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RESEARCH ARTICLE

COMBINED EFFECT OF *MORINGA OLEIFERA* LAM PLANT LAYOUT AND CUTTING LEVEL]]ON ONION BULB YIELD (*ALLIUM CEPA* L, GALMI PURPLE VARIETY)

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ABSTRACT

In the Niger River Valley, as well as in some areas of preference, *M. oleifera* is most often produced in association with some vegetable crops, including onions. This association can involve significant agronomic and economic effects. Thus, the combined effect of the factors layout and plant cutting level of *M. oleifera* plants on the yield of *Allium cepa* (onion) bulbs was studied. These factors include three and two levels, respectively. Each level of the first factor has been combined with each of the two levels of the second giving thus six (6) treatments that are: A1B1, A1B2, A2B1, A2B2, A3B1 and A3B2. Also, in order to compare the results with a reference situation, a control treatment (T) where the onion plants were sub cultured in pure culture was carried out. The parameters measured are the weight and the diameter of the bulbs. The yield in terms of weight was reported per hectare under the different treatments then was evaluated. The statistical tests on the comparison of means showed that the yield in weight, the average weight and the mean diameter of the bulbs are not significantly different between the treatments at the threshold of 5%. The study also showed that the treatments A1B1, A2B2, A3B2 and the Control are the ones that best explain the variability of the weight according to the diameter of the bulbs with more than 50% of the inertia and that we can adjust a straight line to their respective clouds. These results show that farmers can associate *M. oleifera* with vegetables such as onions without risk of considerable loss of yield.

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INTRODUCTION

Given some of their properties, African farmers have deliberately left trees in their fields for centuries, constituting true agro forestry systems. These systems have known over time a more or less remarkable stability. Numerous scientific studies, including those conducted by ANAFE-RAFT Sahel (2006) have shown how important interest is accorded to this type of land use. These systems that group in a spatial or temporal arrangement and in a concomitant or sequential manner trees, crops and / or animales components in fact exhibit ecological interactions. According to Ong *et al*. (1991), these ecological interactions between trees and crops are beneficial because woody plants have an effect on soil fertility through the fixation of atmospheric nitrogen (N2) for legumes, the production of organic matter, recycling of nutrients from the soil by the leaves of trees. They also protect the soil against erosion (Wiersum, 1991) and can therefore improve crop yields.

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In order to harmonize the tree-crop association and to benefit all components by minimizing competition for water, nutrients and light, crops are often parctice in tree alleys forming systems called cropping systems. The studies conducted by Thevathasan and Gordon (1997) have shown that these systems can contribute to increased soil organic matter returns, compared to conventional farming systems, through the residues of above-ground biomass and in situ decomposition of trees roots. Similarly, humus from deciduous tree litter is often of excellent quality and can therefore be managed as a true fertilizer, which may result in a decrease in the application of inorganic fertilizers. However, according to Baldy *et al*. (1993) their incorporation into the ground requires the implementation of very specific technical itineraries. Several studies have been conducted with the objective of evaluating the effect of the tree on the productivity of intercrops. In fact, as much as the tree-crop interface can have complementarity effects, it can also have competitive effects (Jose *et al*., 2007). Jose *et al*. (2004) revealed that in the United States, tree competition for water can become critical to the point of significantly reducing the productivity of associated crops. Reynolds *et al*. (2007) and Rivest *et al*. (2009) showed that in Quebec and Ontario, the reduction in yields of crops such as soybeans and corn near trees is generally due to shade.

Gbemavo *et al*. (2010) studied the influence of shea shade on cotton cultivation. These authors found a significant difference between the average number of plants / m² and the average number of branches loaded with capsules per plant of cotton which are lower in shea respectively 24.07% and 27.26%. In addition, the number of capsules per cotton plant decreased by an average of 28.46% under shea tree crowns. Abundant in the same sense, Rivest *et al*. (2009) analyzed the effect of three clones and hybrid poplars on different soy productivity parameters during two growing seasons. By drawing up a summary document of the experiments undertaken for the acquisition of technical and economic references on the functioning of agroforestry systems Balandier (1999) made a case of different association modalities studied in order to have a better understanding of the mechanisms involved. during the interaction between a tree and a culture, to model these interactions in order to know in the long term the evolution of the system and thus to choose the most complementary species in these types of association. Today, the association also concerns fruit trees and vegetable crops. In Niger, for example, trees such as Manguiferaindica, Carica papaya, Cocosnucifera, Phoenix dactylifera, Psidiumguajava, Citrus limon, Citrus sinensis and Moringa oleifera are becoming more and more common in Niger. vegetable crops and, conversely.

In Niger, one of the trees that has gained the confidence of the farmers is M. oleifera because its leaves are very popular with the populations, especially the big cities. Before the installation of vegetable crops certain treatments whose cutting are made on the plants of M. oleifera. However, few studies have been conducted as part of the evaluation of the influence of fruit trees on the productivity of these vegetable crops. This study therefore proposes to study the effect of certain treatments on M. oleifera on the bulb yields of the onion. More specifically, it is:

- To evaluate the effect of the combination of two factors namely the disposition and cutting level of M. oleifera plants on bulb yields of the onion.
- To evaluate the shading effect that M. oleifera plants might have on bulb formation by a linear correlation study followed by a linear adjustment according to treatments.

The results of this study will make it possible to propose a combination of the layout and the level of cut on M. oleifera plants in order to improve the yields of the onion associated with M. oleifera.

MATERIAL AND METHODS

Study area: The test was conducted in a peasant environment in the Fifth Arrondissement of the city of Niamey (Niger), located on the right bank of the Niger River. The climate is Sahelian with average rainfall of 550mm / year and average temperatures fluctuating between 23 ° C and 37 ° C.

Experimental device: The study investigates the effect of the combination of layout and cutting level of *M. oleifera* plants on onion crop yields. So two factors have been studied. The factor (A) layout of *M. oleifera* plants with respect to crops: It comprises three levels: Level 1 (A1): the *M. oleifera* plants were associated with crops at a distance of one meter on the line and between the lines of *M. oleifera*; Level 2 (A2): *M. oleifera* plants were associated with crops at a spacing of one meter on the line and two meters between rows of *M. oleifera* plants; Level 3 (A3): *M. oleifera* plants were arranged in a hedge with respect to crops. Two hedges of two lines each were used with a spacing of one meter on the line and between the lines of hedgerows and a spacing of two (2) meters between hedgerows.

The device used is that of a complete random block.

Operation and management of culture: The onion plants were transplanted when those of *M. oleifera* were twenty-seven (27) months old in order, two (2) years and three (3) months. The plants of *M. oleifera* were cut the day before the establishment of the crop. The onion was transplanted with a density of 120 plants / m² according to the densities practiced by the farmers. One week after the installation of the culture, an organic manure application was carried out at a rate of 1 bag per experimental unit and then three weeks later urea was introduced at the rate of 100 g / experimental unit.

At the bulbification, NPK (15-15-15) was spread at a rate of 200g / experimental unit and one week after a bag of manure was brought per experimental unit. Before each addition of organic or mineral manure, the experimental units are first binned. The application of manure takes place at least four days after hoeing and during all this time no water supply is made. Irrigation was always done as needed by gravitation. The culture, from transplanting to harvesting, lasted four months. No phytosanitary treatment has been done.

Data collection:In total, the study focused on 35 experimental units. In each experimental unit a plot of 1m² was placed. The plants contained in these plots were observed. To avoid edge effects andinterference between experimental units, the plots were placed at the point of competition of the diagonals of each experimental unit. Observations have, in fact, focused on the weight and diameter of the bulbs contained in the plots. Also, the sum of the weights gave the yield in kg / m² and by extrapolation, the yield per hectare. For the linear correlation between bulb weight and bulb diameter, only five bulbs were randomly considered per plot.

Statistical analyzes of the data: Statistical analyzes focused on onion bulb yields and the diameters of these bulbs. In order to normalize the populations and to stabilize the variances, the numerical values collected from the diameter variable were transformed into logarithmic values (neperian logarithm) while the data relating to the yield variable did not undergo any transformation. In addition, the average values of all the parameters studied were calculated.

The averages comparison was done by ANOVA for yield values. For the diameter variable, the transformed values were compared by ANOVA. The software used to do the statistical analysis is Ri386 2.15.3 and Minitab version 16. In order to determine the effect of the treatments on bulb formation, a linear regression was made between the weight and the diameter of the bulbs. In order to validate the different models obtained according to the treatments, it was first carried out to check the overall significance of the model and the coefficients. Then the tests of the normality, the nullity of the mean, the homogeneity of the variances and the autocorrelation of the residentiated residues generated by the two parameters were realized.

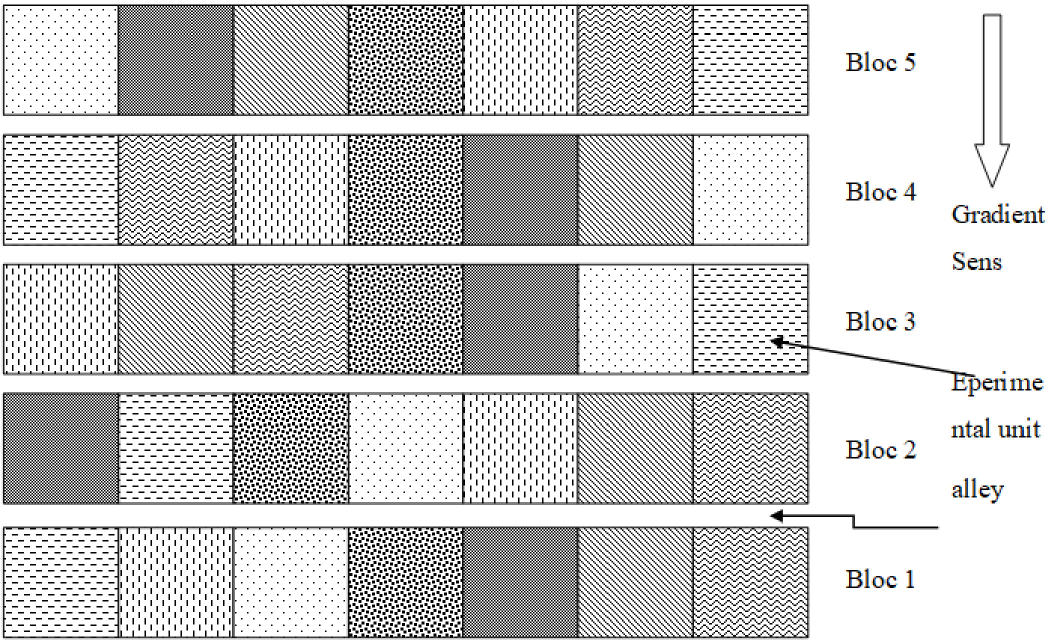
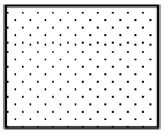
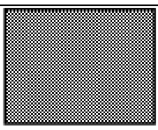
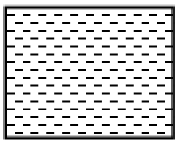
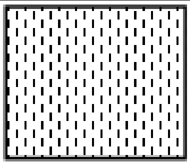
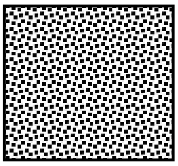
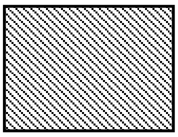
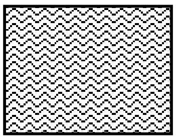


Figure 1. Experimental device

	Witness: the onion plants were subcultured in monoculture
	A1B1: The plants of *M. oleifera* were associated with onion plants with a spacing of one meter on the line and between the lines of *M. oleifera*; *M. oleifera* plants were cut 0.5 m above the ground
	A1B2: The plants of *M. oleifera* were associated with onion plants at a distance of one meter on the line and between the lines of *M. oleifera*; *M. oleifera* plants were cut 1 m above the ground
	A2B1: *M. oleifera* plants were associated with onion plants at a distance of one meter on the line and two meters between the rows of *M. oleifera* plants; *M. oleifera* plants were cut 0.5 m above the ground
	A2B2:The plants of *M. oleifera* were associated with onion plants with a spacing of one meter on the line and two meters between the rows of *M. oleifera* plants; *M. oleifera* plants were cut 1 m above the ground
	A3B1: *M. oleifera* plants were arranged in a hedge with respect to onion plants. Two hedges of two lines each were used with a spacing of one meter on the line and between the lines of the hedges and a spacing of two (2) meters between the hedges; *M. oleifera* plants were cut 0.5 m above the ground
	A3B2: *M. oleifera* plants were arranged in a hedge compared to onion plants. Two hedges of two lines each were used at a distance of one meter on the line and between the lines of hedgerows and a gap of two (2) meters between hedgerows, the plants of *M. oleifera* were cut to 1 m from ground

RESULTS

Effect of treatments applied on the yield of onion bulbs: Onion bulb yields, based on applied treatments, were calculated and reported per hectare. Also, average yields were calculated (Table 1). The analysis of this table shows that average yields are not significantly different. In addition, the lowest and highest minimum yields are observed at the level of the A3B1 treatment and the control, respectively. Similarly, the highest and lowest maximum yields are observed respectively at the level of the A1B1, A3B1, A1B2 treatments and the control. The average yield being 157886 ± 26706 kg / ha

The analysis of the coefficients of determination given in figure 2 shows that the A1B1, A2B2, A3B2 and the Control models are the ones that best explain the variability of the weight as a function of the diameter with more than 50% of the inertia and the Analysis of Table 3 shows that these models are globally significant. The joint analysis of this table and this figure shows that these models (A1B1, A2B2 and A3B2) are those whose equations fit best to their respective clouds.

DISCUSSION

The results showed that there is no significant difference between the parameters studied. Indeed, these results showed that the presence of the tree had neither a negative effect nor a significant positive effect on the parameters studied.

Table 1. Average, minimum and maximum yields of onion bulbs according to applied treatments (in kg / ha)

Treatments	Average	Minimum	Maximum
A1B1	158000 ± 16047 *a*	140000	175000
A2B1	151200 ± 24077 *a*	125000	176000
A3B1	138000 ± 27973 *a*	100000	175000
A1B2	151000 23822 *a*	125000	175000
A2B2	161000 ± 27019 *a*	130000	200000
A3B2	159000 ± 28373 *a*	130000	200000
T	187000 ± 25642 *a*	160000	225000

The averages followed by the same letter on the same column are not statistically different.

Table 2. Average, minimum and maximum diameter of onion bulbs according to treatments applied (mm)

Treatments	Average	Minimum	Maximum
A1B1	4,540 ± 0,629(1,5044) *a*	3,7	6,4
A2B1	4,3233 ± 0,4854(1,4580) *a*	3,6	5,4
A3B1	4,4467 ± 0,4826(1,4864) *a*	3,6	5,4
A1B2	4,537 ± 0,559(1,5045) *a*	3,2	5,7
A2B2	4,4467 ± 0,3589(1,4891) *a*	3,9	5,2
A3B2	4,637 ± 0,568(1,5265) *a*	3,3	5,6
T	4,6067 ± 0,5030(1,5217) *a*	3,6	5,7

The averages followed by the same letter on the same column are not statistically different; the numbers in parentheses are the averages from the numerical values transformed into values of neperianlogarithmic.

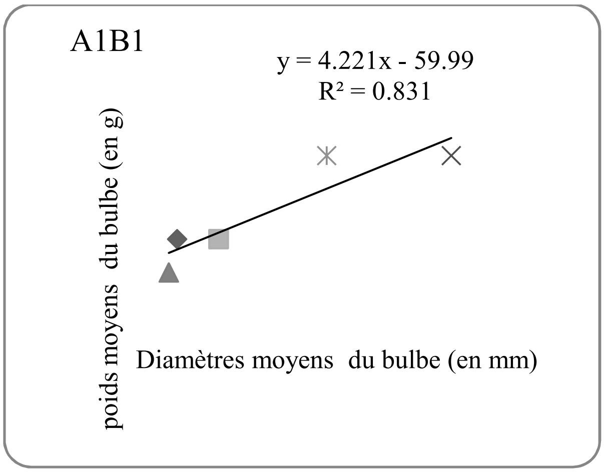
Table 3. Values of the probability (p) for the various validation tests of the linear adjustment models between the weight and the diameter of the onion bulbs according to the treatments carried out

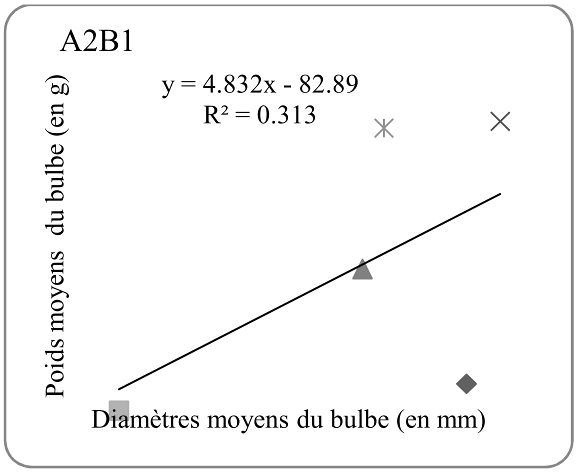
Treatments	Significativities	Studentised residues			
		Normality	Nullity of the mean	Homogeneity of the variance	Auto correlation
A1B1	0,03	0,34	1	0,41	0,24
A1B2	0,27	0,71	1	0,30	0,77
A2B1	0,32	0,74	1	0,25	0,02
A2B2	0,07	0,48	1	0,58	0,60
A3B1	0,31	0,22	1	0,61	0,74
A3B2	0,04	0,19	1	0,61	0,39
T	0,01	0,02	1	0,88	0,45

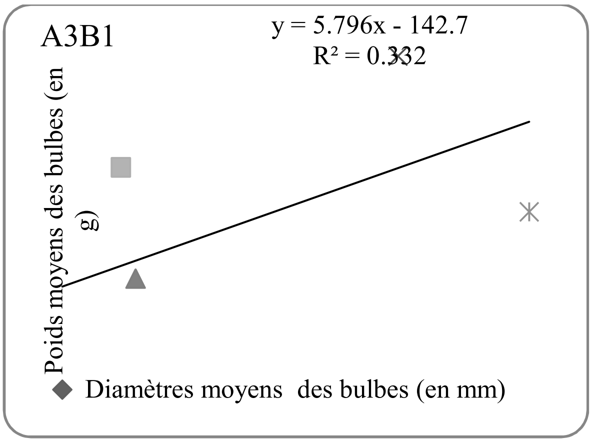
The averages followed by the same letter on the same column are not statistically different; the numbers in parentheses are the averages from the numerical values transformed into values of neperianlogarithmic.

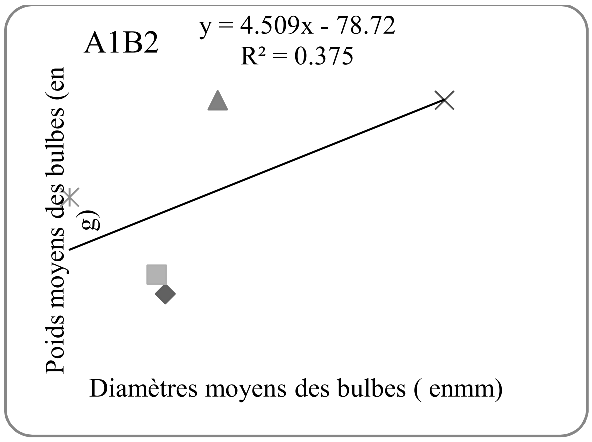
Effect of applied treatments on linear correlation between weight and diameter of onion bulbs: In order to check if the weight of the bulbs is correlated with their diameter, under the treatments applied, a linear correlation test was carried out. Figure 2 gives the weight of onion bulbs as a function of their diameter. This figure also gives the coefficients of determination of the different models obtained. As for Table 3, it gives rather the values of the probabilities (p) for the various tests of validation of linear adjustment models between the weight and the diameter of the bulbs according to the treatments carried out.

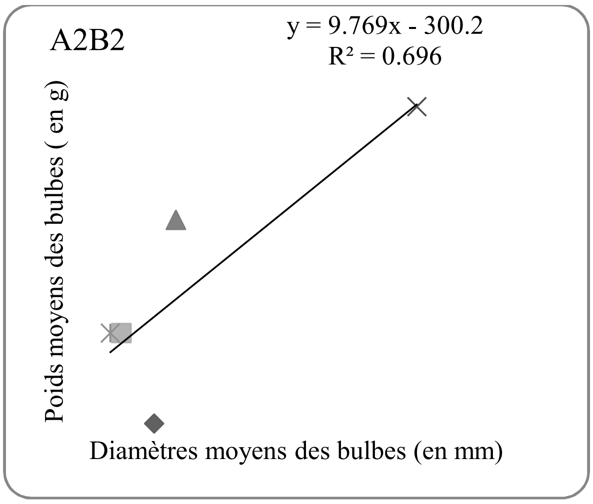
It can therefore be conjectured that from a competition point of view for nutrients, water and light, *M. oleifera* plants can not disturb crop development. According to Miller and Pallardy (2001), the few competition trials for soil nutrients have shown that it is generally negligible, as the nutrient requirements of intercropping are met by appropriate fertilization practices. The culture has been well conducted according to its requirements. In addition, the influence of *M. oleifera* plants on the studied parameters could be exerted by shading effect. However, this was not the case because of cutting on the *M. oleifera*plants. Indeed, immediately after cutting, all the crops were transplanted and it took two months for the leaves of *M. oleifera* to develop well. However, this shading effect can not disturb the development of the intercropping because the leaves are regularly removed thus allowing the light to reach the underlying culture.

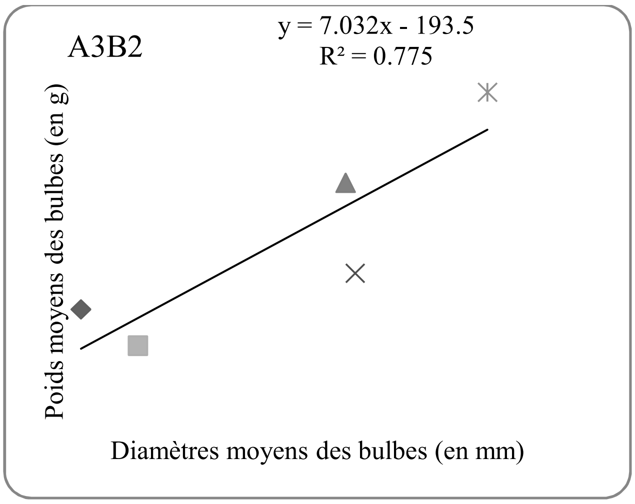

A1B1
y = 4.221x - 59.99
R² = 0.831
poids moyens du bulbe (en g)
Diamètres moyens du bulbe (en mm)

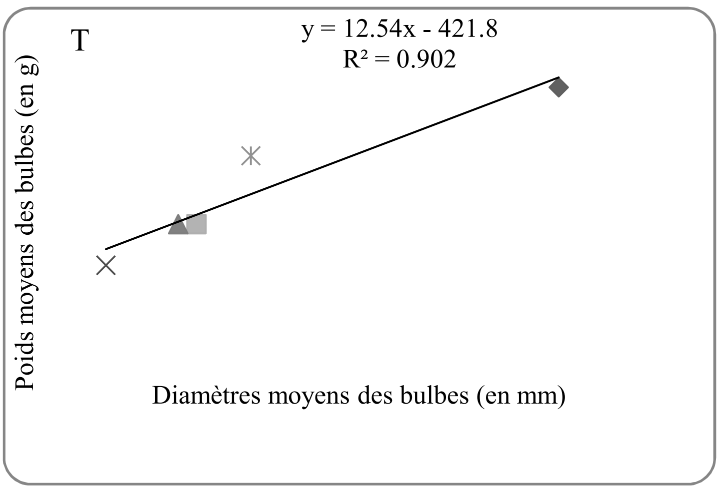

A2B1
y = 4.832x - 82.89
R² = 0.313
Poids moyens du bulbe (en g)
Diamètres moyens du bulbe (en mm)


A3B1
y = 5.796x - 142.7
R² = 0.332
Poids moyens des bulbes (en g)
Diamètres moyens des bulbes (en mm)


A1B2
y = 4.509x - 78.72
R² = 0.375
Poids moyens des bulbes (en g)
Diamètres moyens des bulbes (enmm)


A2B2
y = 9.769x - 300.2
R² = 0.696
Poids moyens des bulbes (en g)
Diamètres moyens des bulbes (en mm)


A3B2
y = 7.032x - 193.5
R² = 0.775
Poids moyens des bulbes (en g)
Diamètres moyens des bulbes (en mm)


T
y = 12.54x - 421.8
R² = 0.902
Poids moyens des bulbes (en g)
Diamètres moyens des bulbes (en mm)

Hence, the effect of *M. oleifera* on culture may not be perceptible. This hypothesis can be verified when one looks at the effect of the treatments on the correlation between the different weights and the respective diameters. Indeed, the correlation is always positive whatever the treatment, even if it is often very weak. This would justify that an increase in diameter would induce an increase in its respective weight. In other words, even in the presence of *M. oleifera* plants the onion bulbs form well and their formation is not disturbed by the shade created by the leafy tree.

In addition, *M. oleifera* plants were very young to cause a significant disturbance in intercrop yield. Rivest *et al*. (2010) found results that corroborate those in this study. According to these authors, young deciduous trees generally produce only negligible productivity losses, and their effect may even be beneficial in some cases. However, over the years, intercropping can be adversely affected by tree competition for light, water and soil minerals. Notwithstanding, shade-grown cultivation may not be a limiting factor for some intercrops. The results of Lin *et al*. (1999) and those of Clinch *et al*. (2009) are sufficiently illustrative. These authors have shown respectively that shading rather than causing a decrease would improve yields of tall fescue and willow compared with monoculture. In addition, the spacings adopted, combined with regular sampling of M. oleifera leaves, would favor the penetration of the system by light and would further avoid competition for this limiting factor. The results of this study are similar to those of Rabo Y. *et al.* (2015). These authors have indeed shown that the combination of layout and cutting level factors of *M. oleifera* plants would not affect the yield of cabbage apple (Brassica oleracea, oxylus variety).

Conclusion

The study found that the combination of layout and cutting level factors on M. oleifera plants had no effect on onion bulb yields. This is explained partly by the cutting of M. oleifera plants and partly by the spacings adopted, especially since the leaves of M. oleifera are regularly removed, allowing the light to reach intercropping. The results also showed that for some treatments, the weight and diameter of the bulbs are positively strongly correlated. From which one can conjecture that an increase of the diameter would induce an increase of the weight of the bulbs. This corroborates the idea that hardwood seedlings cause only negligible loss of intercrop yields. In the end, the results of this study show that farmers can now combine the onion with *M. Oleifera* without the risk of a considerable loss of yield due to the association or treatments made on *M. oleifera* plants.

REFERENCES

Anafe-Raft Sahel, 2006. Manuel d'agroforesterie à l'intention des établissements supérieurs du sahel. Bamako-Mali 70p.

Balandier, P., 1999. Analyse et modélisation de l'interaction arbre-culture. In: Bois et forêts des agriculteurs - Actes du colloque Clermont-Ferrand, 20 et 21 octobre 1999. C. Editions. Clermont- Ferrand, INRA/Cemagref/Ministère de l'Agriculture et de la Pêche: 10-12.

Baldy, C., Dupraz, C., Schilizzi, S., 1993. Vers de nouvelles agroforesteries en climats tempérés et méditérranéens. I. Aspects agronomiques. *Cahiers Agricultures*. 2: 375-386.

Clinch, R.L., Thevathasan, N.V., Gordon, A.M., Volk, T.A., Sidders, D. 2009. BiophysicalGbemavo D.S.J.C., Glèlè R. K., Assogbadjo A.E., Katary A. et Gnanglè P. 2010. Effet de l ombrage du karité sur le rendement capsulaire du coton dans les agroécosystèmes coton-karité du Nord Bénin. *Tropicultura*. 28 (4) : 193- 199

Jose, S., Gillespie, A.R., Pallardy, S.G. 2004. Interspecific interactions in temperate agroforestry. *Agroforestry Systems*61 : 237-255.

Lin, C.H., McGraw, R.L., George, M.F., Garrett, H.E. 1999. Shade effects on forage crops with potential in temperate agroforestry practices. *Agroforestry Systems*44 : 109-119.

Miller, A.W., Pallardy, S.G. 2001. Resource competition across the tree-crop interface in a maize-silver maple temperate alley cropping stand in Missouri. *Agroforestry Systems*53 : 247-259.

Ong, C.K., Corlett, J.E., Singh, R.P., Black, C.R., 1991. Above and below ground interactions in agroforestry systems. *For. Ecol. Manage*. 45: 45- 57.

Rivest D., Olivier A. et Gordon A. M., 2010. Les systèmes de cultures intercalaires avec arbres feuillus. Jumeler production de bois et production agricole tout en protégeant l environnement. Université Laval. University of Guelph. 12p

Rivest, D., Cogliastro, A., Olivier, A. 2009. Tree-based intercropping systems increase growth and nutrient status of hybrid poplar: a case study from two Northeastern American experiments. *Journal of Environmental Management* 91: 432-440.

Rivest, D., Cogliastro, A., Vanasse, A.,Olivier, A. 2009. Production of soybean associated with different hybrid poplar clones in a tree-based intercropping system in southwestern Québec, Canada. *Agriculture, Ecosystems and Environment*131 : 51-60.

Thevathasan, N.V., Gordon, A.M. 1997. Poplar leaf biomass distribution and nitrogen dynamics in a poplar-barley intercropped system in southern Ontario, Canada. *Agrofor. Syst.* 37: 79-90.9

Rabo Y., Laouali A., Moussa B. et Mahamane A., 2015. Effect of the combination of the layout and the cutting level of *Moringa oleifera* plants on the yield in apple of Brassica oleracea (cabbage, variety Oxylus). *Int.J. Curr. Microbiol. App. Sci.* 4(11): 800-807

Wiersum K., F., 1991.Domestication of valuable tree species in agroforestry systems: evolutionary stages from gathering to breeding.

Williams, P.A., Gordon, A.M. 1992. The potential of intercropping as an alternative land use system in temperate North America. *Agroforestry Systems*19 : 253-263.

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