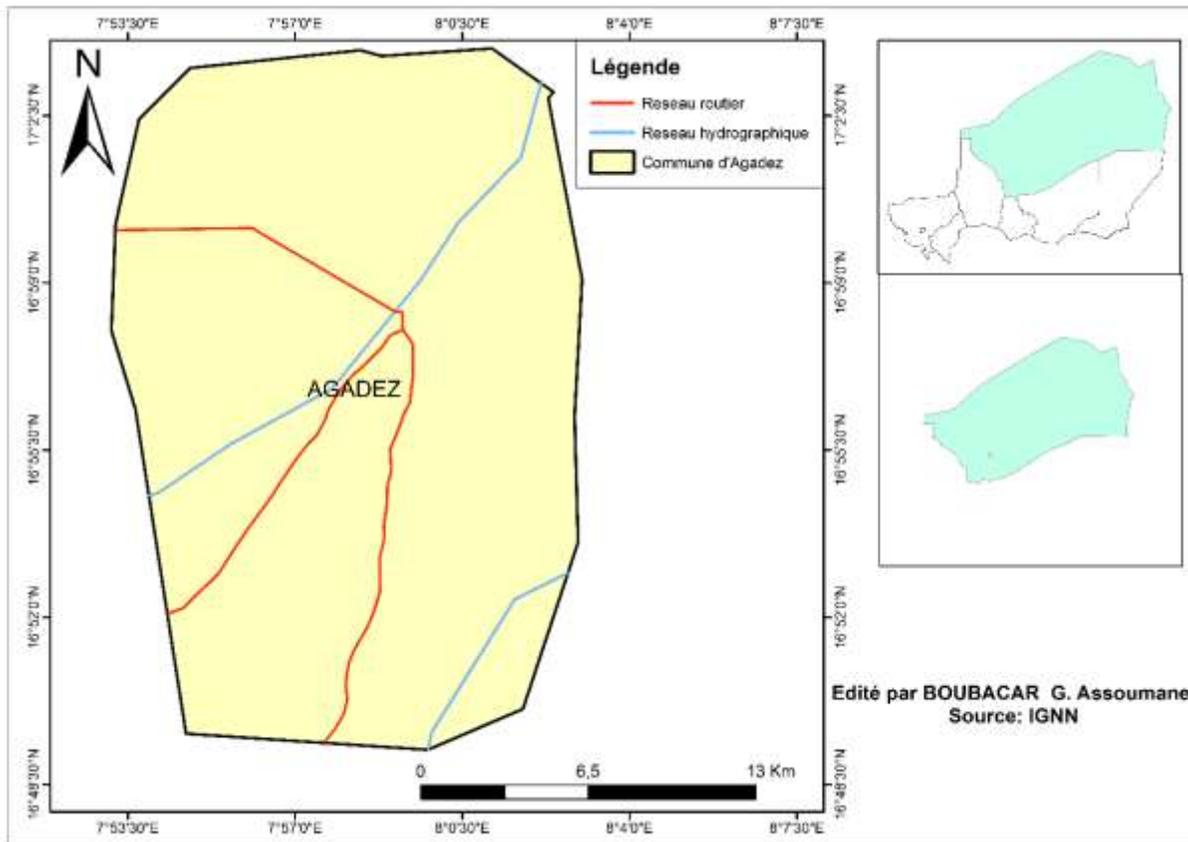


Figure 1: Study municipality

Equipment:-

The study used various materials to collect information. Specifically, data collection tools appropriate to the field were employed. The study used a questionnaire distributed to farmers for primary data collection; a car for visiting agricultural sites in the Agadez commune that produce irrigated moringa; a motorcycle for obtaining supplementary data; and a camera for taking photographs.

Methods:-**Sampling:-**

The sampling method applied at each site for this study was carried out in two stages. The first stage involved contacting technical services and farmer leaders. The collaboration of these two experienced agricultural stakeholders, who are familiar with the area, allowed us to determine the number of Moringa producers in 2023 at 459 sites in the Agadez municipality. The sampling method was simple random sampling; respondents were selected from a list, each assigned a number, giving each producer an equal probability of being chosen. The objective was to survey at least 25%, or one-quarter, of the target producers. Thus, data collection involved 115 Moringa farmers in the study area.

Table 1: Sampling of the population visited

Sites	Number of operators			Sampling		
	Men	Women	Total	Men	Women	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
ToudouN'Bila	127	20	147	32	5	37
Tchiguefene	40	0	40	10	0	10
Effective	386	73	459	97	18	115

Data Collection:-

Secondary data were collected from regional, departmental, and municipal technical services and libraries to obtain technical and general information about the study area. This data allowed for an overview of the concepts and theories relevant to the research topic. Primary data were obtained through individual interviews and focus groups. This phase involved collecting data using a questionnaire containing questions about socio-economic characteristics, financial resources, and expenses incurred in farming operations. In addition to these individual interviews, focus groups and observations were conducted to gather further information and identify missing or irrelevant data from the farmers.

Data Processing:-

All data were processed according to their nature. Means and standard deviations were calculated for quantitative variables, while proportions were calculated for qualitative variables. Descriptive statistics (frequencies, means, and standard deviations) for each variable and comparison tests of means for economic profitability elements were performed using R and SPSS software, Microsoft Excel for creating figures and tables, and Microsoft Word for word processing.

Determinantsof Economic profitabilityMoringaproductio

Some authors have attempted to define profitability and methods for its evaluation (Babacar et al., 2020). Economic profitability is a measure of a company's economic performance in utilizing all of its employed capital. Total employed capital equals the sum of equity, provided by capital providers, plus capital acquired through debt. Economic profitability is therefore independent of the type of capital financing and expresses the capacity of invested capital to generate a certain level of profit before the payment of any interest on the debt (Soumana, 2011). According to Pirou (2005), profitability is the capacity of capital to generate income. Profitability can also be defined as a company's ability to make profits over a given period. The gross margin, which is the balance of the production account, equals the value of production minus the value of intermediate consumption. Indeed, the elements below were used to determine the economic profitability of Moringa production :

➤ Gross margin (GM) is calculated as follows:**MB = Noise Product – Operational Loads (1)**

Operating costs include the amounts allocated for the purchase of seeds, organic fertilizer, cultivation costs, transportation costs, food and snack costs, the purchase of plastic bags, and the transportation costs of those bags. Gross output or revenue is obtained by multiplying the total quantity of the output by its unit price.

➤ **Net margin (MN) is the difference between gross margin (MB) and fixed costs, formulated as follows:**

$$MN = MB - \text{Fixed costs (2)}$$

Fixed costs relate to the depreciation of the following equipment: Motor pump, Gas bottle, Pipes, solar panel installation, shovel, pickaxe, hoe, hoe, knife, rakes, machete.

➤ **Linear depreciation is calculated as follows :**

$$\text{Amortization} = (n_i * P_i / D_i) \text{ (3)}$$

Or :

✚ Amortization = depreciation of equipment;

✚ n_i = the number of copies of the equipment considered at the same operator.

✚ P_i = the unit purchase price;

✚ D_i = the lifespan of the equipment.

➤ **The added value created per product (AV) is estimated according to the following formula from Fabe et al. (2009) :**

$$VA = PB - CI \text{ (4)}$$

PB represents gross product in FCFA; CI, intermediate consumption in FCFA .

➤ **Economic profitability** measures a producer's ability to create value through their activity. Its ratio is calculated as follows:

$$\text{Economic profitability ratio: (Net operating profit) / (Invested capital). (5)}$$

➤ **The rate of return (r) is obtained using the formula:**

$$r = R/I \times 100 \text{ (6)}$$

Where: R = net operating profit and I = amount of investment.

With R=VA- (Remuneration for work + Financial expenses + Taxes + Depreciation).

Note: Operators do not pay taxes or duties, and therefore do not incur financial charges. For the purposes of this study, the invested capital consists primarily of amounts invested during the year.

Results:-

Socioeconomic characteristics:-

Socioeconomic characteristics were obtained from questions on variables such as the support received by farmers, membership in farmers' organizations, the farmers' socio-professional activity, reasons for being producers, the nature of the relationship between buyers and farmers, and the type of buyers. Table 2 illustrates the description of these variables below.

Variables	Terms and conditions	Effective	Frequency
Management	Yes	19	16.5%
	No	96	83.5%
Affiliation with Peasant Organizations	Yes	19	16.5%
	No	96	83.5%
Primary activity	Market gardening	110	95.7%
	Official	1	0.9%
	Trade	2	1.7%
	Livestock farming	1	0.9%
	Craftsmanship	1	0.9%
Secondary activity	Official	4	3.5%
	Trade	29	25.2%
	Livestock farming	70	60.9%
	Market gardening	3	2.6%
	Craftsmanship	7	6.1%
	Masonry	2	1.7%

Producers' reason for being	Family	98	85.2%
	Friend	13	11.3%
	NGO	4	3.5%
Link between buyers and operators	Link in sight	57	49.6%
	Persistent link	9	7.8%
	Contractual link	23	20.0%
	Visible and persistent	25	21.7%
	Visual and contractual	1	0.9%
Buyers	Men	14	12.2%
	Women	5	4.3%
	Two at a time	96	83.5%

Table 2: Descriptive statistics of variables

Furthermore, the distribution of farmers according to the support received is illustrated in Table 2. Analysis of this table shows that 83.5% of producers received no support whatsoever; that is, they do not belong to any organization. The remaining 16.5% received training in the production and processing of Moringa, with most of the women involved in processing. This table reveals that market gardening is the primary occupation, practiced by 95.7% of farmers. Moreover, the analysis of secondary activities in the table above indicates that this population's secondary occupations are limited to livestock farming (60.9%) and small-scale trade (25.2%).

The study shows that the primary reason for becoming a producer is family (85.2%), as children are introduced to farm work from a young age. An additional 11.3% of respondents became producers through relationships with other producers. According to the research, farmers' organizations are not very developed in the area. The analysis shows that membership is very low, with only 16.5% of the producers surveyed belonging to a producer organization. 83.5% of farmers are not affiliated with any organization. Those who do belong to organizations receive training and technical support. The table above reveals that the most common type of relationship between farmers and buyers is a visual connection (49.9%). However, 21.7% and 20% of producers report having visual and ongoing relationships, respectively, and contractual relationships. According to these respondents, everyone in the same gender buys Moringa leaves. It appears in this table that 83.5% of men and women buy the production compared to 12.2% of men and 4.3% of women.

Analysis of the economics Moringa leaf production:-

Producer's operating account:-

Table 3 shows the diverse and varied expenses incurred by the farmers, as well as the revenues obtained by the surveyed farmers. Average expenses are obtained by dividing total expenses by the number of farmers. Average revenues are obtained by dividing total revenues by the number of farmers. Table 3 presents the accounts of the surveyed farmers:

Charges		Products	
Section	Amount	Section	Amount
Seeds	22308	Moringa	781723
Fertilizer	37037	Associated cultures	175957
Pesticide	23859		
Energy consumption	57285		
Manure	4955		
Day laborers	31154		
Family Labor (MOF)	80094		
Total variable costs (VC)	256692		

Permanent workers	116609		
Equipment depreciation	104672		
Total fixed costs (FC)	221281		
Total costs (CV+CF)	477793		
Operating profit	479707		
Total	957680	Total	957680

Table 3: Operating Account of the producer in FCFA

This table shows that variable costs consist of all current expenses incurred during the respondents' farming campaigns. In the context of this research, these include inputs such as manure, day laborers, and family labor for cultivation. The average variable cost is 256,692 FCFA. Fixed costs consist of permanent staff and depreciation of equipment used by the farmers. The average of these two values is 221,228 FCFA for fixed costs. The sum of these variable and fixed costs gives the total production costs (477,973 FCFA). The profit from the associated Moringa production (957,680 FCFA) exceeds the costs (477,793 FCFA), resulting in an operating profit of 479,707 FCFA for Moringa production. The account balances because the total expenses plus operating profit on the left side of the table equal the total revenue on the right. Therefore, Moringa production provides a positive economic profile for farmers in the study area.

Profitability of the economic Moringa leaf production:-

Added value created by the activity:-

Moringa production obtained by producers in the commune of Agadez is determined in Table 4.

Table 4: Added value created by the activity in FCFA

Elements	Average	Standard deviation
Noise reducer(Moringa)	781723	584012
Variable charges (VC)	209529	189738
Fixed costs (FC)	180625	163564
Added value	663002	476505

Based on the analysis of this table, the added value was determined by the difference between the gross product and intermediate consumption plus depreciation of the equipment used. For the purposes of this study, intermediate consumption includes inputs (seeds, fertilizers, pesticides, and energy consumption) and the use of organic manure. Following this calculation, the added value created by this activity averages 663,002 FCFA, with a range of approximately 476,505 FCFA.

Rate of Return:-

As a reminder, the rate of return is the ratio of net operating income to the amount of investment. The net production margin was determined by subtracting total costs per hectare from the gross output per hectare, or by subtracting fixed costs per hectare from the gross margin. These values are presented in Table 5.

Table 5: Rate of Return

Elements	Average	Standard deviation
Noise margin (MB)	572194	394274
Net Margin (NM)	391569	230710
Net operating profit	361763	186658
Profitability ratio	0.927	0.528
Rate of return (%)	92.7	52.8

Discussion:-**Socioeconomic characteristics of Moringa farms in the study area:**

Analysis of the results shows that the primary reason for becoming a producer is family (85.2%), as children are introduced to agricultural work from a young age. An additional 11.3% of respondents became producers through relationships with other farmers. These friends adopted this practice because of the income it generated. These results are consistent with those found by IDI (2021) in Maradi, where 87.7% became producers through family and 12.3% through friends. According to the study, farmers' organizations are not very developed in the area. The analysis shows very low membership rates, with only 16.5% of the producers surveyed belonging to an organization. 83.5% of farmers are not affiliated with any organization. Those who do belong to organizations receive training and technical support. Table 2 shows that market gardening is the main socio-professional activity, accounting for 95.7%. This rate of 95.7% is explained by the fact that producers are turning to market gardening, which appears to be the activity requiring fewer constraints and providing them with a significant income.

These results are consistent with those found in the PDC-Agadez (2018). Links exist between buyers and producers in the event of sales. Table 2 shows that the most common type of link between producers and buyers is a visual relationship (49.9%). However, 21.7% and 20% of producers state that they maintain visual and persistent relationships, and contractual relationships, respectively. These figures are close to those found by IDI in 2021. In Maradi, the distribution is as follows: 45% direct sales, 12% direct and ongoing sales, and 37% contractual. Direct sales account for half of the transactions, but in most cases, farmers have no choice but to sell to whoever is closest, even if they have relationships with other buyers. This is because Moringa leaves do not keep for long (at most 24 hours) after harvesting. According to the respondents, all genders purchase Moringa leaves. Table 2 shows the proportion of buyers by gender. This table shows that 83.5% of buyers are men and women, with 12.2% of men and 4.3% of women purchasing the produce. This result contrasts with that obtained by Chipkaou (2020) in Tillabéry, where 100% of buyers were women. This is explained by the fact that women and men play an important role during the harvest, especially in the sale of Moringa leaves. The first point of purchase is at the local market, where women and men buy Moringa leaves by the bundle. The purchase price is based on the number of bundles harvested. In most cases, those who buy Moringa leaves in bulk resell them at the market. Only 4.3% of women buyers process the leaves themselves. According to those involved, these purchases of all kinds foster competition among buyers, which benefits farmers because it allows them to sell at a higher price and increases the profitability of their harvests.

Analysis of the economics moringa leaf production in the municipality of Agadez:

The study notes that the gross margin was obtained by subtracting variable costs from gross revenue. This calculation yielded an average gross margin of 572,194 FCFA, with a range of approximately 394,274 FCFA. The net margin was calculated by deducting the gross margin from the total cost per hectare. This result yielded a value of 391,569 FCFA with a standard deviation of 230,710 FCFA. This figure is similar to that found by CHERIF (2010) in the Niamey urban area, which was 381,800 FCFA/ha. This is explained by the fact that Agadez is a suitable area for Moringa production, although producers in this area face enormous difficulties, namely insufficient or complete lack of water, especially during the hot, dry season, and a lack of support and necessary equipment. This leads to the determination of the net operating profit, which was calculated using a specific formula.

The result obtained is 361763 FCFA with a standard deviation of 186658 FCFA. However, economic profitability was obtained by subtracting invested capital from net operating income, where invested capital is simply the expenses incurred during the year. This calculation yielded an economic profitability ratio of 0.927, with a range around 0.528. Finally, the rate of return was calculated, which is simply the ratio of net operating profit to the investment amount, or the economic profitability ratio multiplied by one hundred. In this study, the investment amount is the sum of all production costs, including family labor. This calculation yielded an economic rate of return of 92.7%, with a dispersion of around 52.8%. This result is higher than that found by Soumana and Ali (2021) in the Djirataoua commune of Niger, which was 61.5% for the rate of return on moringa leaf cultivation. Therefore, the resulting rate of return is positive at 92.7%, meaning that the revenue generated exceeds the expenses incurred. For example, if a producer invests 5 FCFA in Moringa cultivation, they should make a profit of 4,635 FCFA. We can conclude that Moringa farms in the Agadez commune are economically viable.

Conclusion:-

In light of the above, this article aimed to analyze the economic profitability of Moringa farms in the Agadez municipality by examining various profitability indicators. This analysis was conducted using a database compiled from a survey of 115 producers. The methodological approach involved a descriptive and differential analysis of the socio-economic characteristics of the farms, their operating accounts, and the economic profitability of Moringa leaves in the study area. The analysis revealed that 95.7% of the surveyed farmers considered market gardening their primary activity, despite nearly 84% reporting that they had not received any formal training or support. This situation warrants particular attention from NGOs and the government to promote new techniques and technologies in order to prevent serious problems in the near future. The results of this study have demonstrated the significant source of food and income for producers of this tree species, with an average net income of 391,569 FCFA/ha. This income is used for food and other needs. The profitability rate achieved by moringa producers in the Agadez commune is 92.7 % . Therefore , the activity is economically viable from a capital investment perspective. This is because the rate is positive, meaning that the income generated exceeds the expenses incurred. For example, if a moringa producer invests 5 FCFA, they should receive a profit of 4,635 FCFA.

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