International Journal of Research in Agriculture and Forestry
Volume 3, Issue 9, September 2016, PP 22-31
ISSN 2394-5907 (Print) & ISSN 2394-5915 (Online)

Effect of the Combination of the Layout and Cutting Level of Plants of *M. Oleifera* on the Leaves Biomass Productivity of the Species

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ABSTRACT

The effect of the combination of factors layout and plant cutting level of M. oleifera in the species leaves biomass productivity was studied The results of this study have shown that the optimal production period of M. oleifera leaves biomass is in the rainy season. It also appears from this study that the treatments had a more or less interesting effect on leaves biomass productivity. The linear adjustment patterns obtained best explain the variability of the productivity in biomass of M. oleifera plants depending on the date of collection with more than 50% of the inertia

Keywords: *M. oleifera, layout, cutting level, Yield*

INTRODUCTION

For centuries, African farmers deliberately leave trees in their fields because of some of their properties, thus constituting veritable agroforestry systems with remarkable stability. Many scientific studies (ANAFE-RAFT Sahel, 2006) showed the interest given to this land use mode. According to Ong et al. (1991), the ecological interactions between trees and crops are beneficial because woody has an effect on soil fertility through the fixation of atmospheric nitrogen (N2) for legumes, organic matter production, recycling of soil nutrients through the leaves of trees; they also protect the soil against erosion (Wiersum, 1991) and therefore improve crop yields. In order to harmonize the tree-crop association and to benefit all components, crops are often practiced in tree alleys forming systems called intercropping systems. Studies conducted by Thevathasan and Gordon (1997) have shown that these systems can help to increase theorganic matter returns to the soil, compared to agricultural systems, due to residues of the aboveground biomass of trees and in situ decomposition of roots. Similarly, humus from deciduous trees litter are often excellent quality and can be managed as true fertilizers, which can induce a reduction of the application of inorganic fertilizers. However, their soil incorporation requires the implementation of specific technical routes (Baldy et al. 1993). Several studies have been conducted with the objective to evaluate the effect of the tree on the productivity of intercropping. Indeed, as the tree-crop interface may have complementary effects, as it may present competition effects (Jose et al., 2007). Jose et al. (2004) revealed that in United States, competition of trees for water can become critical as to reduce significantly the productivity of intercropping.

Reynolds et al. (2007) and Rivest et al. (2009) showed that in Ontario and Quebec, the decrease in the yield of crops such as soybeans and corn near trees is usually assigned to their shade. Gbemavo et al. (2010) studied the influence of shading on shea cotton cultivation. These authors found a significant difference between the mean number of plants / m² and the average number of branches laden with cotton bolls per plant of which are lower in shea 24.07% and 27.26% respectively. Also the number of capsules per plant cotton decreased by 28.46% on average in shea crown. Abundant in the same direction, Rivest et al. (2009) analyzed the effect of three clones and hybrid poplars on different soybean productivity parameters for two growing seasons. Drawing up an experimental synthetic paper to acquire technical and economic references on the operation of agroforestry systems Balandier (1999) made the case of different forms of association studied to obtain a better understanding of the mechanisms involved during the interaction between a tree and a culture, to model these interactions to determine on the long-term evolution of the system and thus choose the most complementary species in these types of association.

Today, the association also applies to fruit trees and vegetable crops. Thus, in Niger there is a introduction of increasingly growing trees like *Manguiferaindica*, *Caricapapaya*, *Cocos nucifera, Phoenix dactylifera*, *Psidiumguajava*, *Cituslimon*,*Citrus sinensis*, *Moringaoleifera*in the spaces devoted to vegetable crops and , Conversely.

Thus, according to Saint Sauver(1997) integration of *M. oleifera* in land use systems date of the years 1983-1984 in the river valley and more than fifty (50) years in the Goulbi of Maradi. For Gamatié(2005) these sites are the main producing areas of *M. oleifera* leaves in Niger. Originally *M. oleifera* was introduced in orchards in Maradi before being introduced gradually into the shallows dedicated to the production of Maize and Sorghum (SaintSauver, 1997). By then it was integrated in the irrigated perimeter of Djirataoua bordering parcels to be associated with vegetable crops. In the river valley, the *M. oleifera* has integrated cereal cropping systems since its introduction in the area and eventually supplant (SaintSauver, 1997).

M. oleifera was especially introduced in the orchards of the river valley for its socio-economic importance. Today, both in the river valley than in the Goulbiof Maradi, there has been an upsurge in land use systems integrating concomitantly or sequentially *M. oleifera* and vegetables, main activity of some operators. Therefore, the productivity of these systems depend on components in place otherwise the fresh leaves of *Moringa oleifera* products and crops that are associated with it. Thus, to improve the yield of leaf biomass of *M. oleifera* among others operators practice several cutting levels on the plants. In addition the spacing between plants is another parameter on which operators rely to optimize production in leaf biomass.

Moreover, the leaves of *Moringa oleifera* are much prized by the Nigerien population and for Mawouma et al. (2014) the reasons for the consumption of *M. oleifera* leaves fall broadly into three factors: food tradition of the household, the organoleptic quality of leaves (taste), and andnutritional virtuesassociated with them. Several authors whose Quashie et al, (2009). Mawouma et al., (2014) and Njehoya et al. (2014) showed how thepeople accorded interest to the production and consumption of leaves of *M. oleifera*.

However few studies have been conducted in the part of the evaluation of the productivity of technical components of these systems. That's why this study was to investigate the effect of some treatments on *M. oleifera* in fresh leaves biomass yields of the species. Indeed, before the installation of vegetable crops the farmers practice cuts on *M. oleifera* seedlings at different levels. It impute to this study to evaluate the effect of the combination of both two factors namely the layout and plant cutting level of *M. oleifera* performance in leaves biomass of the species. The results that will come from this study will make to purpose a combination of layout and the cutting level on *M. oleifera* seedlings to improve engineering productivity in leaves biomass of *M. oleifera* in these systems.

MATERIAL AND METHODS

Study Zone

The test was conducted on-farm in the five district of Niamey (Niger), located at the right bank of the Niger River. The climate is Sahelian with an average rainfall of 550mm / year and average temperatures fluctuating between 23 ° C and 37 ° C (INS, 2014).

Experimental Device

The study is to verify the effect of the combination of the layout and the cutting level on*M. oleifera*plants on the yield of leaves biomass of the species. Thus two (2) factors were studied.

The factor (A) layout of *M. oleifera*plants: There are three (3) levels: Level 1: *M. oleifera*plants were placed at a distance of one meter on the line and between the lines of *M. oleifera*; Level 2: *M. oleifera*plants were placed at a distance of one meter on the line and two meters between rows of plants of *M. oleifera*; Level 3: *M. oleifera*plants were arranged in hedge. Two rows of two lines were used at a distance of one meter on the line and between the lines of hedges and a spacing of two (2) meters between the hedges.

The factor (B) cutting level on *M. oleifera*plants: This factor has two levels: Level 1: M. oleifera plants were cut to 0.5 m above the ground; Level 2: *M. oleifera*plants were cut at 1m from the ground. These cuttinglevels represent those normally practiced by operators.

Each level of the factor (A) was combined with each of the two levels of the factor (B) giving six (6) treatments each corresponding to an experimental unit of 20 m² with five (5) repetitions. The device used is that of a randomized complete block.

Operation and Crop Management

Sowing took place on August 18th two thousand and thirteen with three seeds per hill. Two weeks after germination the less vigorous plants were uprooted. When the plants of *M. oleifera* had four months it has been made the first cut and then followed by two more cuts. Cutting periods coincide with those used by operators and correspond to the installation period of vegetable crops associated with *M. oleifera*. After each cut it was processedan application of organic manure with two bags per experimental unit. Irrigation was made at the request and was very variable depending on the season. Phytosanitary treatment was also made to the request to prevent the destruction of production by caterpillars which are major pests of *M. oleifera* leaves.

Data Collection

In total, the study included 30 experimental units. At each observation it was proceed to sample the fresh leaves produced on the entire unit and weigh that amount. Since the production time varies depending on the season, observations were made on demand. This time can be two weeks when the production is very good for a month or more when production is very low. The quantities of fresh leaves weighed were reported per hectare.

Moreover, to achieve optimal production quantity flowers are also removed because otherwise they would evolve in fruits and compromise the foliar biomassproduction.

Statistical Analyses

They focused on the yieldin leaves biomass of *M. oleifera*. To standardize the population and stabilize the variances of numerical values collected on yield datawere transformed into square root values. The comparison of means was made by ANOVA test. The software used for statistical analysis are Ri386 2.15.3et Minitab Version 16.

In order to determine the effect of different treatments on the development of leaves biomass as a function of date a linear regression was performed. To validate the models achieved with the treatments, it was first conducted an audit of the overall significance of the model and coefficients. Then the normality tests, the nullity of the average, homogeneity of variances and autocorrelation studentized residues generated by the settings have been made.

RESULTS

Effect of Treatments Applied to the Evolution of the Quantity of Leaves Biomass

The effect of treatment on the evolution of leaves biomass productivity of plants *M. oleifera* is given in Figure 1. In fact, the plants of *M. oleifera* underwent three rounds of cuts. The first has taken place in December 2013, the other two respectively in October 2014 and 2015. From this figure remains low production during the cold dry season (December to February) and then gradually evolves during the hot dry season (March to May) to reach its peak in August. Also the curves representing the different treatments have the same tendencies.

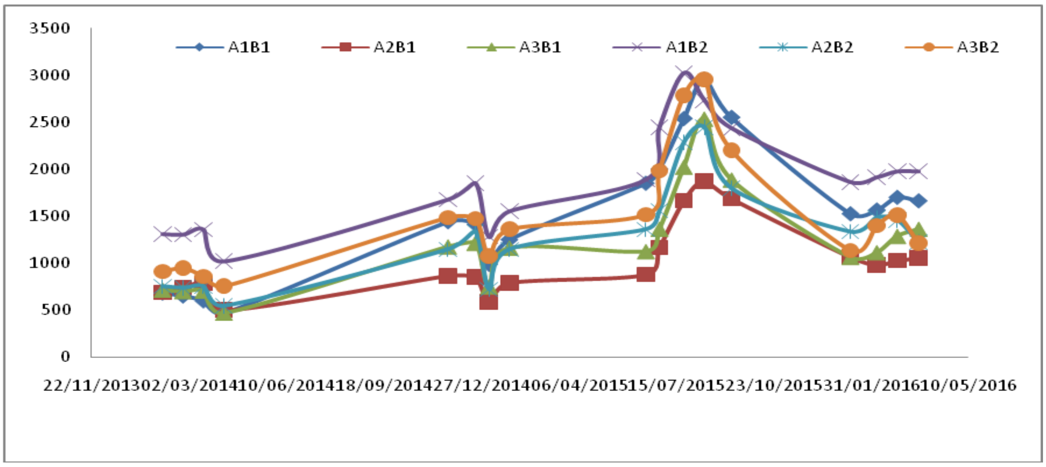
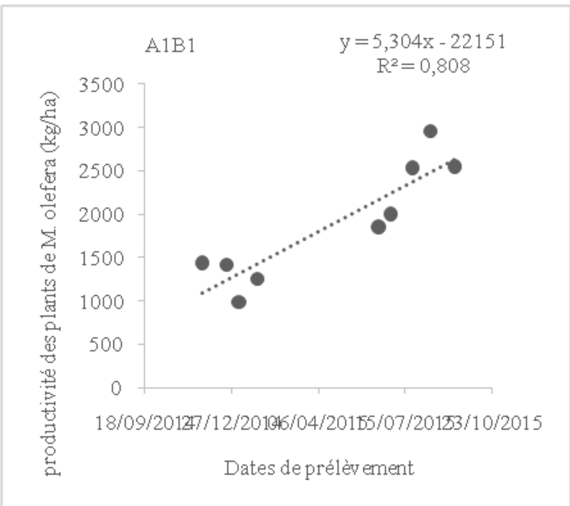


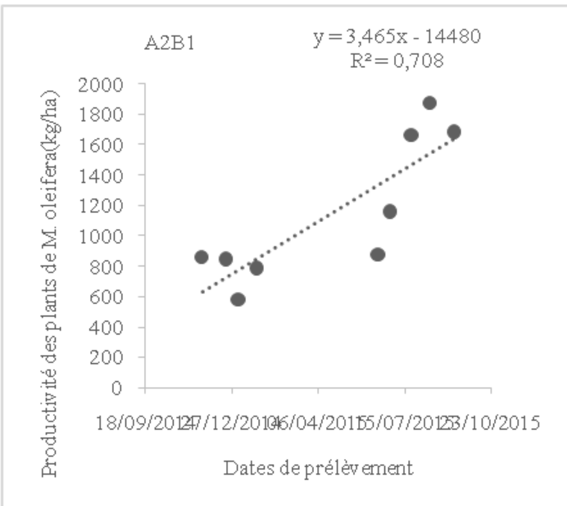
Figure1. *Effect of treatments on the evolution of the production of leaves biomass of M. oleifera*

Legend: A1B1: M. oleifera plants are spaced by one meter on lines and between the rows of M. oleifera and are cut to 0.5 m above the ground; A1B2: M. oleifera plants are spaced by one meter on lines and between the rows of M. oleifera and are cut to 1 m above the ground; A2B1: M. oleifera plants are spaced by one meter on lines and two meters between the rows of Moringa oleifera plants and are cut to 0.5 m above the ground; A2B2: M. oleifera plants have are spaced by one meter on lines and two meters between the rows of plants M. oleifera and are cut to 1m above the ground; A3B1: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 0.5m above the ground ; A3B2: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 1m above the ground.

Effect of Treatments on the Linear Correlation between the Productivity in Leaves Biomass of M. Oleifera Plants and the Collection Date

To better understand the effect of treatments on the linear correlation between the productivity in leaves biomass of plants of *M. oleifera* and sampling date, only the observer data between the second and third cut were considered. Thus, Figure 2 provides linear adjustments with coefficients of determination. The analysis of these coefficients of determination shows that all models explain the variability of the productivity in biomass of *M. oleifera* plants depending on the date of collection with more than 50% of the inertia and the analysis in. Table 1 stresses that these models are globally significants. The joint analysis of this table and this figure shows that the equations of all models best fit their respective clouds.





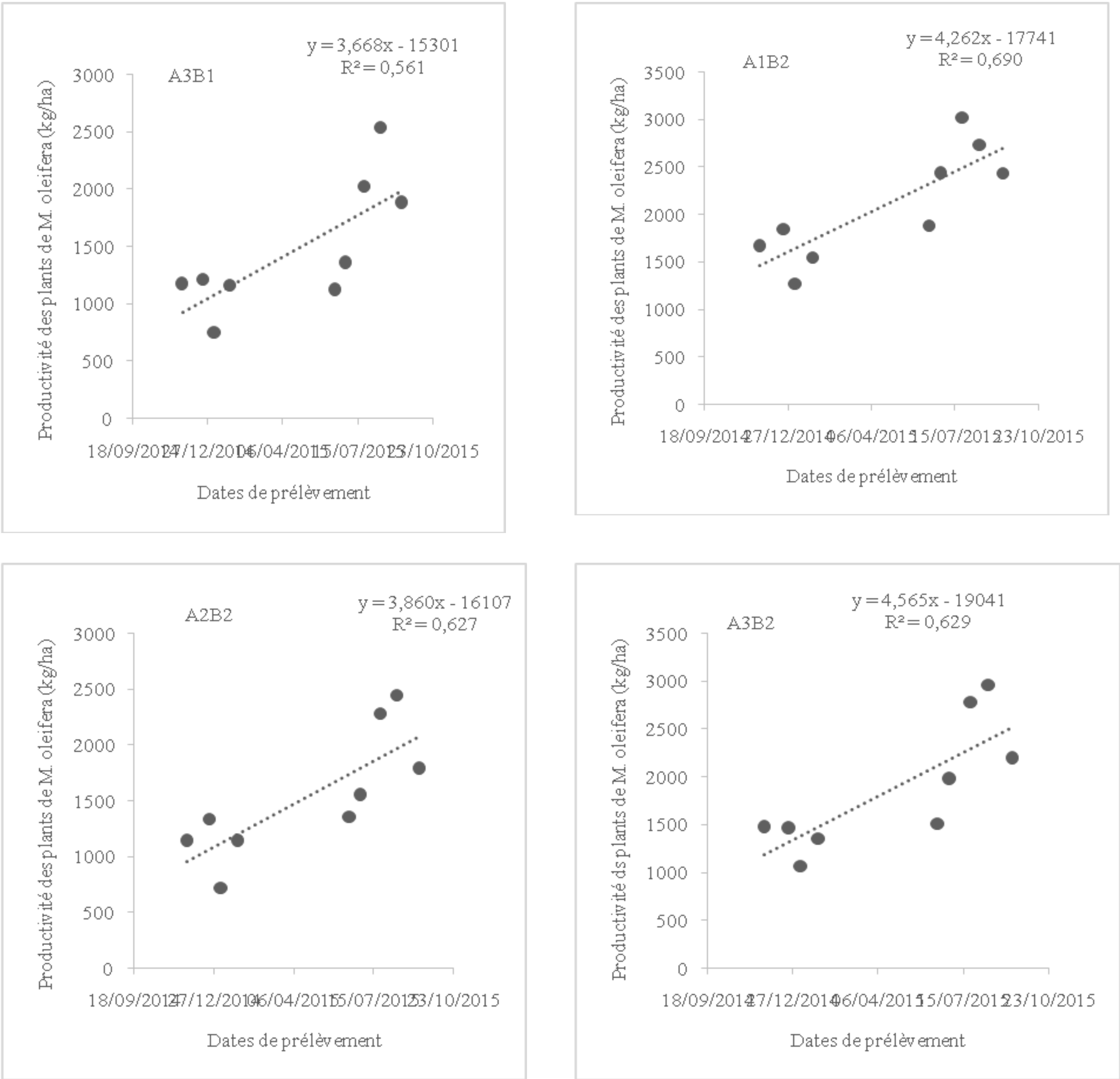


Figure2. *Effect of treatments on the linear correlation between the productivity of plants of M. oleifera and the sampling date*

Legend: A1B1: M. oleifera plants are spacedby one meter on lines and between the rows of M. oleifera and are cut to 0.5 m above the ground; A1B2: M. oleifera plants are spaced by one meter on lines and between the rows of M. oleifera and are cut to 1 m above the ground; A2B1: M. oleifera plants are spacedby one meter on lines and two meters between the rows of Moringa oleifera plants and are cut to 0.5 m above the ground; A2B2: M. oleifera plants have are spacedby one meter on lines and two meters between the rows of plants M. oleifera and are cut to 1m above the ground; A3B1: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 0.5m above the ground ; A3B2: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 1m above the ground.

Table1. *Valeurs de la probabilité (p) pour les différents tests de validation des modèles en fonction des traitements effectués*

treatments	**significances**	**studentizedresidues**			
		Normality	Nullityof the average	Homogeneity of variance	Auto correlation
A1B1	0,0009	0,37	0,87	0,74	0,05
A1B2	0,005	0,20	0,96	0,86	0,09
A2B1	0,004	0,93	0,95	0,31	0,04

A2B2	0,01	0,47	0,97	0,71	0,15
A3B1	0,02	0,62	0,95	0,43	0,08
A3B2	0,01	0,64	0,99	0,64	0,08

Legend: A1B1: M. oleifera plants are spaced by one meter on lines and between the rows of M. oleifera and are cut to 0.5 m above the ground; A1B2: M. oleifera plants are spaced by one meter on lines and between the rows of M. oleifera and are cut to 1 m above the ground; A2B1: M. oleifera plants are spaced by one meter on lines and two meters between the rows of Moringa oleifera plants and are cut to 0.5 m above the ground; A2B2: M. oleifera plants have are spaced by one meter on lines and two meters between the rows of plants M. oleifera and are cut to 1m above the ground; A3B1: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 0.5m above the ground ; A3B2: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 1m above the ground.

Treatments Effect on Average Productivity in Leaves Biomass of M. Oleifera Plants

The quantities of leaves biomass were sampled and weighed and reported per hectare throughout the experiment. These samples were taken when allowed by leavesbiomass production. The effect of treatments on average productivity of *M. oleifera* plants is given in Table 2. Indeed, according to this table unlike the average productivities in leaves biomass of *M. oleifera*plants is not significant between treatmentsA1B1, A1B2, A2B2 and A3B2 one hand and between the treatment A1B1, A2B1, A2B2, A3B2 and A3B1 other. Average productivity in leaves biomass of *M. oleifera*plants of treatment A1B2 is more important than those of treatments A3B1and A2B1. The most minimal amounts during production are observed for the treatmentsA1B1 and A3B1 (ie 469 kg / ha) and the highest minimum quantities are observed for the A1B2 treatment (1016 kg / ha) which also has the maximum amount the higher. Lowest maximum is observed for treatment A2B1.

Table2. *Effect of treatments on average productivity in leaves biomass of M. oleifera*

Treatments	Average	Minimum	Maximum
A1B1	1520±722(37,86)*ab*	469	2955
A1B2	1858±553(42,66)*a*	1016	3025
A2B1	1008,5±392,9(31,42)*b*	494,8	1875
A2B2	1302±533(35,37)*ab*	547	2450
A3B1	1214±531(34,11)*b*	469	2538
A3B2	1506±641(38,05)*ab*	755	2963

Averages followed by the same letter are not significantly different; numerals in parentheses are the averages from the numerical values converted into square root values.

Legend: A1B1: M. oleifera plants are spaced by one meter on lines and between the rows of M. oleifera and are cut to 0.5 m above the ground; A1B2: M. oleifera plants are spaced by one meter on lines and between the rows of M. oleifera and are cut to 1 m above the ground; A2B1: M. oleifera plants are spaced by one meter on lines and two meters between the rows of Moringa oleifera plants and are cut to 0.5 m above the ground; A2B2: M. oleifera plants have are spaced by one meter on lines and two meters between the rows of plants M. oleifera and are cut to 1m above the ground; A3B1: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 0.5m above the ground ; A3B2: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 1m above the ground.

Treatments Effect on Average Productivity in Leaves Biomass of M. Oleifera Plants between Cutting

The plants of *M. oleifera* underwent a total of three (3) sections. Table 3 shows the average productivities after cutting. According to this table after the first cut the treatment A1B2 is by far the one with the best performance. As against the treatment A1B1 is less productive than treatment A3B2, yet they are not significantly different from treatments A2B1, A2B2 and A3B1.

After the second cut, in other one year after the first, the treatment A1B2 was only more efficient than the treatment A2B1. This is not statistically different from treatments A3B1 and A2B2. Also the treatments A1B1, A2B2 and A3B2 are not significantly different from one hand, as treatments A1B1, A1B2, A2B2, A3B2 and A3B1are not significantly different in other.

After the third cut the treatment A1B2 still has the best performance. Also the treatments A1B1 and A2B2 are significantly different astreatmentsA2B2, A3B1 and A3B2 from one hand and A2B2 and A3B1 in other.

Table3. *Effect of treatments on leaves biomass productivity of M. oleifera plants according to time*

Treatments	Average 1	Average 2	Average 3
A1B1	600.3 ± 94.2(24.44)*c*	1803±569(41.99)*ab*	1613.1±81.8(40.154)*b*
A1B2	1244.8 ±154.6(35.23)*a*	2047±487(44.96)*b*	1931.3±54.5(43.943)*a*
A2B1	671.9 ±124.8(25.83)*bc*	1112 ±390(32.91)*c*	1028.8±37.6(32.070)*d*
A2B2	699.2±101.8(26.39)*bc*	1488± 466(38.15)*abc*	1378.1±121.4(37.096)*bc*
A3B1	645.8 ±118.2(25.32)*bc*	1389±481(36.82)*bc*	1206.3±142.0(34.686) *cd*
A3B2	868.5 ± 83.8(29.44)*b*	1702±607(40.71)*ab*	1315.6±171.5(36.214)*c*

Averages followed by same letter on the same column are not statistically different. Numerals in parentheses are the averages from the numerical values converted into square root values. Averages 1, 2 and 3 are respectively those of productivities after 1st, 2nde and 3rd cutting.

Legend: A1B1: M. oleifera plants are spaced by one meter on lines and between the rows of M. oleifera and are cut to 0.5 m above the ground; A1B2: M. oleifera plants are spaced by one meter on lines and between the rows of M. oleifera and are cut to 1 m above the ground; A2B1: M. oleifera plants are spaced by one meter on lines and two meters between the rows of Moringa oleifera plants and are cut to 0.5 m above the ground; A2B2: M. oleifera plants have are spaced by one meter on lines and two meters between the rows of plants M. oleifera and are cut to 1m above the ground; A3B1: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 0.5m above the ground ; A3B2: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 1m above the ground.

Treatments Effect on the Evolution of the Average Productivity in Leaves Biomass of M. Oleifera Plants after Cutting

Table 4 shows the effect of treatments on the evolution of the average productivity in leaves biomass of *M. oleifera* plants after cutting. The analysis of this table shows that the average productivity after the second cut is above average productivity after the first cut for all treatments except for the treatment A2B1 for which the evolution of productivity remained insignificant between different cuts. The evolution of average productivity between the second and third cut is not significant for all treatments. Also, for treatment A1B2, A3B1 and A3B2 average productivity is significantly different after the third cut and after the first and third cutting.

Table4 *Effect of treatments on the evolution of M. oleiferaplants leaves biomass average productivity after cut*

Treatments	Average 1	Average 2	Average 3
A1B1	600.3 ± 94.2(24.44)*b*	1803±569(41.99)*a*	1613.1±81.8(40.154)*a*
A1B2	1244.8 ±154.6(35.23)*b*	2047±487(44.96)*a*	1931.3±54.5(43.943)*ab*
A2B1	671.9 ±124.8(25.83)*a*	1112 ±390(32.91)*a*	1028.8±37.6(32.070)*a*

A2B2	699.2±101.8(26.39)*b*	1488± 466(38.15)*a*	1378.1±121.4(37.096)*a*
A3B1	645.8 ±118.2(25.32)*b*	1389±481(36.82)*a*	1206.3±142.0(34.686) *ab*
A3B2	868.5 ± 83.8(29.44)*b*	1702±607(40.71)*a*	1315.6±171.5(36.214)*ab*

Means followed by the same letters in the same row are not statistically different. Numerals in parentheses are the averages from the numerical values converted into square root values. Averages 1, 2 and 3 are respectively those of productivities after 1st, 2nde and 3rd cutting.

Legend: A1B1: M. oleifera plants are spaced by one meter on lines and between the rows of M. oleifera and are cut to 0.5 m above the ground; A1B2: M. oleifera plants are spaced by one meter on lines and between the rows of M. oleifera and are cut to 1 m above the ground; A2B1: M. oleifera plants are spaced by one meter on lines and two meters between the rows of Moringa oleifera plants and are cut to 0.5 m above the ground; A2B2: M. oleifera plants have are spaced by one meter on lines and two meters between the rows of plants M. oleifera and are cut to 1m above the ground; A3B1: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 0.5m above the ground ; A3B2: M. oleifera plants were arranged in two rows of hedges with a spacing of one meter between the rows and on rows of hedges and a spacing of two (2) meters between the hedges and M. oleifera plants are cut to 1m above the ground.

DISCUSSION

The treatments induced the same evolutionary trend of leaves biomass productivity of the of *M. oleifera*plants. This trend shows that the leaves biomass production is higher in the rainy season and less in cold dry season. This shows that *M. oleifera* is a long day species that likes so sunny days. These results are in perfect harmony with the origins of the species. Indeed, *M. oleifera* is a fast growing plant, a native of the North West region of India and south of the mountains of the Himalayas, but believeth well in tropical climates (Makkaret Becker, 1996). According Fuglie and Sreeja (2001) it supports well enough temperatures and high rainfall and tolerates a variety of soils.

Also during the rainy season, the plants of *M. oleifera* are less bothered by fungus and caterpillars which are its main pests. Another factor explaining the lower of leaves biomass in productivity during the cold dry season is fruits production. Indeed, it is this season which is the main period of *M. oleifera* fruit even if the species can produce on a good part of the year as during the main year.

Moreover, between two cuts, treatments showed a linear correlation between the leaves biomass productivity of the plants of *M. oleifera* and the sampling date. Indeed production increased over time for all treatments. This explains the positivity of the correlation. This comforts the idea that the more the leaves of *M. oleifera* are taken more leaves biomass production increases. This linear correlation between leaves biomass productivity of plants of *M. oleifera* depending on the sampling date is influenced neither by the level of cut or by the arrangement of plants of *M. oleifera*. The overall significance of all the models obtained as the determination coefficients consistent with this expectation.

The results showed that the treatments had any effect on average productivity in leaves biomass plants of *M. oleifera*. These effects are much more noticeable between the treatment A1B2 and A2B1 and A3B1 treatment. This can be explained by plant density of *M. oleifera* is higher for treatmentsA1B2 then A2B1 and A3B1. Indeed, plant density of *M. oleifera* is 12500 plants / ha, 7500 plants / ha and 10,000 plants / ha respectively for A1B2, A2B1 and A3B1. This assumption can be supported by the non-significance of the difference of biomass productivity between treatments Athat carried the same number. These results corroborate those obtained by Rabo Y. et al. (2016b). This author has shown that agroforestry systems of *M. oleifera* in the the Goulbi of Maradi which are more dense in *M. oleifera*plants are on average more productive leave biomass than the river valley that are ten times less dense than the first. Also, some farmers practice monocropping spacings of 0.7m x 0.7m between plants of *M. oleifera*. Which indicates that the spacings adopted constitute hardly a limiting factor for the growth of plants of *M. oleifera* and consequently on production in leaves biomass. Since neither the cutting level, or the *M. Oleifera* plants layout have had no effect on productivity in leaves biomass of the species in intercropping system only the requirements of culture must prevail . In this context the level of cut and the gaps are imposed by culture to associate with *M. oleifera* in seen to optimize yields of the two components in place and especially the *M. oleifera* seems indifferent treatment to apply. Rabo et al. (2015) conducted a study on the effect of the same treatment on yield in apple of *Brassica oleracea* L (Cabbage, Variety Oxylus). This study showed that these treatments have no influence on the yield of apple cabbage.

Following the average productivity in leaves biomass of plants of *M. oleifera* after cutting according to time, we generally found that the average after the first cut is lower than that after the second cut, which is substantially equal to that after the third cut. The productivity remained constant after the second and third cut can be explained by the same age of the of plants of *M. oleifera*. Indeed, productivity in leaves biomass of plants of *M. oleifera* is low the first year and increases to stabilize in the second and third year. When the first cut had occurred the plants of *M. oleifera* had only two months to very young first rejected and then produce the leaves biomass in order to compete with future productivity. After the last two cuts, the rejects of *M. oleifera* plants can be considerably similar.

CONCLUSION

This study has shown that the optimal production period of *M. oleifera* leaves biomass is in the rainy season and especially the months of July and August. It also appears from this study that the treatments had a more or less interesting effect on leaves biomass productivity of the plants of *M. oleifera*. The treatment A1B2 is indeed the one that best expresses the best performance over the duration of the experiment. Also, the treatment A1B2 is by far the one with the best performance after the first and the third cut. After the second cut no treatment has significantly cleared other in terms of effect on leaves biomass productivity of the plants of *M. oleifera*. Furthermore, the average productivity after the second cut is greater than the average productivity after the first cut for all treatments except for treatmentA2B1. The evolution of average productivity between the second and third cut is not significant for all treatments. Also, for treatmentsA1B2, A3B1 and A3B2 average productivity is significantly different after various cuts.

This study also showed that the treatments have generated a linear correlation between the productivity of plants of *M. oleifera* and the sampling date. The linear adjustment patterns obtained best explain the variability of the productivity in biomass of *M. oleifera*plants depending on the sampling date with more than 50% of the inertia and that these models are generally significant.

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