International Journal of Food Science and Nutrition
www.foodsciencejournal.com
ISSN: 2455-4898
Received: 06-09-2021, Accepted: 23-09-2021, Published: 07-10-2021
Volume 6, Issue 5, 2021, Page No. 95-97

Study of the growth and production of the biomass of *Moringa oleifera*

Charles W Yaméogo[1], Marcel D Bengaly[2], Aly Savadogo[2], Phylippe A Nikiéma[2], Alfred S Traoré[2]
[1] Institut de Recherche en Sciences de la Santé, Ouagadougou, Burkina Faso
[2] Université Joseph KI-ZERBO, Ouagadougou, Burkina Faso

Abstract
The objective of this study was to assess the growth and the biomass produced of *Moringa oleifera* plants.
For the study, a total of 10 plants divided to 5 plants were cultivated on two separate sites. During 50 days follow-up of the plants, the growth and biomass produced have been assessed.
The results showed that the mean height of the plants were 44.2 centimeters and 36.9 centimeters respectively for the plants of site1 and site 2. For the biomass produced for all the plants, the results showed 67.7% and 64.3% respectively for the rate of total biomass and the rate of biomass consumable.
The plants of *Moringa oleifera* had a fast growth and high production in biomass.

Keywords: *Moringa oleifera*, growth, biomass, Burkina Faso

Introduction
The *Moringa oleifera* is a tree included in the family of Moringaceae with 12 to 14 known species [1]. The *Moringa oleifera* is the most species know and used through the world[1]. In Burkina Faso, the known species is the *Moringa oleifera* which is used in the family diet [2]. It is also met in other country through Africa, Arabian, South-East Asian [3, 4]. The author Von Maydell (1986) [5] give the name of "purification tree" to this species.
Also, the *Moringa oleifera* have multiples qualities in medicine. The peels, the roots and the leaves of this tree are used in traditional medicine through the world[6]. The seeds of *Moringa oleifera* have antimicrobial and antioxydant properties. They are used effectiveness for the purification of trouble water [6, 7]. The seeds have high nutritional qualities used in sauces cooks [1, 8]. The leaves have high nutritional qualities such as proteins, sugar, Calcium, Potassium, Magnesium, Phosphorus, iron and zinc [2].
The objective of this study is to assess the growth and the biomass produced of plants of *Moringa oleifera.*

Material and methods
For the follow-up of the growth and the biomass produced, the seeds have been extracted from pods appropriated on a tree of *Moringa oleifera*. These seeds have been stored in laboratory temperature before study.

Follow-up of the growth and assessment of the biomass produced
Seeds selection and sow
The seeds of *Moringa oleifera* have been selected following the criteria: seeds of *Moringa oleifera* with ≥ 1 centimeter (cm) of diameter and no perforated.
The seeds selected have been soaked in water with 25°C during 24 hours. After this time, the seeds have been removed from water and sow on two separates sites. The dimensions of each site was 60 cm of width and 300 cm de length. The distance between these two sites was 50 cm. The sites were previously plowed and moisten with water 48 hours before. On each site have been sowed 2 seeds in 10 points with 30 cm between the points. After germination and when the plants were appearing, 5 plants by site have been selected. The total 10 plants included in the study have been moisten with local water each afternoon and during 50 days.

Speed of growth and biomass produced
The high of plants measured and the assessment of leaves and leaflets numbers have been performed each 5 days. The measurement of the high has been done with a graduated device. The numbers of leaves and leaflets have been determined after a count. Curves have been done to show the mean speed of plants growth (high by time in day) and the speed of biomass produced (number of leaves and number of leaflets by time in day).
The high has been expressed in cm.

Rate of biomass produced
It has been assessed after 50 days follow-up of the growth. Two type of rate have been defined: The rate in total biomass (RTB) and the rate in biomass consumable (RBC).
The RTB is the quotient of the mean mass of total leaflets (green and yellow leaflets) divided by the mean mass of leaves produced. The RBC is the quotient of the mean mass of consumable leaflets (green leaflets) by the mean mass of total leaflets. These values have been expressed in percentage (%).

Data analyses
The data have been entered and analyses using Epi Info version 6.04 software. The statistical analyses have been done with significant threshold of 5%.

Results
Evolution of growth and biomass produced of the plants
A total of 10 plants of *Moringa oleifera* divided in 5 on two

sites have been used to assess the growth and the biomass produced. In the table 1 have been show the results.

The analyses of means values showed a positive evolution of the high with the time. We found most remarquable growth of the plants from site 1 than site 2. The means high after 50 days were 44.2 ± 8.6 cm et 36.9 ± 3.8 cm respectivelly for the site 1 and site 2. However, these two values are not different statisticaly (P = 0.1080).

In the table 2 have been show the means values of the leaves produced. The mean number of leaves produced showed a positive evolution with the time. The mean number of leaves is not different between the two site (9 and 9.4, p=0.3157) (table 2). We found for certains plants from site 1, a decrease of the leaves number with the time (between the 25 and 30 days or 35 and 40 days). But none of the variation between the 40 and 45 days. The simillary results on leaves number decrease have been found for the site 2 (between 30 and 35 days, or 35 and 40 days). These decrease in the leaves number is non-significant for the site 1 with P=0, 6435 and P=0, 7837 respectively for the leaves number between 25 and 30 days or 35 and 40 days. For the site 2, we found a non-significant decrease of leaves number between 30 and 35 days (P=0.7329) or 35 et 40 days (P=0.6853). In the table 3 have been show the mean number of leaflets produced with the time. We found an increase of the mean number of leaflets with the time (table 3). The mean number of leaflets found in 50 days for the site 1 was 414.6. This number was higher than the mean number of leaflets from the site 2 which was 346.6. However, these two means were not different statisticaly (p=0.2880).

The figure 1 show the evolution curves of the high of plants and the biomass produced with the time for the all 10 plants. The analyses of the curves of growth and biomass produced showed a positive correlation between the plants growth and the biomass produced. We found with the curves, that the mean number of leaflets produced increase positively with the mean high of the plants. The curve of leaves produced increase also positively with the time.

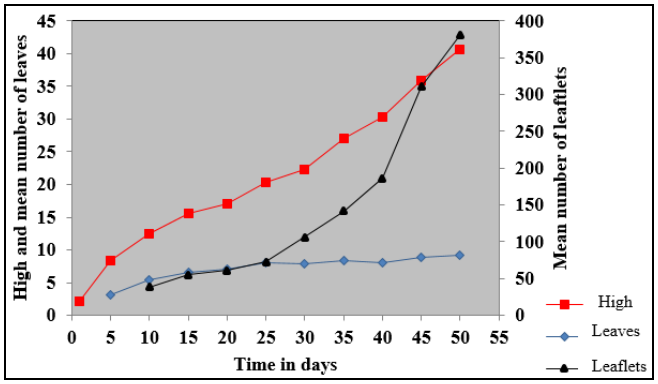

Fig 1: Curves of growth and biomass produced with the time

Rate in biomass produced

In the table 4 have been show the results of the RTB and RBC. We found for all individual plant, a rate more than 50% in RTB and RBC. Means rates of 71.6% and 63.8% in RTB have been found respectively for the site 1 and site 2 (table 4). Means rates of 69.6% and 58.9% in RBC have been found respectively for the site 1 and site 2. The means RTB and RBC for all the plants were respectively 67.7% et 64.3%.

Table 1: Means values ± Satandart deviation (SD) of the high of plants

Time in days	Site 1 (5 plants)	Site 2 (5 plants)	comparison test
	Mean high ± SD	Mean high ± SD	P values
d 1	2.2 ±1.3	2.2 ± 2.1	ID
d 5	7.9 ± 2.9	8.7 ± 0.9	0.4855
d 10	12.8 ± 2.1	12.0 ± 1.4	0.4920
d 15	16.0 ± 2.7	15.1 ±1.2	0.5206
d 20	17.8 ± 2.9	16.2 ± 0.8	0.6815
d 25	22.1± 1.9	18.5 ± 1.4	0.0516
d 30	24.1 ± 2.4	20.4 ± 2.4	0.0312
d 35	28.9 ± 4.4	25.1 ± 4.1	0.1864
d 40	33.1 ± 5.3	27.5 ± 2.8	0.0586
d 45	39.2 ± 7.1	32.7 ± 4.2	0.1035
d 50	44.2 ± 8.6	36.9 ± 3.8	0.1081

ID: Indetermined

Table 2: Means values ± SD of the number of leaves produced

Time in days	Site 1 (5 plants)	Site 2 (5 plants)	comparison Test
	Mean number of leaves ± SD	Mean number of leaves ± SD	P values
J1	ID	ID	ID
J5	3.4 ± 0.1	3.0 ± 0.7	0.3236
J10	5.6 ±1.1	5.4 ± 0.5	0.7177
J15	6.8 ± 0.8	6.2 ± 0.8	0.2586
J20	7.2 ± 0.8	6.8 ± 0.4	0.3370
J25	7.8 ± 0.8	8.2 ± 0.4	0.3370
J30	7.6 ± 0.5	8.2 ± 0.8	0.1804
J35	8.6 ± 1.3	8.0 ± 1.0	0.4292
J40	8.4 ± 1.3	7.8 ± 0.4	0.3768
J45	8.4 ± 1.3	9.2 ± 1.1	0.3142
J50	9.0 ± 0.3	9.4 ± 0.8	0.3157

ID: Indetermined

Table 3: Means values ± SD of leaflets number produced

Time in days	Planche1 (5 plants)	Planche2 (5 plants)	Comparison Test
	Mean number of leaflets ± SD	**Mean number of leaflets ± SD**	**P values**
d 1	ID	ID	ID
d 5	ID	ID	ID
d 10	38.0 ±15.1	38.8 ± 10.7	0.9245
d 15	55.8 ± 13.8	54.2 ± 11.8	0.8470
d 20	66.2 ± 15.0	55.6 ± 9.2	0.2028
d 25	77.8 ± 17.8	67.2 ± 16.0	0.3415
d 30	104.2 ± 17.4	107.6 ± 25.4	0.8091
d 35	146.4 ± 50.7	137.8 ± 36.8	0.7641
d 40	216.2 ± 86.4	156.6 ± 33.2	0.1754
d 45	331.6 ±161.7	290.2 ± 82.8	0.2880
d 50	414.6 ± 110.3	346.6 ± 80.9	0.6195

ID: Indetermined

Table 4: Rate in biomass produced

Plants N°	Site 1		Site 2	
	RBT (%)	**RBC (%)**	**RBT (%)**	**RBC (%)**
1	65.7	65.1	64.0	53.8
2	64.8	64.8	67.0	60.8
3	58.5	56.2	63.5	55.3
4	77.0	75.3	69.4	63.3
5	91.8	86.6	65.4	61.6
Means ± SD per site	71.6 ± 13.1	69.6 ± 11.7	63.8 ± 2.8	58.9 ± 4.2
Means ± SD for two sites	RTB (%) = 67.7 ± 9.8 RBC (%) = 64.3 ± 1			

RTB: rate in total biomass,
RBC: rate in biomass consumable

Discussion

The decrease of the leaves number for some plants with the time can be explain that from 25 days of growth, the leaves located at the bottom site of the plants and the leaflets became yellow were fall down. These yellow leaflets are due to a deficiency in the leaflets. The deficiency in azote, phosphorus, iron and magnesium lead to yellowing of leaflets due to a blocking of the chlorophyll synthesis [10]. This phenomenon leads to a loss of leaflets nutritional values. The increase in high from 2 to 5 cm on only 5 days and the mean high of 40.5 cm found after 50 days showed that the plants of *Moringa oleifera* are species with a fast growth. This high of the plants found in this study is more than those found by Manh et *al*. (2003) [11] which was 30.3 cm. The biomass produced has increased with the time. An increase in the leaflets produced has been found between 5 to 125 on only 5 days. These results show that the plants of *Moringa oleifera* have a good rate of biomass produced and specificaly the leaflets which are the consumable part of the leaves. An analyze of the curves show that more the plants are growthing more the biomass produced is important. A comparison of RTB and RBC show a great production of biomass for the plants from site 1 than site 2. Then, the quantity of biomass produced depend of the stage of growth because. The RTB and RBC found were satisfactory.

This study shows the *Moringa oleifera* as a specise with great growth performance. The plants have an important biomass produced. This biomass can contribute to solve the problem of food insecurity in the families in low income country.

Acknowledgements

We thank Dr Dianou Dayeri for his help to acquire necessary material for conducting this study.

We thank Mr Kaboré Dieudonné for his help in the laboratory.

References

1. Lalas S, Tsaknis J. Characterization of Moringa oleifera seed oil variety Priyakulam-1. J. Food Compos. Anal,2002:15:65-77.
2. Yaméogo CW, Bengaly MD, Savadogo Aly, Nikiema PA, Traore SA. Determination of Chemical Composition and Nutritional Values of Moringa oleifera Leaves Pakistan Journal of Nutrition,2011:10(3):264-268.
3. Morton JF. The horseradish tree, *Moringa pterigosperma* (Moringaceae). A boon to arid lands Econ. Bot,1991:45:318-333.
4. Somali MA, Bajnedi MA, Fhaimani AL. Chemical composition and characteristics of *Moringa peregrina* seeds and seed oil. J. Am. Oil Chem. Soc,1984:61:85-86.
5. Von Maydell HJ. Trees and shrubs of the Sahel, their characteristics and Uses, Deutsche Gesellschaft fur Technische Zusammenarbeit, Eschborn, Germany, 1986, 334-337.
6. Anwar F, Latif S, Ashraf M, Gilani AH. *Moringa oleifera*: a good plant with multiple medicinal uses. Phytother Res,2007:21(1):17-25.
7. Ndabigengeser A, Narasiah KS. Use of *Moringa oleifera* seeds as a primary coagulant in waste water treatment, Environ. Technolol,1998:19:789-800.
8. Anwar F, Banger MI. Analytical characterization of *Moringa oleifera* seed oil grown in temperate regions of Pakistan. J. Agric. Food chem,2003:51:6558 -6563.
9. Heller R, Esnaul TR, Lance C. Physiologie végétale 1. Nutrition. ISBN 210003911, 1998, 323.
10. Manh LH, Nguyen ND, Xuan TV. Biomass production of *Moringa oleifera* and some legumes in the hilly area of Tinh Bien district, An Giang province. In: proceeding of final national Seminar. Retrieved, 2003, 3. from http: www.mekan.org/sare.03amanhc.