Evaluation of Intercropped *Aloe vera* with plantain on Growth and yield Status in a real culture situation in Daloa, Côte d'Ivoire

ABSTRACT

Rainfall decrease and irregularity pose a threat to farmers and call for the promotion of crops of interest,such as *Aloe vera*, which require little water. However, the scarcity of land requires the development of interrow spacing of crops occupying large spaces. Thus, a study was carried out in west central Côte d'Ivoire in order to assess the effect of plantain tree (*Musa*sp) - *Aloe vera*combination on the growth and yield of these crops. To this end, a complete randomization design comprising two treatments with eight repetitions was carried out. The treatments consisted in planting either one *Aloe vera*plant (treatment 1) or two *Aloe vera*plants (treatment 2) between four plantain tree plants. The spacing used for planting the plantain suckers in the 40-cm deep pockets was 3 m x 2 m. The results showed that treatment 2 accelerated *Aloe vera* leaf emergence rate and made easier the generation of a high number of leaves (39 leaves) longer (20.06 cm) and wider (2.78 cm) causing large fresh and dry biomasses, compared to treatment 1 and the control, with 125.42 g and 64.27 g, respectively. As for plantain tree, the intercropping favored a higher leaf emergence rate with a high number of leaves (23 leaves) longer and wider, 113.53 cm and 58.70 cm long, respectively. The intercropping also favored in plantain a large number of hands (7) and fingers (32) with a finger length of 35.25 cm weighing on average 0.46 kg and causing a mass of 9.23 kg / regime. The yield in terms of banana regime was higher in the combinedplantain trees (15.39 t. ha^{-1}) compared to the control (7.83 t. ha^{-1}).

Keywords: Rainfall irregularity, Aloe vera, plantain tree, interrow spacing

1. INTRODUCTION

Logging and agriculture have always been the main activities that have largely founded the country's economy. These activities, favored by an imprecise land code, which was later on aggravated by a very high and uncontrolled flow of immigration, have caused great damage to the natural environment, in particular the dense forest. Several areas of forest have been destroyed and transformed either into farms (food, commercial or agro-industrial plantations), or into fallow land[1]. To date, the Ivorian forest cover is estimated at only 2.7 million hectares with an estimated annual deforestation rate of 4.32% between 1990 and 2005 [2]. This forest destruction is one of the major causes of the observed climate change.

Concerns about the effects of climate change are high, especially regarding rising temperatures, risk of floods and other extreme weather events, as well as reduced water availability. Now, agricultural production in Côte d'Ivoire is essentially food- and rain-fed; only 0.2% of the country's cultivated land is currently equipped for irrigation [3]. Smallholders therefore suffer particularly from the impacts of climate variability which limits their sources of food and increases the risk of hunger and poverty. The low adaptive capacity of the agricultural sector highlights the country's vulnerability to climate change.
Moreover, environmental stresses, especially water stress, seriously limit plant growth as well as plant productivity [4]. Indeed, water stress affects several plant functioning variables, such as leaf temperature [5], stomatal conductance and leaf area [6], as well as photosynthesis[7]. A decrease in the water content of the plant results immediately in a reduction in the growth of the different organs even before photosynthesis is affected [8]. Faced with this observation, the optimization of the crop diversification policy, through the search for new speculations of interest and which require little water, is essential.

It is in this light that*Aloe vera*stands as an interesting crop. Indeed, *Aloe vera* is a succulent plant resistant to drought and certain diseases responsible for the destruction of several crops [9]. It can also develop with water irregularity or low availability. *Aloe vera* is cultivated mainly for its leaves from which juice and gel are extracted, which give rise to the manufacture of products with diversified uses to such an extent that the plant has today become a marketing strategy[9]. It is involved in the

manufacturing of several food, cosmetic and pharmaceutical products. The main producing countries are Mexico, Venezuela and the Dominican Republic [10]. In this regard, the American continent alone produces 60% of the *Aloe vera* gel marketed in the world while the remaining 40% comes from Asia and Australia. In these countries, *Aloe vera* is cultivated to meet constantly increasing international demand. According to IMF estimates, the *Aloe vera* market could bring in more than 3.3 trillion dollars by 2026 [11]. For Africa and other developing countries, this could therefore become a significant financial windfall.

Unfortunately, in Côte d'Ivoire, *Aloe vera* is a little-known plant which is mainly cultivated as an ornamental plant. Promotion of this plant is therefore necessary. However, faced with the scarcity of arable land, this promotion requires the valorization of interrow spacing of crops occupying large spaces like plantain tree, ideally cultivated with a spacing of 3 m x 2 m, that is, a density of 1666 plants per hectare [12]. Thus, the hypothesis that we put forward is that *Aloe vera*intercropping in plantain plantations would positively influence the growth and yield parameters of both speculations. This study, carried out in Daloa, in west central Côte d'Ivoire, therefore aims at assessing the effect of intercropped *Aloe vera* with plantain (*Musa*sp) on the growth and yield of both crops.

2. MATERIAL AND METHODS

2.1. Study site

This study was conducted on the experimental plot of the University Jean Lorougnon Guédé in the west central Côte d'Ivoire in the department of Daloa (6.48° and 6.41° and 6.91° and 6.84°). The climate of this area is of the Attiéan subequatorial type [13] with two seasons, namely a dry season and a rainy season. The dry season extends over four months from November to February. As for the rainy season, it lasts eight months and extends from March to October. The wettest months are April, August and September when an average of 103.58 mm of rain is recorded each year. The soils in this area are generally ferralitic, moderately leached on firm land and sandy hydromorphic [14].

2.2. Methodology

The plant material used was composed of corne 1 variety plantain tree suckers, mainly cultivated in Côte d'Ivoire, and *Aloe vera*suckers. The plantain suckers were taken from a rural field in the department of Daloa and transported to the University Jean Lorougnon Guédé (UJLoG). The most vigorous suckers were then selected for the experiment. As for *Aloe vera*suckers, they were collected from a nursery within the UJLoG. These suckers had an average leaf length ranging from 15 to 20 cm [15] with 5 to 7 leaves.

The preparation of the experimental site consisted initially in the clearing of a 288 m^2 plot, followed by the staking stage which consisted in materializing pocket locations with stakes. The spacing used for planting plantain suckers in 40 cm deep pockets was 3 m x 2 m [12]. Regarding *Aloe vera* suckers, the spacing between the plants used was 1 m x 1 m [15]. The aloe suckers were planted on mounds so as to allow better root fixation of the plants [16].
The experimental design (Fig. 1) used for setting up the trial was a complete randomization design comprising two treatments and eight repetitions. The treatments consisted in placing one *Aloe vera*plantbetween four plantain tree plants(treatment 1) and two *Aloe vera*plants one meter apart between four plantain tree plants (treatment 2). After preparing the land, the test was set up according to the experimental design. Thus, the plantain and *Aloe vera*suckers were planted inside the pockets amended with 500 g of cow dung/pocket. The planting of *Aloe vera* suckers was carried out one month after establishment of the plantain trees corresponding to the time necessary for a good recovery of the plantain trees.

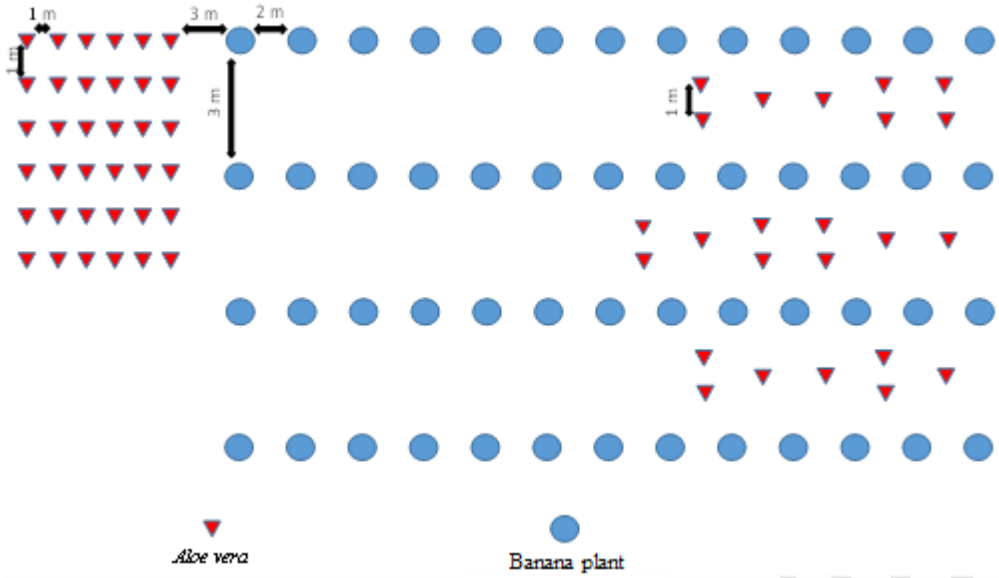

Fig.1: Experimental design

2.3. Parameters measured

Observations started 20 days after establishing*Aloe vera* and focused on the growth and yield parameters of *Aloe vera* and plantain tree. The measurement of growth parameters was conducted over 05 months. Indeed, from 05 months, it becomes almost impossible to measure *Aloe vera* leaves without breaking them because of the clump of leaves formed and their fragility. The measurement concerned leaf emergence rate, the number of emerged leaves, the length and width of*Aloe vera* leaves. At the end of the experiment, the biomass of *Aloe vera* leaves was determined. A leaf was considered new when its length reached 4 cm [17]. The length of new generated leaves as well as their width were taken using a graduated ruler every 20 days. Regarding plantain tree, leaf growth was also assessed every 20 days by counting the number of generated leaves and measuring their length and width using a tape measure. The yield parameters assessedwerethe number of hands and fingers, finger mass (kg), finger length (cm), and bunch mass (kg). Yield in terms of bunch ($t.ha^{-1}$) was calculated using the formula below:

Bunch yield ($t.ha^{-1}$) = bunch mass x planting density

2.4. Statistical analysis of data

The collected data were subjected to statistical tests using Statistica 10.0 software. An analysis of variance made it possible to assess the effect of combinations on *Aloe vera* and plantain tree growth and yield. Equality of means hypothesis was assessed at α = 5%risk. Incase of rejection of this hypothesis, the Newman-Keuls multiple comparison test (at α = 5% threshold) made it possible to classify the means into homogeneous groups.

3. RESULTS

3.1. Effect of the intercropping *Aloe vera* with plantain on *Aloe vera* growth

3.1.1. *Aloe vera* leaf emergence rate

Fig. 2 shows that the number of leaves increaseddepending on time regardless of the treatment. From the 20thday to the 60thday after intercropping *Aloe vera* with plantain, the evolution curves of the

number of leaves almost overlapped. From the 60th day after planting, the evolution curve of the number of *Aloe vera* leaves resulting from the arrangement of two *Aloe vera*suckers between four plantain plants was clearly above the other two ones with an average of 4 leaves every 20 days. However, the evolution curve of the number of *Aloe vera* leaves from treatment 1 overlapped the one of control suckers until the 160th day after combination.

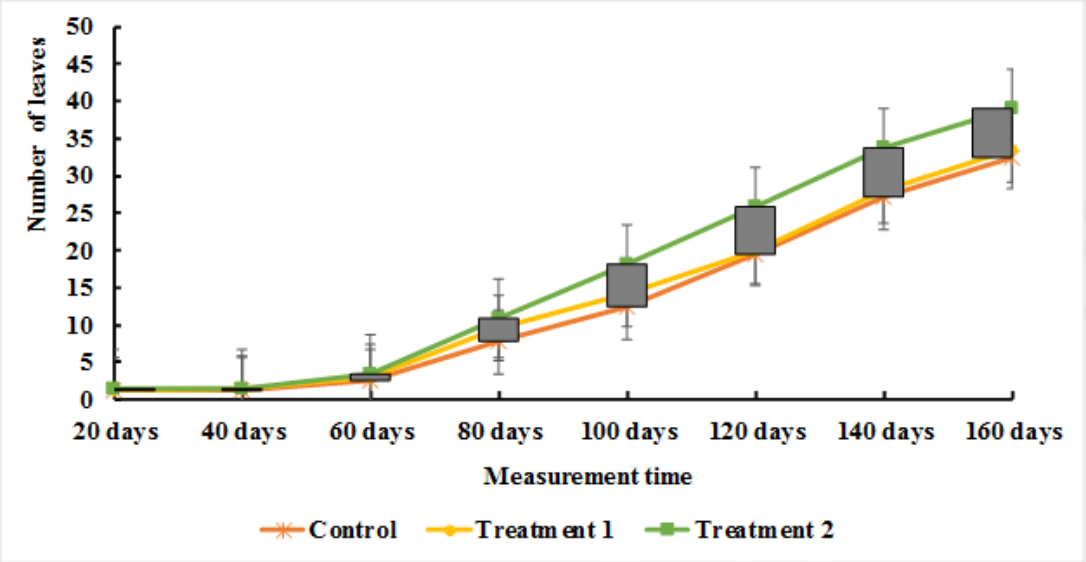

Fig.2: Evolution of the number of *Aloe vera* leaves generateddepending on time

Treatment 1: One Aloe vera plant between four plantain plants; Treatment 2: Two Aloe vera plants between four plantain plants

3.1.2. Number of *Aloe vera* leaves generated

Table 1 shows the number of new *Aloe vera* leaves generated during the experiment. We could note that this number was higher from the 60th day after planting regarding treatment 2. However, the statistical analysis showed a significant difference between the number of leaves generated depending on the treatments only from the 100th day after planting. Thirty-nine leaves on average were generated 160 days after combinationregarding treatment 2 against 33 for treatment 1. The lowest value regarding the number of leaves was observed in the control (32 leaves on average). However, the number of leaves generatedin the control was statistically identical to that of treatment 1 as of 160 days after combination.

Table1.Number of new *Aloe vera* leaves generated

Time after combination	Control	Treatment 1	Treatment 2	P
20 days	1.25 ± 0.46[a]	1.25 ± 0.46[a]	1.38 ± 0.52[a]	0.84
40 days	1.25 ± 0.46[a]	1.38 ± 0.52[a]	1.38 ± 0.52[a]	0.85
60 days	2.50 ± 1.20[a]	3.00 ± 1.20[a]	3.50 ± 1.31[a]	0.3
80 days	7.75 ± 4.20[a]	9.63 ± 4.24[a]	10.88 ± 2.10[a]	0.29
100 days	12.38 ± 4.78[b]	14.13 ± 3.18[ab]	18.13 ± 4.32[a]	0.03
120 days	19.50 ± 3.85[b]	19.88 ± 6.03[b]	25.88 ± 5.49[a]	0.03
140 days	27.13 ± 4.67[b]	28.00 ± 6.82[b]	33.75 ± 5.01[a]	0.04
160 days	32.50 ± 4.14[b]	33.50 ± 5.83[b]	39.00 ± 5.50[a]	0.03

The means of the same line followed by different letters are significantly different at 5% threshold.
P: Probability.Treatment 1: One Aloe vera plant between four plantain plants; Treatment 2: Two Aloe vera plants between four plantain plants.

3.1.3.*Aloe vera* leaf length

The evolution of the length of generated leaves depending on time is shown in Fig. 3. The lengths of generated leaves with treatment 2 were found to be the highest from the 20thday to the 160thday after planting. Leaf length varied from 6.88 ± 2.09 cm to 20.06 ± 7.66 cm (Table 2). The highest leaf lengths after those of treatment 2 were those of treatment 1. The lengths of generated leaves with treatment 1 varied on average from 6.44 ± 1.50 cm (20 days after planting) to 17.55 ± 7.89 cm (160 days after planting). Statistically, a significant difference ($p < 0.05$) between the leaf lengths of the control and treatments 1 and 2 appeared from the 100thday after planting. From the 140thday to the 160thday after planting, the lengths of the leaves generated by treatment 1 were statistically identical to those of the control.

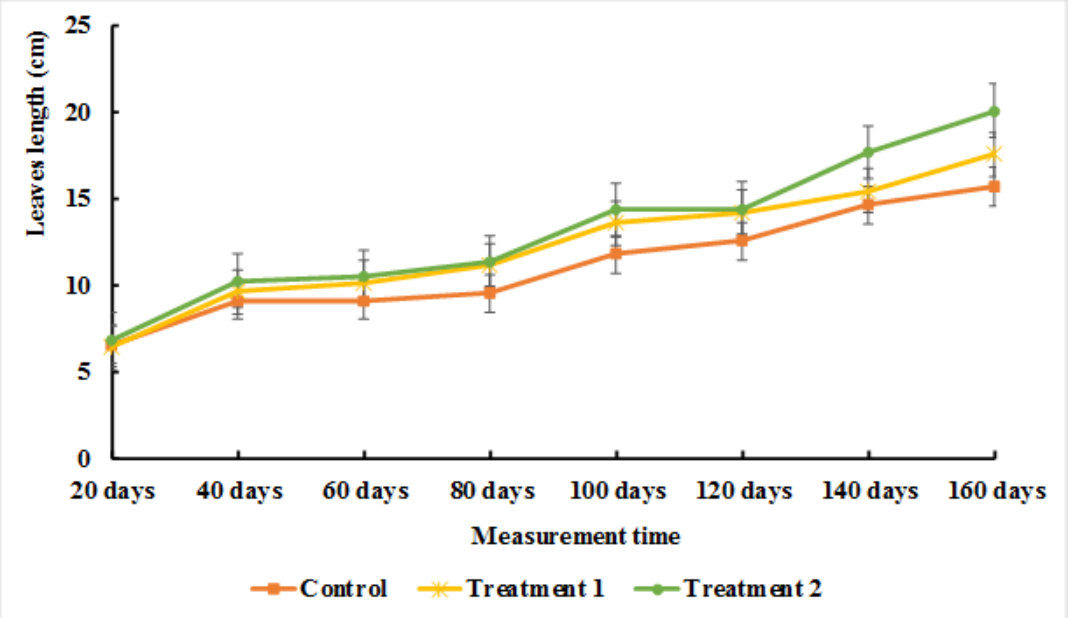

Fig.3: Evolution of the length of *Aloe vera*leaves generated depending on the treatments

Treatment 1: One Aloe vera plant between four plantain plants; Treatment 2: Two Aloe vera plants between four plantain plants.

Table2.Length of *Aloe vera* leaves generated depending on the treatments

Time after combination	Control	Treatment 1	Treatment 2	P
20 days	6.58 ± 2.10[a]	6.44 ± 1.50[a]	6.88 ± 2.09[a]	0.89
40 days	9.13 ± 3.66[a]	9.65 ± 3.33[a]	10.27 ± 3.73[a]	0.77
60 days	9.11 ± 4.72[a]	10.15 ± 4.44[a]	10.50 ± 4.66[a]	0.61
80 days	9.55 ± 5.80[a]	11.17 ± 5.46[a]	11.35 ± 6.27[a]	0.17
100 days	11.79 ± 6.24[b]	13.57 ± 6.67[a]	14.33 ± 5.15[a]	0.01
120 days	12.54 ± 6.51[b]	14.22 ± 6.64[a]	14.41 ± 6.29[a]	0.02
140 days	14.61 ± 6.48[b]	15.42 ± 6.87[b]	17.65 ± 6.81[a]	0.00
160 days	15.69 ± 7.25[c]	17.55 ± 7.89[b]	20.06 ± 7.66[a]	0.00

Means on the same line followed by different letters are significantly different at 5% threshold. P: Probability. Treatment 1: One Aloe veraplant between four plantain plants; Treatment 2: Two Aloe vera plants between four plantain plants

3.1.4.*Aloe vera* leaf width

The evolution of the width of the leaves generateddepending on time is represented by Fig. 4. The widths of the leaves generated with treatment 2 (two *Aloe vera* plants combined with four plantain plants) from the 20thday to the 160th day after planting were the highest. Leaf width varied on average from 0.70 ± 0.21 cm to 2.78 ± 0.61 cm. The highest leaf widths after those of treatment 2 were those of treatment 1. The widths of the leavesgenerated with treatment 1 fluctuated from 0.65 ± 0.23 cm (20 days after planting) to 2.43 ± 0. 81 cm (160 days after planting). The narrowest leaves were those generatedbythe control. Table 3 shows the results after analysis of variance. Statistically, a significant difference ($p < 0.05$) between the widths of the leaves of the control and treatments 1 and 2 appeared from the 100thday after planting.

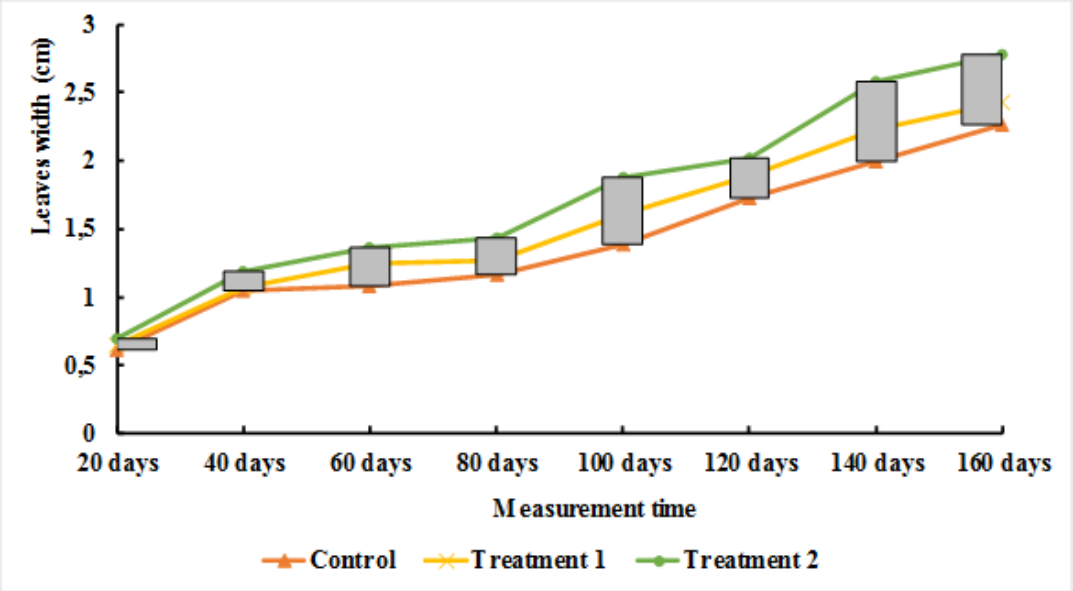

Fig.4: Evolution of the width of *Aloe vera* leaves generated depending on the treatments

Treatment 1: One Aloe veraplant between four plantain plants; Treatment 2: Two Aloe vera plants between four plantain plants

Table3l.Width of leaves generated depending on the treatments

Time after combination	Control	Treatment 1	Treatment 2	P
20 days	0.61 ± 0.18[a]	0.65 ± 0.23[a]	0.70 ± 0.21[a]	0.70
40 days	1.05 ± 0.46[a]	1.07 ± 0.34[a]	1.19 ± 0.35[a]	0.68
60 days	1.08 ± 0.54[a]	1.25 ± 0.59[a]	1.36 ± 0.64[a]	0.33
80 days	1.16 ± 0.70[a]	1.27 ± 0.64[a]	1.43 ± 0.72[a]	0.09
100 days	1.39 ± 0.72[c]	1.61 ± 0.62[b]	1.88 ± 0.83[a]	0.00
120 days	1.73 ± 0.79[b]	1.89 ± 0.79[ab]	2.02 ± 0.76[a]	0.01
140 days	2.00 ± 0.76[c]	2.23 ± 0.74[b]	2.58 ± 0.59[a]	0.00
160 days	2.26 ± 0.76[c]	2.43 ± 0.81[b]	2.78 ± 0.61[a]	0.00

The means of the same line followed by different letters are significantly different at 5% threshold
P: Probability.Treatment 1: One Aloe vera plant between four plantain plants; Treatment 2: Two Aloe vera plants between four plantain plants

3.1.5. *Aloe vera* yield

*Aloe vera*yield (Table 4) was expressed in quantity of fresh and dry leaf matter. The mass of fresh leaf mattergeneratedby treatment 2 (125.42 ± 3.12 g) was greater than those of the leaves generatedby treatment 1 (103.48 ± 12.11 g) and the control (88.59±7.02g). The dry biomass of the leaves generatedby treatment 2 (64.27 ± 5.93 g) was also higher than those of the leaves generatedby treatment 1 (42.70 ± 13.62 g) and the control (27.80 ± 7.31g). The statistical analysis showed a significant difference between leaf biomasses depending on the treatments. However, there was no significant difference between the fresh and dry biomass of the leaves from treatment 1 and the control.

Table 4.Fresh and dry masses of *Aloe vera* leaves

Leaf masses	Control	Treatment 1	Treatment 2	P
Fresh mass	88.59 ± 7.02[b]	103.48 ± 12.11[b]	125.42 ± 3.12[a]	0.00
Dry mass	27.80 ± 7.31[b]	42.70 ± 13.62[b]	64.27± 5.93[a]	0.00

The means of the same line followed by different letters are significantly different at 5% threshold
P: Probability.

3.2. Effect of the intercropping *Aloe vera* with plantain on plantain tree growth

3.2.1. Plantain tree leaf emergence rate

Fig. 5 shows us the emergence rate curves of plantain tree leaves. These overlapped from the 20thto the 40thday after combination. However, we noted that from the 40thday after combination, the emergence rate curve of the leaves from combined plantain trees was above that of control plantain trees with an average of 3 leaves every 20 days.

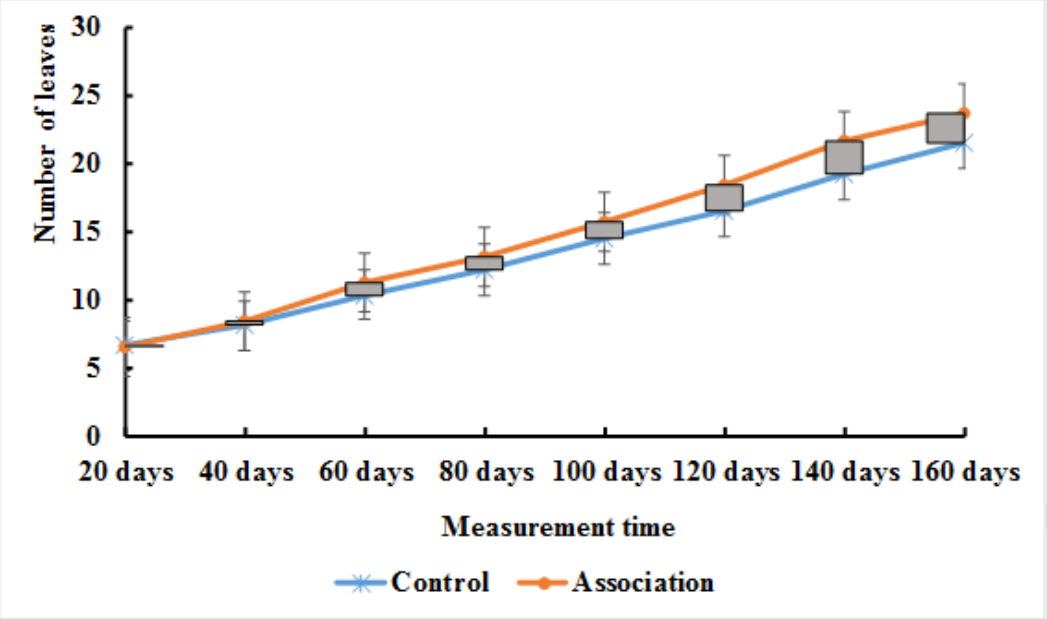

Fig.5: Evolution of the number of plantain tree leaves generated over time

3.2.2. Number of plantain tree leaves

Table 5 shows us the number of leaves generated by plantain trees during the experiment. We notice that this number was higher from the 40thday after planting in the combined plantain trees. However, the statistical analysis showed a significant difference between the numbers of leaves generated only from the 120thday after planting. Twenty-three leaves on average were produced 160 days after combination in the combined plantain trees compared to 21 for the controls.

Table5.Number of leaves generated by plantain trees

Time after combination	Control	Combination	P
20 days	6.63 ± 1.06^{a}	6.50 ± 0.53^{a}	0.77
40 days	8.13 ± 1.13^{a}	8.50 ± 0.93^{a}	0.47
60 days	10.38 ± 1.06^{a}	11.25 ± 0.89^{a}	0.09
80 days	12.25 ± 1.16^{a}	13.13 ± 1.13^{a}	0.14
100 days	14.50 ± 1.41^{a}	15.75 ± 0.89^{a}	0.05
120 days	16.50 ± 1.41^{b}	18.38 ± 0.92^{a}	0.00
140 days	19.25 ± 1.83^{b}	21.63 ± 0.74^{a}	0.00
160 days	21.50 ± 1.41^{b}	23.63 ± 0.74^{a}	0.00

The means of the same line followed by different letters are significantly different at 5% threshold
P: Probability

3.2.3. Plantain tree leaf length

The evolution of the length of plantain tree leavesgenerated depending on time is represented by Fig. 6. The results showed that the leaf length curve of combined plantain trees was above that of control plantain trees. The length of leaves generatedbycombinedplantain trees was greater than that of control plantain trees from the 20thday to the 160thday after planting. This vacillated between 48.60 cm

and 113.53 cm for combined plantain trees and between 38.73 cm and 85.61 cm for control plantain trees 20 and 160 days after combination, respectively.

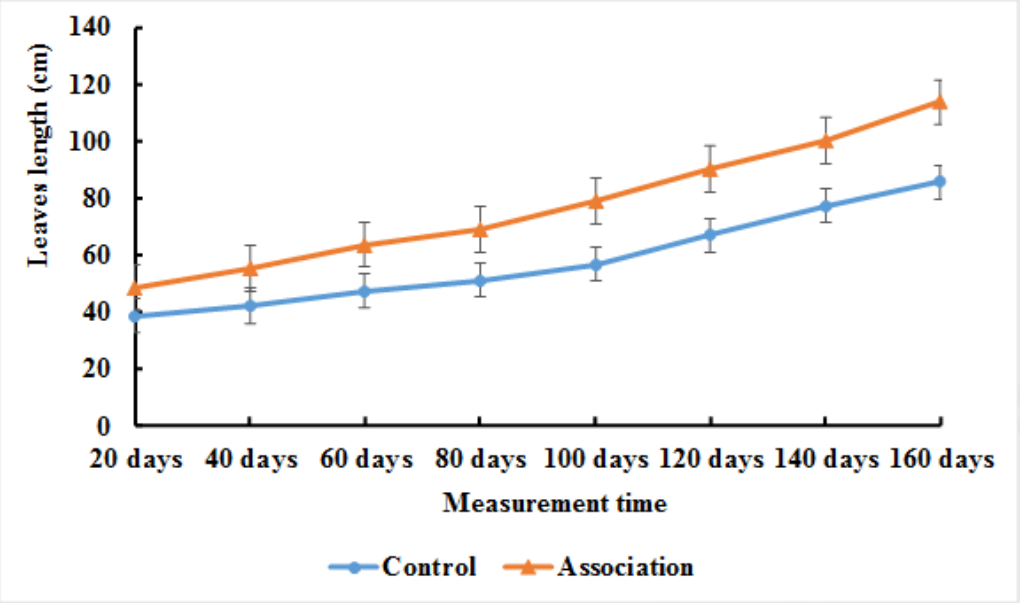

Fig.6: Evolution of the length of plantain tree leaves

3.2.4. Plantain tree leaf width

Fig. 7 shows the evolution of the width of plantain tree leaves depending on time. The leaf width evolution curve of plantain trees resulting from the combinationwas above that of control plantain trees. It thus appeared that combinationfavored better plantain tree leaf growth. The leaf width of plantain treescombined with *Aloe vera* varied from 26.84 ± 5.38 cm (20 days after combination) to 58.70 ± 13.38 cm (160 days after combination). As for that of control plantain trees, it ranged from 21.14 ± 3.62 cm (20 days after combination) to 44.18 ± 13.80 cm (160 days after combination). The leaf widths of combined plantain trees were statistically different from those of control plantain trees from the 20thday after combination.

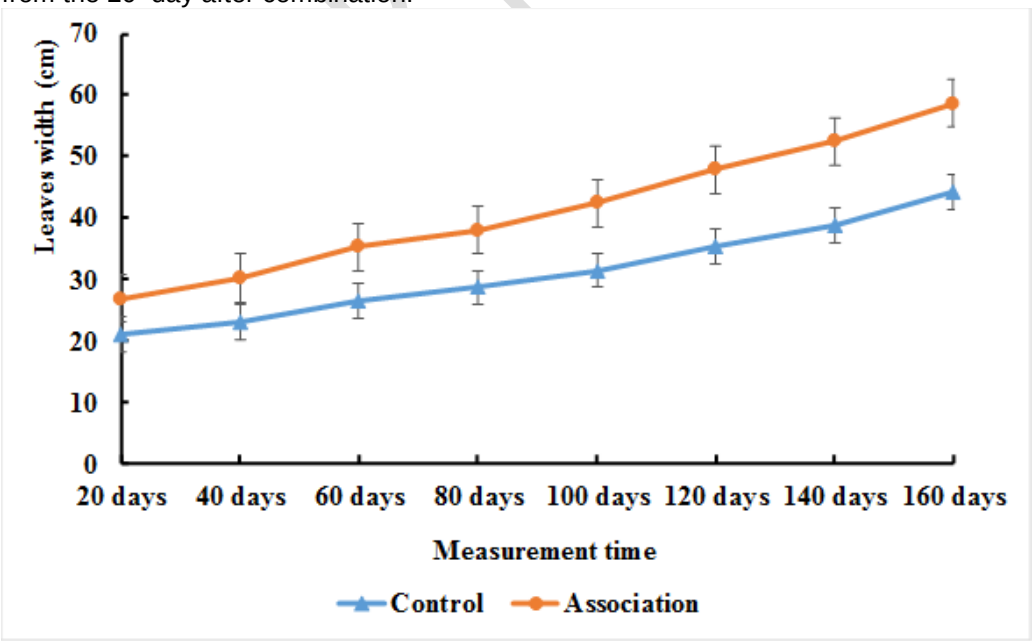

Fig.7 : Evolution of the width of plantain trees leaves

3.2.5. Plantain tree yield

The results of yield parameters and bunch yield plantains trees are shown in Table 6. Yield parameters included the numbers of hands and fingers, finger length, finger mass per regime, and regime mass. The results showed that the number of hands, fingers as well as the length of fingers were not significantly different depending on whether the plantains trees were combined with *Aloe vera* or not. However, a statistical difference (at 5% threshold) was observed in finger mass (0.24 ± 0.01 kg for control bunches and 0.46 ± 0.01 kg for combinedbunches), bunches (4.70 ± 0.53 kg for control bunches and 9.23 ± 0.18 kg for combinedbunches) and bunch yield (7.83 ± 0.25 $t.ha^{-1}$ for control bunches and 15.39 ± 1.21 $t.ha^{-1}$ for combined bunches).

Table 6: Yield and yield parameters of plantain trees

	Control bunches	Combined bunches	P
Number of hands	6.80 ± 0.22^{a}	7.00 ± 0.41^{a}	0.86
Number of fingers	31.33 ± 0.87^{a}	32.00 ± 0.25^{a}	0.75
Finger length (cm)	34.6 ± 1.72^{a}	35.25 ± 1.87^{a}	0.78
Finger mass (kg)	0.24 ± 0.01^{b}	0.46 ± 0.01^{a}	0.00
regime mass (kg)	4.70 ± 0.53^{b}	9.23 ± 0.18^{a}	0.00
Regime yield ($t.ha^{-1}$)	7.83 ± 0.25^{b}	15.39 ± 1.21^{a}	0.00

The means of the same line followed by different letters are significantly different at 5% threshold
P: Probability

4. DISCUSSION

This study was carried out to assess the effect of plantain tree (*Musa*sp) – aloe (*Aloe vera*) combination on the growth and yield of both crops. The results showed that the plantain tree-*Aloe vera*combination was beneficial for both crops. Indeed, the *Aloe vera*suckers planted between the plantain plants had a higher leaf emergence rate, number of leaves, leaf length and leaf width than those of the controls. This result could be explained by the fact that the *Aloe vera* suckers arranged between plantain plants benefited from the shade and, in turn, the humidity created by plantain tree leaves, hence their harmonious growth. The importance of shade for the good growth and development of plants, especially shade plants such as *Aloe vera*, is mentioned by several authors ([18];[19]). Indeed, shade improves soil humidity, helps moderate ambient temperature and increase air humidity. Thus, plants under shade considerably reduce their transpiration even in periods of extreme heat [20]. *Aloe vera* suckerscombined with plantain trees thus escape the limitation of water availability in the soil while reducing their transpiration unlike the control suckers which were exposed to the sun and faced with water stress. As a result, the high temperatures observed during the first quarter after planting and combination (February to April 2023) would therefore have slowed down the growth of control *Aloe vera*suckers. Our results confirm the conclusions of Gharib & Ben [19] in their assertion that shade is important for the good development of *Aloe vera* plants. Moreover, the beneficial demonstration of the combination of plantain trees with other crops has been widely documented ([21]; [22]; [23]).

Aloe vera under shade also benefited from the availability of mineral elements stemming from the large plantain tree leaves which fall and decompose quickly because of the humid microclimate generated by the combination. In this context, the mineral elements released by the falling of plantain tree leaves followed by their decomposition favored optimal mineral nutrition of the combined*Aloe vera* suckers unlike the controls. Plantain tree leaves are used in the manufacture of certain compost [24]. Plantain tree leaves are obviously green materials that decompose to provide a nutrient-rich additive for aloe growth. According to one study, banana-based compost has greater nutrient efficiency in the soil compared to other fertilizers, good aeration associated with relatively low water application, and decreased nutrient loss through leaching[25]. The high values of fresh and dry matter of *Aloe vera* leaves observed in *Aloe vera* plants combined with plantain trees would be one of the consequences [26].

Regarding plantain trees combined with *Aloe vera*suckers; they were able to grow and develop more healthily unlike the controls. Indeed, control plantain trees were severely attacked by pests of the genus *Mycosphaerella sp*. This genus is responsible for Sigatoka disease in plantain tree. These

attacks would have had an impact on the growth and development of control plantain trees. Tuo *et al*. [27] reported the presence of these diseases in the area of Daloa and argue that they reduce the photosynthetic capacity of leaves and affect the growth and development of plantain trees. As for the combinedplantain trees, the low attack rate observed in this study would probably be due to the proximity of the plantain trees to *Aloe vera* suckers, which would create a natural protection provided by the latter. According to Gharib& Ben[19], the presence of bitter anthraquinones and other polyphenolic components in *Aloe vera* leaves makes it unattractive to pests and pathogens.

5. CONCLUSION

This study showed that plantain tree-*Aloe vera*combination is beneficial for both crops. Indeed, *Aloe vera*, which is a shade plant, could benefit from the shade and humid microclimate caused by the large plantain tree leaves, especially during periods of high temperature. In addition, the fall of large plantain tree leaves would favor optimal mineral nutrition of *Aloe vera*. As for plantain trees, the presence of *Aloe vera* could reduce the rate of attack on plantain trees by pests. Thus, plantain tree-aloe combination can be recommended and could be carried out at the density of two *Aloe vera*plants between four plantain plants. In perspective, we are planning to combine *Aloe vera* with other crops such as rubber tree and oil palm.

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