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Full Length Research Paper

Effect of mycorrhiza and pruning regimes on seasonality of hedgerow tree mulch contribution to alley-cropped cassava in Ibadan, Nigeria

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Field experiments were carried out on an alley-cropping farm in Ajibode village, near Ibadan where cassava alley-cropped with three hedgerow trees (*Leucaena leucocephala*, *Gliricidia sepium* and *Senna* (Syn *Cassia*) *siamea*), and sole planted cassava (all in three replicates) were arranged with arbuscular mycorrhizal fungi (AMF) inoculation (with *Glomus deserticolum*) in a completely randomized block design. Each plot was split after the first year into two and hedgerows within subjected to 2 and 3-month pruning regimes. Wet and dry season mulch contribution by pruning to alley-cropped cassava, as well as cassava yield characteristics in both alley-cropped and sole plots as affected by AMF inoculation and pruning regimes were monitored over two consecutive planting periods. During the first pruning year, AMF inoculation promoted dry season pruning production which was masked in *Leucaena* at 3 months by biomass diversion into flowering and in *Gliricidia* with both flowering and mite infestation. No definite patterns were observed in the second pruning year due to development of indigenous AMF symbiosis in all plots. Total yield of cassava increased with inoculation in all plots but dry season leaf area values and tuber yield indices were relatively higher in cassava alley-cropped with *Senna* and sole cassava than in others. The low total yield of sole cassava makes cassava alley cropped with *Senna* (inoculated or uninoculated) the best option for maintaining steady tuber yield with time in a continuing alley-cropping system.

Key words: Biomass diversion, cassava tuber yield index, mycorrhizal contribution.

INTRODUCTION

The choice of hedgerow trees for alley cropping has always been site, intercrop and situation specific (Nair, 1993). Among the long list of multipurpose tree species that had been found useful in alley cropping, especially in the humid to sub-humid lowland tropics of West Africa three have been used consistently by both scientists and farmers in on-farm, on-station and adopting farmer's plots. They are *Leucaena leucocephala* (Lam) de Witt, *Gliricidia sepium* (Jacq.) Walp. and *Senna* syn. (*Cassia*) *siamea* Lam. Irwin and Barneby.

L. leucocephala, a legume of the subfamily mimosoideae is the most widely studied of all the three hedgerow trees (Nair, 1993). *G. sepium*, a leguminous tree belonging to the family papilionaceae, native to Central America but extensively introduced to West Indies, Africa, South east and South Asia (Nair, 1993), is also widely used. Mulch formed by pruning from both trees is noted for the high nitrogen content. *S. siamea* is a non nodulating tree legume commonly found in the humid and sub-humid tropics (Allen and Allen, 1976; Nair, 1993). It is also known to perform well in semi-arid highland conditions (Atayese, 1994). *S. siamea*, separately quoted as originating from Southeast Asia (Keay et al., 1964) and from Africa (Lock, 1988) is cur-

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rently gaining popularity in alley cropping. Both *Leucaena* and *Gliricidia* fix atmospheric nitrogen while *Senna* is non N_2 – fixing. However, *Senna* still produces appreciable amount of N_2, and most importantly, it is an indigenous tree species.

The three leguminous trees have been found to give good results in tropical soils and this has influenced their choice as hedgerow trees in this experiment. However, *Leucaena* exhibits slow growth when planted in soils lacking certain rhizobia species because it is rhizobium specific. When growing in acid soils, it suffers slow growth as a result of aluminum toxicity and P deficiency. Also, as *Leucaena* matures, the trees become hardy and the roots become weedy. *Gliricidia* establishes very poorly in alley-cropping farms established in poor and infertile soils. Also, *Gliricidia* leaves can be attacked by mites which encourages termite attack and causes leaf fall (Nair, 1993), a condition that has been observed during the dry seasons in farmers plots in the humid lowland regions of western Nigeria but which disappears without any apparent effect when the rainy seasons come (Liasu, 2001). One negative attribute of *Senna* as regards its suitability for alley-cropping is that it has most (76%) of its fine roots in the top 20 cm of the soil profile (Ruhigwa et al., 1992). This is an indication that *Senna* as a hedgerow tree might compete with crop since the roots of both crop and tree will be localized in the same zone. Consequently, many workers have found *S. siamea* (which does not produce root nodule) unsuitable as sole hedgerow compared to most other hedgerow trees used in alley-cropping systems (Gichuru et al., 1990; Okon, 1996). In addition, *Senna* establishment is often difficult and there may be low germination rate. It is best established by seedlings (Nair, 1993).

Alley cropping can produce vastly contrasting effect on crop yield at different locations because of wide ranges of climatic and soil factors such as rainfall, acidity and slope as well as competition between hedgerow and intercrop which often limit crop and sometimes mulch yield. Rainfall in the humid to sub humid regions of southwestern Nigeria is bimodal with two peaks, (June\July and September \October) separated by a period of uncertain rainfall (August break). The rainy season is clearly demarcated from the dry season which begins around mid-November and ends around mid-March to early April. Generally, cultivation of crops (mostly annuals) are timed to coincide with the rainy seasons but cassava (the intercrop), a perennial long duration crop has its growth on the field span at least portions of two cropping years, i.e. the crop is hardly ever harvested during the season in which it was planted. As such, for cassava to complete its growth cycle on the field, it must experience at least a period of dry season (Onwueme and Sinha, 1993). In the tropics, shorter day-length, a characteristic of the dry seasons favours tuber production. Mulch contribution by hedgerow tree leaf pruning to cassava during the dry seasons is therefore of immense significance as the mulch can help to ameliorate the harsh conditions prevalent during the dry seasons. Active growth of the cassava intercrop during the dry seasons will likely result in significant tuber yield increase since the shorter day-length promotes tuber production.

Mycorrhizae are symbiotic association between plant roots and certain soil fungi (Sieverding, 1991). Vesicular-arbuscular mycorrhizal (VAM) fungi, now known as arbuscular mycorrhizal (AM) fungi (Morton, 1990) are the most commonly occurring form and are associated with most agricultural crops. Infected plants respond by showing improved physiology i.e. improved growth followed by improved biomass yield. This phenomenon has been exploited by both scientists and farmers in a deliberate (biologically based) technology to increase the productivity of agricultural crops. AM fungal inoculation has been known to improve the growth and biomass production of hedgerow trees and crops alike under dry situations through improved water relations of infected plants (Osonubi et al., 1992).

No report has been given on the seasonality of hedgerow tree pruning production in alley cropping plots established on alfisols in the humid and sub humid tropics where there are sharply defined wet and dry seasons. The objective of this study is to assess the performance e.g. leaf production, of the three popular hedgerow trees i.e *Leucaena, Gliricidia,* and *Senna* under the wet and dry conditions of the rainy and dry seasons, and how this may be affected by AM inoculation (with *Glomus deserticolum*). This is with the aim of attaining increased cassava productivity in alley cropping systems.

MATERIALS AND METHOD

The description of experimental site

The field study was conducted on an alley-cropping plot established in 1990 on a sloping land, a degraded and eroded Alfisol, at Ajibode village located between the University of Ibadan and the International Institute of Tropical Agriculture, IITA, Ibadan. Nigeria. The site is on Latitude 7° 43′N and longitude 30° 91′E with average annual temperature range of 25.0 - 35.80°C. Rainfall is bimodal with a long and short period of heavy rainfall separated into two by a short interval of uncertain rainfall i.e. the first rains commence from late March to the end of July followed by a short dry period in August and the second rains begin from September to end by mid-November.

The experimental layout of the hedgerow trees

The experiment was a split-split plot completely randomized block design with three replicates. The main plots consisting of inoculation (M^+) and non inoculation (M^-) with *Glomus deserticolum* as the first factor arranged in blocks to reduce the possibility of transfer of propagules to uninoculated plots. The second factor was the tree treatment and it was represented at three levels with the hedgerow trees *G. sepium, L. leucocephala* and *S. siamea*

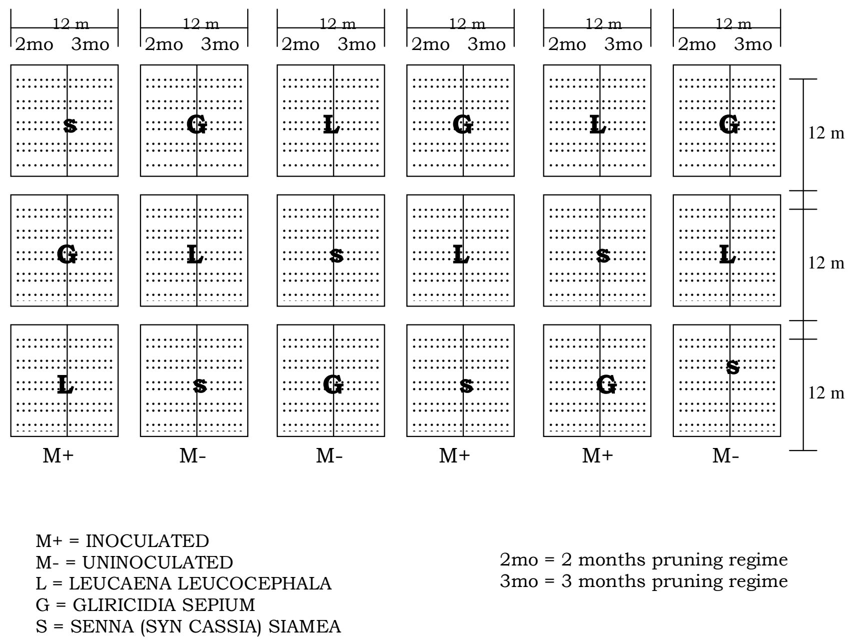

Figure 1. Layout of alley cropping experimental site.

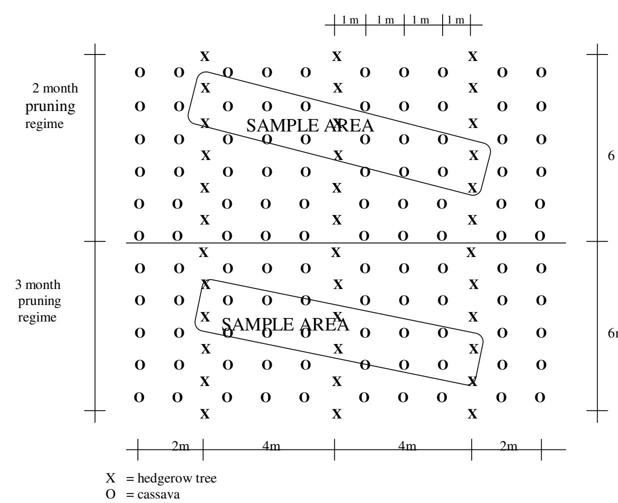

Figure 2. Layout of a subplot.

alley plots as subplots, and cassava as the intercrop (Figure 1).

Hedgerow tree establishment and pruning application

Each subplot covering an area of 12 m x 12 m consisted of three lines of each hedgerow tree planted with an inter-row space of 4 m with 2 m borders on both sides, and an intra-row space of 0.5 m to give a plant population of 5000 tree/ha. The cassava intercrop was planted in rows 1 m apart (between plants) and 1 m from the hedgerow to give a plant population of 7500 cassava plants/ha. Adjacent plots were separated by 4 m long borders (Figure 2). The hedgerow trees were established from 4 week old seedlings previously grown in nursery polythene bags (11.5 cm diameter, 15 cm depth) containing sterilised top soil from the site. The AM inoculum of *G. deserticolum* (Trappe Bloss and Menge) Trappe et al. (1984) was collected from Arizona (USA) and maintained in the soil biology laboratory of the Department of Botany and Microbiology, University of Ibadan. 10 g of the crude inoculum was put under the seeds in the polythene bags for inoculated hedgerow tree seedlings and planted along with inoculated cassava in plots designated inoculated M^+, while uninoculated hedgerow trees with their uninoculated cassava intercrop were planted in plots designated inoculated M^-. The hedgerow trees were left untouched during the first cropping season after which the first harvests of tree and cassava were made. The pruning experiments commenced at the beginning of the second cropping season and repeated during the third cropping season.

At the beginning of the experiment, all the plots were mulched at the same time with pruning (consisting of leaves and small branches) from their respective hedgerow trees i.e., the pruning from the hedgerow trees in each subplot were applied as mulch to the inter-row spaces within their alleys. The area within each subplot was split into two and the hedgerow trees within each half subjected to pruning at two and three month intervals. At each pruning, the hedgerows were cut at a point 50 cm above ground level. The pruning (both leaves and young stem branches) were reapplied to the alley as mulch. Prior to the application, the pruning were separated into leaves and stem and weighed fresh on the farm. Weighed leaf sub-samples were taken to the laboratory, oven dried at a temperature of 70°C for 1 day after which the dry weight was measured and recorded. The values were used to calculate the leaf dry matter yield of hedgerows by extrapolation. The total leaf mulch yields during periods falling within the rainy seasons were separately collated from those that fall within the dry seasons. The rainfall data were collected from the agroclimatology unit of the International institute of Tropical Agriculture (IITA) Ibadan station headquarters located on a site adjacent to the experimental site. From this, the total wet and dry season values of rainfall available to regenerating trees at both 2 and 3 month pruning regimes were computed.

Presentation of data

Pruning regimes and inoculation effects on wet and dry season leaf mulch production by hedgerow trees. The percentage reduction in leaf dry matter yield in the dry seasons compared to wet seasons was calculated at each pruning regime for each of the three hedgerow trees (inoculated and uninoculated) using the formula:

Percentage reduction in leaf dry weight = [(X-Y)/X] 100.

Where X = wet season leaf dry matter productions and Y= dry season leaf dry matter productions.

Mycorrhizal contribution to wet and dry season hedgerow tree leaf production

Hedgerow tree leaf yield response to mycorrhizal inoculation was calculated from the difference between the leaf dry matter yield of AM inoculated and uninoculated hedgerow trees and presented as a percentage of leaf dry matter yield of hedgerow trees i.e. inoculated with *Glomus deserticolum* (Kothari et al., 1991).

Mycorrhizal contribution to leaf mulch production % = [(A – B)/A] 100

Where A = Leaf dry matter yield by inoculated hedgerow trees. B = Leaf dry matter yield by uninoculated hedgerow trees.

Inoculated and uninoculated cassava tuber at the end of the second and the third harvest were subjected to the following yield analysis.

Fresh weight of cassava tubers in t ha^{-1} was measured by means of a spring balance. The total plant dry weight was measured from sub samples of stem, leaf root stock and root tubers that were first weighed fresh cassava yield characteristics.

Cassava plants harvested from within the hedgerows and those from sole plots of both inoculation treatments were separated into leaves, root tubers, and stems and were oven dried at 80°C until constant dry weights were recorded for the various plant parts. Total dry weight of plant was calculated by extrapolation and summation of the various dry weights measurement of each constituent part.

Leaf area determination

The leaf area (M^2/plant) of alley and sole cropped cassava was determined by harvesting all leaves from representative samples during the peak of the wet and dry seasons. The leaf areas were measured with a Li-Cor leaf area-meter. The tuber yield index was calculated from the formula.

$$\text{Yield index}_{(tuber)}, Y\% = \frac{\text{Tuber yield}}{\text{Total plant yield}} \times 100$$

Data analysis

The data collected were subjected to combined analysis of variance (ANOVA). The treatment means were separated by Duncan's multiple Range Test (DMRT) at P<0.05.

RESULTS

Mulch production

In the first cropping, mulch production by both *Leucaena* and *Gliricidia* were high and relatively lower in *Senna* during the rainy season. In addition, mulch production decreased drastically during the dry season in *Senna* and *Gliricidia* but marginally in *Leucaena* irrespective of AM inoculation and pruning regimes (Table 1).

However in the second planting period, mulch production from *Leucaena* at 2 month pruning regime was much higher than at 3 month during the rainy season while the mulch production from both *Leucaena* and *Gliricidia* showed drastic reduction as the dry season sets in with the highest coming from uninoculated *Leucaena* at 2 months pruning regime.

Senna at 2 months showed similar patterns of mulch production with a drastic reduction in dry season mulch production from inoculated *Senna* hedgerows. Curiously the *Senna* hedgerows at 3 months pruning regime produced large quantity of leaf regenerates (mulch) in the dry season compare to the other hedgerow trees. More noteworthy is the fact that the amounts of mulch produced during the dry season were in fact larger than those produced in the rainy season by uninoculated *Senna* hedgerow trees at 3 month pruning regime.

Table 1. Effect of inoculation and pruning regime on leaf production by hedgerow trees during the dry and wet seasons of the first year of cropping.

Hedgerow tree	Pruning regime	Inoculation treatment	Leaf dry production (t/ha)		Percentage reduction
			matter Wet seasons (X)	Dry seasons (Y)	[(X-Y)/X] 100
Leucaena	2-mo	M+	4.80c	4.20b	12.5b
		M-	2.75d	2.10d	23.6a
	3-mo	M+	7.40a	6.45a	12.8b
		M-	4.05b	3.90c	3.70c.
Gliricida	2-mo	M+	6.15b	3.60a	41.5b
		M-	3.15c	1.95c	38.1c
	3- mo	M+	6.60a	3.45a	47.7a
		M-	3.45c	2.25b	34.8d
Senna	2-mo	M+	3.80b	2.25b	40.8b
		M-	3.00c	1.65c	45.0a
	3-mo	M+	5.70a	3.60a	36.8c
		M-	4.05b	2.40b	40.7b

**For each hedgerow tree, means within same column followed by different letters are significantly different (P=0.05) according to Duncan's Multiple Range Test DMRT

Table 2. Effect of inoculation and pruning regime on leaf production by hedgerow trees during the dry and wet seasons of second year of cropping

Hedgerow tree	Pruning regime	Inoculation treatment	Leaf dry production (t/ha)		Percentage reduction
			matter Wet seasons (X)	Dry seasons (Y)	[(X-Y)/X] 100
Leucaena	2-mo	M+	6.42b	3.33a	48.1b
		M-	8.45a	2.77b	67.2a
	3-mo	M+	5.53d	2.99ab	45.9c
		M-	6.09c	3.23a	47.0bc
Gliricida	2-mo	M+	5.32a	3.05a	42.7c
		M-	4.38b	2.55b	41.8c
	3-mo	M+	4.39b	1.97c	55.1a
		M-	3.97c	2.02c	49.1b
Senna	2-mo	M+	4.67a	1.86d	60.2a
		M-	4.04b	2.28c	37.7b
	3-mo	M+	3.45c	2.61b	24.3c
		M-	2.62d	3.12a	-19.1d

**For each hedgerow tree, means within same column followed by different letters are significantly different (P=0.05) according to Duncan's Multiple Range Test DMRT

Mycorrhizal contribution to pruning production by hedgerow trees

Mycorrhizal contribution to pruning production in *Leucaena* and *Gliricidia* were similar in both hedgerows and higher than in *Senna* during the rainy seasons of the first cropping season irrespective of pruning frequencies. However during the dry season mycorrhizal contribution to pruning production decreased in *Gliricidia* and *Senna* but increased marginally in *Leucaena*.

The amount of rainfall incident on regenerating hedgerow trees was similar for those at 2 and 3 months prun-

Table 3. Pruning frequencies, rainfall and seasonal variation in mycorrhizal contribution to leaf mulch production by hedgerow trees during for consecutive planting seasons

SEASON	Pruning	Hedgerow	First year		second year	
			Total Rainfall	MC	Total rainfall	MC
			mm	%	mm	%
WET	2-mo	*Leucaena*		42.7 a		-31.6 f
		Gliricidia	704.2	48.7 a	790	+17.7 b
		Senna		21.5 c		+13.5 c
	3-mo	*Leucaena*		45.2 a		-10.1e
		Gliricidia	880.1	47.7 a	768	+9.6 d
		Senna		28.9 b		+24.1a
	2-mo	*Leucaena*		50.0 a		+16.8 a
DRY		*Gliricidia*	191.8	31.2 b	196.7	+16.4 a
		Senna		26.7 c		-22.6 d
	3-mo	*Leucaena*		38.5 b		-8.0 c
		Giliricidia	178.9	34.7 b	220.7	-2.5 b
		Senna		33.3 b		-19.5 d

Mycorrhizal contribution (MC) values for each season followed by different letters are significantly different at ($P<0.05$) according to Duncan's Multiple Range Test DMRT.

ing regimes during each of the seasons (i.e. wet and dry seasons). During the rainy seasons of second season planting period, mycorrhizal contribution to pruning production in all hedgerows declined with highest decrease from *Leucaena* hedgerows which recorded negative values at both 2 and 3 months pruning regime.
However, during the dry seasons, mycorrhizal contribution (MC) to pruning in *Senna* hedgerows also dropped to an all time low (i.e. recording negative values) irrespective of pruning regimes while pruning in *Gliricidia* was only negative in hedgerows at 3 months pruning regime.

Effect of inoculation on yield distribution in alley and sole cropped cassava

During the first cropping season, all cassava yield parameters considered (i.e. cassava tuber fresh weight, leaf area, total dry matter yield and tuber yield index were promoted by AM inoculation in sole plots as well as plots with all hedgerow trees irrespective of pruning regimes except in cassava alley-cropped with *Senna* at 3 months pruning regime where inoculation did not appear to affect total dry matter yield (Table 4).

During the second season, inoculation still promoted tuber fresh weight in both sole and alley cropped cassava plots except in plots with *Gliricidia* where tuber yield from uninoculated were higher than those from inoculated (Table 5).

The total leaf area of cassava plants reduced drastically during the dry season except in plots with *Senna* and sole cassava. It was not affected by inoculation in those alleys cropped with *Leucaena*. In plots with *Gliricidia* cassava leaf area was still higher in inoculated than uninoculated. However in cassava alleycropped with *Senna*, the reverse in the case irrespective of pruning frequencies. The tuber yield indices of cassava from inoculated plots were higher than uninoculated. High tuber yield indices were recorded for sole cassava and those alley-cropped with *Senna*. The highest total dry matter yields were recorded from *Gliricidia* and *Leucaena* plots. Total cassava dry matter yield from these two alley-cropped plots were higher than from *Senna* irrespective of inoculation and pruning frequencies while the sole planted cassava (both inoculated and uninoculated) recorded the lowest total dry matter yield.

Discussion

The dry season leaf mulch production by L*eucaena* at 3 months pruning regime did not appear to show any particular pattern with AM inoculation because of biomass diversion to flower production that begins in *Leuceana* regenerants at between 2 and 3 months after pruning. In *Gliricidia* that flowers in the dry season, losses as a result of biomass diversion to flower formation coupled with due to attacks by mites also contribute to lowering the quantity of leaf mulch produced. However, inoculation with AMF will still likely promote total biomass regenerated (not shown) as earlier reported by Liasu et al. (2005). That the promotive effect of AM fungi on leaf mulch production is apparent in *Senna* hedgerows irrespective of pruning regime is probably because the

Table 4. Influence of hedgerow trees and AM inoculation on yield distribution and leaf area of cassava intercrop at 2 and 3-month pruning regime during the first year of cropping

Hedgerow Tree	Inoculation	Tuber fresh Weight (t/ha)	Leaf area M^2/plant		Total dry weight (t/ha)	Yield index(tuber)
			Wet season	Dry season		
2 month Pruning Regime						
Leucaena	M+	21.0a	6.70a	2.71a	25.1a	0.84a
	M-	11.4b	4.52b	2.03b	20.2 b	0.56b
Gliricidia	M+	20.0a	6.41a	2.84a	26.8 a	0.75a
	M-	15.3b	4.79b	2.53b	22.4 b	0.68b
Senna	M+	16.7a	3.31a	1.90a	16.1a	1.03a
	M-	9.2b	2.79b	1.12b	12.2 b	0.75b
3 month Pruning Regime						
Leucaena	M+	24.1a	6.91a	1.09a	31.3a	0.77a
	M-	15.1b	5.78b	0.92b	21.4 b	0.71b
Gliricidia	M+	26.3a	7.20a	2.15a	32.8a	0.80a
	M-	18.6b	6.80b	1.93b	25.6 b	0.73b
Senna	M+	17.3a	4.81a	1.01a	20.1a	0.86a
	M-	14.8b	3.10b	0.84b	19.2a	0.77b
Sole (no tree)						
	M+	11.6a	2.88a	1.79a	21.7a	0.53a
	M-	7.1b	2.10b	1.66b	19.8b	0.36b

*Means within each hedgerow tree followed by different letters are significantly different at $P < 0.05$ according to Duncan's Multiple Range Test DMRT.

trees had not yet reached maturity to flower. Besides, Kadiata et al. (1996) had reported late upsurge in biomass accumulation in Senna compared to two other hedgerow trees. The response of hedgerow tree regeneration to applied AM fungus becomes more complex during the second planting period because of the redistribution of AM fungal propagules across treatments and the development of indigenous mycorrhizae in the uninoculated plots i.e. hedgerow tree plots not initially subjected to AM inoculation. Hence AM fungal contribution to leaf mulch production during the second cropping period especially in *Senna* hedgerows appeared to dwindle not because of a decrease in AM support but rather because of an increase in AM support from newly developed AM symbiosis from uninoculated plots (Atayese et al., 1993).

Liasu (2001) also predicted increased efficiency of indigenous AM fungi in promoting hedgerow tree leaf production with continuous cultivation as the alley copping field ages. Effects of water availability here may be ruled out since the total amount of rainfall incident on trees at both 2 and 3 months pruning regime appeared similar. *Senna* appeared to maintain a fairly steady if not improved mulch production with time in this continuous alley cropping plot is in line with recent reports by Liasu et al. (2005). The fact that AM inoculation improves tuber yield of both alley and sole cropped cassava has been established (Atayese, 1994; Osonubi et al., 1995; Okon and Osonubi, 2005) but sustained yield promotion with continuous cultivation as studied in this work involves an interplay of factors, one of which is competition between hedgerow tree and crop at the root-crop interface which gets critical during the dry season thus affecting tuber yields in spite of AM fungi induced increase in the total biomass production of cassava intercrop. Consequently, cassava tuber yield indices were steady in sole planted plots and plots alley cropped with *Senna* because of absence of competition between tree and crop in the former and minimized competition (particularly during the dry season) coupled with improved soil nutrient and soil physical property in the latter. These which probably resulted from increased mulch supply and decreased

Table 5. Influence of hedgerow trees and AM inoculation on yield distribution and leaf area of cassava intercrop at 2 and 3-month pruning regime during the second year of cropping.

Hedgerow Tree	Inoculation	Tuber fresh Weight (t/ha)	Leaf area M^2/plant Wet season	Leaf area M^2/plant Dry season	Total dry weight (t/ha)	Yield index (tuber)
2 month Pruning Regime						
Leucaena	M+	9.5a	3.22a	0.66b	21.14a	0.45a
	M-	5.8b	2.52b	0.85a	12.07b	0.48a
Gliricidia	M+	9.8b	7.58a	0.62b	25.58a	0.38b
	M-	11.3a	6.58b	0.93a	20.98b	0.54a
Senna	M+	10.0a	1.79a	2.98a	16.72a	0.60b
	M-	8.5b	1.00b	2.83b	11.17b	0.76a
3 month Pruning Regime						
Leucaena	M+	15.5a	4.60a	0.73a	28.69a	0.54a
	M-	6.0b	4.40a	0.70a	16.24b	0.37b
Gliricidia	M+	11.8a	9.48a	0.79b	32.93a	0.36a
	M-	8.5b	7.35b	1.06a	21.37b	0.39a
Senna	M+	16.8a	1.59b	3.87a	22.48a	0.75a
	M-	13.3b	2.48a	3.33b	19.82b	0.67b
Sole (no tree)						
	M+	3.3a	2.77a	2.65a	4.99a	0.65a
	M-	2.3b	1.75b	1.25b	3.36b	0.67a

*Means within each hedgerow tree followed by different letters are significantly different at P > 0.05 according to Duncan's Multiple Range Test DMRT.

interference by tree roots may be responsible for the appreciable foliage leaf cover on cassava plants during the dry season which translates to increased photosynthesis during a period when most photosynthetase are being diverted into tuber formation (Onwueme and Sinha, 1991; Ekanayake et al., 1997).

However, the total yield as well as absolute tuber yield which declined continuously with time in sole planted cassava makes sole planting of cassava less desirable in spite of the fairly high yield index. On the other hand, when the fairly high total yield of cassava from plots with *Senna* are combined with the high tuber yield index, it leaves cassava alley-cropped with *Senna* as the only sustainable cropping option that can maintain fairly steady and economically feasible returns from cassava cultivation.

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