ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 5.2
IJAR 2017; 3(10): 32-38
www.allresearchjournal.com
Received: 08-08-2017
Accepted: 09-09-2017

Anguessin Benjamine
Laboratory of Biodiversity and Sustainable Development; Faculty of Science; University of Ngaoundere, P.O. Box 454, Cameroon

Ibrahima Adamou
Laboratory of Biodiversity and Sustainable Development; Faculty of Science; University of Ngaoundere, P.O. Box 454, Cameroon

Mapongmetsem Pierre Marie
Laboratory of Biodiversity and Sustainable Development; Faculty of Science; University of Ngaoundere, P.O. Box 454, Cameroon

Correspondence
Anguessin Benjamine
Laboratory of Biodiversity and Sustainable Development; Faculty of Science; University of Ngaoundere, P.O. Box 454, Cameroon

Litter quality and decomposition along climatic gradient in northern Cameroon

Anguessin Benjamine, Ibrahima Adamou and Mapongmetsem Pierre Marie

Abstract
In the Sudano-Sahelian zone of Cameroon, *Jatropha curcas* L. and *Jatropha gossipifolia* L. are among the species integrated in farmer production systems. Despite their importance in rural areas, little attention is paid to their litters. The overall objective of this work is to contribute to the valorization of *Jatropha* in the region. Leaf litter collected was put in litterbags and incubated *in situ* in three stations following the climatic gradient from Ngaoundéré to Maroua via Ngong under and outside tree canopy. The experimental design was a split-split-plot. Data was subjected to analysis of the variance. The results obtained reveal that the litters of the two species differ in their physico - chemical characteristics. The remaining dry mass varies significantly (0.0002 < 0.001) according to stations: 0.89% (Ngaoundere), 2.85% (Ngong) and 8.80% (Maroua), 16 weeks after incubation. It is also significant (0.0003 < 0.001) between micro stations: under (6.58 ± 0.96) and outside canopy (1.79 ± 0.72). The rate of litter decomposition decreases from the humid to the dry station. Litter decomposition is faster outside than under canopy. Litters of the two species are both labile.

Keywords: Climate, litter, decomposition, *jatropha curcas*, *jatropha gossypifolia*, guinea, sudano-sahelian

Introduction

Natural resources in the Sudano-sahelian zone of Cameroon are degraded [1, 2]. The population growth with its corollary soil overexploitation is the main factors which reduce cultivable land as well as soil fertility [3]. To circumvent this disastrous situation, sustainable approach needs to be promoted in the management of natural resources and soil fertility. Agroforestry appears as an alternative which both protects soil and increases plant production [4, 5].

In this zone of Cameroon, species from the genera *Jotropha* (*J. curcas*, *J. gossypifolia*) is used in the farmer production system as life fences [6]. In fact *Jatropha* species present many advantages to farmers. In addition to their use as biodiesel, different parts of these species are used in pharmacopeia. They play important role in soil aeration as well as erosion control through life fence and provide shade to crops. Litters and residues from biofuel production could be used as organic fertilizer in farms, then permitting to reduce the quantity of chemical fertilizers which are not often affordable to farmers due to their expensive cost [7]. Recent works demonstrated that soil productivity in the tropics decreased with the continual use of chemical fertilizers [8].

Many scientific works have investigated different aspects of jatropha species among which are: genetic diversity [9]; molecular characterization [10]; vegetative development and productivity [11]; productivity of *J. curcas* and its impact on soil chemical properties [12] and Ethnobotany and botanical characterization of the genera *Jatropha* [6]. Despite the multitude of studies above-mentioned, little scientific attention was given to litter decomposition of the genera.

The present work attempts to contribute to the valorization of jatropha species in northern Cameroon. Specifically, it consists to:

- Determine the initial physico-chemical characteristics of leaf litter of the two species;
- Follow the remain dry mass dynamic during litter decomposition;
- Determine the influence of the climatic gradient on litter decomposition.

Materials and decomposition

Study site

The work was undertaken in the northern part of Cameroon mainly in Guinea savannah highlands and Sudano-sahelian areas. Litters of *Jatropha curcas* and *J. gossypifolia* were incubated along a climatic gradient in the following stations: humid (Ngaoundere), intermediate precipitations (Gong) and dry (Maroua). The climate prevailing in these parts of the country is:

- Guinean characterized by a dry season (November-March) and a rainy season (April-October) for the guinea savannah highlands. The annual rainfall is 1500 mm whereas the temperature is 23 °C;
- Tropical sudano-sahelian with two sub-climates: a sudanian climate with a dry season (December–March) and rainy season (April-November); temperature of 29.07; relative humidity of 73.38% and an annual rainfall of 984.08mm. Concerning the sahelian climate, there is a dry season (December-March) and a rainy season (April-November). The annual rainfall is 861.17 mm whereas the temperature is 30.08 °C (Table 1).

The vegetation of the zone varies from woody savannahs to steppes. The main plant species encountered are *Vitellaria paradoxa*, *Balanites aegyptiaca*, *Anogeissus leiocarpus*, *Combretum* spp., *Acacia* spp., *Terminalia* spp. etc [13, 14]. The main activities of the populations are farming and fishing.

Table 1: Meteorological parameters of the Soudano-Sahelian zone of Cameroon (2010-2014)

		J	F	M	A	M	J	J	O	D	O	N	D	Total
Ngaoundere	Pmm	0	0,65	30,27	141,45	196,72	212,07	228,62	246,22	236,07	126,32	4,3	0	1422,72
	T°C	25,32	27,55	30, 30,1	30,6	29,67	29,35	26,8	26,35	26,27	26,8	27,95	25,12	27,65
	HR%	48,1	46,1	53,5	61,3	78	80,6	82,05	83,4	81,65	76,45	65,35	53,1	67,46
Gong	Pmm	0	0	0,5	25,32	126,38	143,54	177,36	180,82	228,98	91,62	9,56	0	984,08
	T°C	27,56	30,51	32,27	33,93	31,13	28,6	26,38	27,2	27,31	28,8	28,75	26,5	29,07
	HR%	48,18	49,78	35,68	64,2	77,14	91,24	97,1	96,28	96,92	95,18	71,7	57,26	73,38
Maroua	Pmm	0	0	0	10,42	37,9	103,47	240,37	257,75	157,05	54,2	0	0	861,17
	T°C	30,71	34,76	35,83	37,59	32,62	26,55	24,73	21,89	23,97	27,76	35	29,51	30,08
	HR%	31,27	23,49	16,78	23,68	55,15	74,82	77,69	84,33	76,25	65,05	37,35	21,32	48,93

Source: Meteorological stations (Ngaoundere, Garoua, Maroua) (2014).

Litters incubation in the field

In the laboratory, litters were weighted and 7 0.01g of each species were put in polyethylene litterbags of 2 x 2 mm^2 stitch. A total of 128 samples were incubated *in situ* in each of the following stations: Humid (Ngaoundere), Intermediate (Gong) and Dry (Maroua).

Litterbags were fixed in the soil in order to avoid their transportation by animals. In each station, litterbags were splited into two parts and inserted in two micro stations: out and under canopy of trees. For the three stations and two micro stations, a total of 384 litterbags (8 withdrawals x 4 litterbags x 3 stations x 2 micro stations x 2 species) were incubated in the three stations. To understand the evolution of the decomposition along the climatic gradient, four litterbags were retrieved at different times in each station after: 2, 4, 6, 10, 16, 24, 36 and 52 weeks during the incubation period. The experimental design was a Split-split-plot with four replicates. Stations represent the main plot whereas species coincide with the sub – plot and micro stations the sub-sub-plot.

Assessment of remaining dry mass according to the initial litter dry mass

In the laboratory, the content of each bag was withdrawn carefully (sorted out of wastes), cleaned and weighed immediately to get the fresh weight. Then it was dried at 59° C for 48 hours in order to determine the dry weight. After withdrawal of steams, its litter was passed through desiccator for 10 mn to consolidate the weight. The remaining litter was subjected to subsequent analyses. Four additional samples of litters were weighted fresh, then passed into oven and their initial dry mass was determined. Their remaining dry mass compared to their initial mass in percentage was calculated following the following formula: Remaining dry mass (RDM (%)) = (DMt/DMo) x 100 where DMt and DMo are dry mass at t time and to initial time respectively.

Estimation of initial physico-chemical characteristics of leaf litters

Three physical initial parameters of leaf litters were determined. The litter thickness was assessed whereas the surface area as well as surfacic mass was estimated using the equation model of [15] and the ratio litter mass per surface.

- Surface (cm^2) = 0.68 x (length x maximal width) – 0.114.
- Index of sclerophylly = Mass surfacic / Litter surface.

The chemical analysis of the litter was undertaken in the laboratory of the National High School of Agro-Industry (ENSAI). The main measurements concerned phosphorus, potassium, calcium, magnesium and sodium for mineral contents then polyphenols, lignin and cellulose for the organic matter. Determination of the amount of dry matter and the ashes content as well as carbon, nitrogen was done by AFNOR [16]. The organic matter content was by calcination of organic matter at 550 °C. Ashes are residues from calcination of organic matter at the temperature abovementioned until constant weight. Minerals are measured out of the above residues. Calcium and magnesium were obtained through EDTA titrimetric method [16] while phosphorous, cellulose and lignin were determined according standard methods [17, 18, 19] and modified method [20]. Total phenolic compounds were assessed by method using Folin-Ciocalteu reactive [21].

Data collected were subjected to analysis of variance. Comparison of the significant mean was done through Duncan Multiple Range Test (DMRT) whereas their separation uses LSD at 5%. The statistical programme used was Statgraphics plus.

Results and discussion

The initial Physico-chemical characteristics of litters are important parameters which allow for the understanding of litter decomposition behavior.

Physical characteristics of the litter

The surface area of the litter varies from108.64±2.87 cm^2 in *Jatropha gossypifolia* to 246.40±46.67 cm^2 in *J. curcas* (Table 2). The thickness and the sclerophylly index follows analogous trend. *J. curcas* has the largest thickness (0.36±0.05mm) as well as sclerophylly index (5.1±1x10^{-3}g/cm^2). There are significant differences among the two species in terms of thickness area (0.0001<0.001) and leaf surface area (0<0.05) contrary to the schlerophylly index (0.258>0.05).

Table 2: Initial physical characteristics of litters

Espèces	Thickness (mm)	Surface (cm2)	Sclerophylly Index.10^{-3}(g/cm²)
Jatropha culcas	0.36±0.05 a	246.40±46.67 a	5,1±1 a
Jatropha gossypifolia	0,214±0.04) b	108.64±2.87 b	4.5±0.9 b
P.value	0.0001	0	0.258

Litter initial chemical characteristics

Mineral and organic compounds of the two litters were determined.

Mineral compounds of litters

The nitrogen initial composition of *J. curcas* (2.14%) is high compared to that of *J. gossypifolia* (1.95%). Nevertheless, there is no significant difference between the two species (0.4436>0.05). The content of the two species in terms of carbon varies significantly from 39.65% (*J. curcas*) to 35.48% (*J. gosssypifolia*) (0.0411<0.05). The ratio C/N for the two species: 18.52 in *J. curcas* and 18.19 in *J. gossypifolia* is less than 20 (Table 3). These results indicate that the behavior of the two species in liberating nitrogen during litter decomposition is similar. Similar results were reported by others [22, 23]. However, litters of *J.gosssypifolia* are rich in phosphorous (64.96mg/100g MS >50.27 mg/100g MS), calcium (1.26%> 1.10%) and in magnesium (305.32mg/100gMS > 268.42 mg/100g MS) than those of *J. curcas.* Despite these variations, significant difference does not exist between the two species as far as contents of calcium and magnesium are concerned except for phosphorus (0.0005< 0.001). The rate of litter decomposition is according to their content in calcium [24]. Litters which are rich in calcium, decompose quickly. This justifies the fast litter decomposition noted in *Jatropha gossypifolia*.

Organic compounds

J. curcas (68.37%) contains a great percentage of organic matters than *J.gosssypifolia* (61.17%). *J. curcas* has equally a high significant concentration in polyphenols (1.29 > 0.83%) (0.0256<0.05) and in cellulose (6.51% >4.84%) (0.0024<0.01) compared to *J.gosssypifolia* (Tableau 3). However the content in terms of lignin in the two species is identical: 7.47% in *J.gosssypifolia* and 5.94% in *J. curcas* (0.1685<0.05). However the proportion of lignin found in the two species is between the intervals (5-10%) of that reported in fresh litters [24]. Vascular tissues of plants were more resistant to decomposition than fibers due to their content in lignin [25]. During decomposition, concentration in lignin increases and slows down decomposition [26]. There is a reverse proportional relation between litter lignin content and its decomposition rate [27].

Table 3: Initial litter chemical content

	Polyphenols (%)	Cellulose (%)	Lignin (%)	N (%)	C (%)	OM (%)	Ashes (%)	P (mg/100gMS)	Ca (%)	Mg (mg/100gMS)
J. curcas	1.29 (0.08)a	6.51 (0.38)a	5.94 (0.30)a	2.14 (0.27)a	39.65 (0.92)a	68.37 (1.59)a	0.31 (0.01)a	50.27 (0.46)a	1.10 (0.04)a	268.42 (21.46)a
J. gossypifolia	0.83 (0.06)b	4.84 (0,28)b	7.47 (0.97)a	1.95 (0.07)a	35.48 (0.82)b	61.17 (1.41)b	0.39 (0.01)b	64.96 (0.04)b	1.26 (0.06)a	305.32 (11.12)a
F	37.61	423.77	4.48	0.90	22.84	22.84	23.06	1974.95	9.80	4.66
P.value	0.0256*	0.0024**	0.1685	0.4436ns	0.0411*	0.0411*	0.0407*	0.0005***	0.0887ns	0.1636ns

Figures in brackets represent standard errors. Means follow by the same letter are not significant * = P<0.05; * * = P<0.01; *** = P<0.001; ns = non-significant (P>0.05); OM = Organic matter

The species of the genera *Jatropha* liberate efficiently with precocity and assimilate nitrogen according to the ratio C/N which is less than 20 [22, 23]. The ratio C/N is currently used as indicator of litter quality. High values of this ratio (>25) indicate that litters have weak capacity of degradation and resist more against organisms and biochemical attacks. Low values of the ratio (20 < C/N > 6) suggest that litters are rich in nitrogen and available to decomposers. The duration of complete decomposition of litter was 16 weeks irrespective of the station. In the beginning of the incubation, litters decompose quickly and its rate reduces till the end. These results corroborate those of various authors who worked in the similar problematic [28, 29, 26]. The reduction of the decomposition rate at the end of the experience explains the increase of lignin content in litters as time goes on. Analogous decomposition behavior was reported by others [26, 27].

Litters' remaining dry mass dynamic

Two weeks after litters' incubation, the remaining mass varied from 81.61 ± 4.02 in *Jatropha gossypifolia* to 85.75 ± 2.85% for *J. curcas*. Four weeks after incubation, the remaining dry mass of litters varies from 3.95 ± 0.07 in *J. gossypifolia* to 4.42 ± 0.92g for *J. curcas*. At the sixteenth weeks after incubation, the trend is similar between the two species: 3.95± 0.068 (*J. gossypilifolia*) and 4.42 ± 0.92 (*J. curcas*). Despite the variation noted after two (0.31 > 0.05), four (0.3077 > 0.05) and sixteen (0.73>0.05) weeks, there was no significant difference among the species suggesting that loss of the dry mass was equal among the two species

(Table 4). This result is against the findings of other authors who reported that litter qualities impact decomposition process [24, 30]. The decomposition behavior is in concordance with the ratio C/N which is similar in *J. curcas* (18.52) and *J. gossypifolia* (18.19). These species released assimilate nitrogen efficiently and with precocity. The explanation of their behavior is given by their C/N ratio which is similar and also less than 20, confirming the results of others [22, 23]. The C/N is currently used as quality indicator of litters. Litters are tough and have low capacity of degradation when the C/N is more than 25. The ratio value less than 6 indicates that litters are rich in nitrogen and well accessible to decomposers.

Table 4: Percentage of remaining dry mass in two species

Species	Incubation duration (weeks)		
	2	4	16
Jatropha curcas	85.75 ± 2.85	4.42 ± 0.92	4.42 ± 0.92
Jatropha gossypifolia	81.61 ± 4.02	3.95 ± 0.068	3.95 ± 0.068
P. value	0.3077[ns]	0,3077[ns]	0.7255[ns]

Concerning the effect of station, the remaining dry mass after two weeks varied from70.40 ± 3.46 in Ngaoundere to 92.87 ± 1.75% in Maroua while after four weeks, it varied from 0.89±0.03 in Ngaoundere to 8.80 ± 2.32% at Maroua. There was no significant difference between stations after two weeks (0.8828 > 0.05) contrary to the behavior observed after four and sixteen weeks (0.0001<0.001). This result showed that litter decomposition in the two species was fast in Ngaoundere than in Maroua. The dynamism of mass loss respects the climatic gradient which varies from the humid station (Ngaoundere) to a dry one (Maroua). The Duncan Multiple Range Test confirms the trend of litter decomposition in these stations. Litter decomposition is fast in the humid station (Ngaoundere) and low in the dry station (Maroua). Litter decomposition was moderate in intermediate station of Gong (Table 5). Differences among stations are due to climatic conditions: Ngaoundere is a humid one with 1422.72 mm of precipitations while Gong and Maroua are from intermediate (984.08 mm) and dry (861.17 mm). In medium limited by water, precipitation effects are superior to that of average temperature and soil texture [31].

Table 5: Percentage of remaining dry mass in different stations

Stations	Incubation duration (weeks)		
	2	4	16
Ngaoundéré	70.40 ± 3.46[a]	0.89 ± 0.03[a]	0.89 ± 0.03[a]
Gong	87.76 ± 3.18[a]	2.85 ± 1.14[ab]	2.85 ± 1.14[ab]
Maroua	92.87 ± 1.75[a]	8.80 ± 2.32[b]	8.80 ± 2.32[b]
P.value	0.8828	0.0001	0.0001

In column, means follow by the same letter are not significant

The dynamic of remaining dry mass evolves significantly (0.0182<0.05) from 78.72 ± 3.58% in the micro station out canopy to 88.63 ± 2.83% under canopy of trees after two weeks of incubation (Table 6). Litter decomposition is faster out of tree canopy than under canopy. The same trend was significantly observed after four and sixteen weeks (0.0000<0.001). Litter decomposition is faster in the micro station out canopy than under canopy. This result suggests that micro stations are different during the incubation period irrespective of duration. Numerous authors have demonstrated the evidence of the climate influence on litter decomposition [32, 33, 28, 34, 35, 36]. Temperature may be among the factors which better explain litter decomposition in these conditions. In fact, decomposer microorganisms are active in dry and humid conditions and less active in very cold and humid conditions [32, 33, 35, 36]. Temperature and humidity are among the main factors influencing litter decomposition at regional level [37]. At local level (microsite, population), it is also argued that the same factors are implicated [38]. At this level, litter quality and microorganisms of the soil are major decisive factors of decomposition due to the fact that the climate is homogenous. In the same thought of mind, it is reported that microorganisms became very active when the ratio C/N is high [39].

Table 6: Percentage of remaining dry mass in different positions

Micro station	Incubation duration (weeks)		
	2	4	16
Under canopy	88.63 ± 2.83a	6.58 ± 0.96a	6.58 ± 0.96a
Out canopy	78.72 ± 3.58b	1.79 ± 0.72b	1.79 ± 0.72b
P. value	0.0182	0.0000	0.0000

In column, means follow by the same letter are not significant

For the station*species interaction after four weeks of litters incubation, the remaining dry mass percentage varies from 0.19 ± 0.03% in *J. gossypifolia* at the Ngaoundere station to 10.33 ± 1.79% in *J. gossypifolia* at the Maroua station (Table7). *J. gossypifolia* litter decomposed faster in Ngaoundere and in Gong station than in Maroua. However there was no significant difference among stations (0.16>0.05). This result suggests that the remaining dry mass between species in different stations is equal after four and sixteen weeks despite the variation noted.

Table 7: Percentage of remaining dry mass in species by station interaction

Species/station	Ngaoundere			Gong			Maroua		
	2	4	16	2	4	16	2	4	16
Jatropha curcas	73.75 ± 4.90	1.59 ± 0.76	1,59 ± 0,76	89.72 ± 4.55	4.38 ± 1.61	4,38 ± 1,61	93.77 ± 2,75 91.96 ± 3,48	7.28 ± 2.06	7,28 ± 2,06
Jatrpha gossypifolia	67.05 ± 3.61	0.19 ± 0.03	0,19 ± 0,03	85.80 ± 1.76	1.33 ± 0.71	1,33 ± 0,71	91.96 ± 3.48	10.33 ± 1.79	10,33 ± 1,79
P.value	0.88	0.16	0.16	0.88	0.16	0.16	0.88	0.16	0.16

After four weeks of litter incubation for the species by position interaction, the remaining dry mass percentage oscillate from 0.83 ± 0.26 in *J. gossypifolia* incubated out canopy to 7.07 ± 2.38% in the same species under canopy of trees (Table 8). Despite this variability, there is no significant difference (0.2780>0.05). Decomposition of litters of these species in the two micro stations is identical after four weeks.

Table 8: Percentage of remaining dry mass in species by position interaction

Species/micro station	Out canopy			Under canopy		
	2	4	16	2	4	16
Jatropha curcas	84.67 ± 3.59	2.74 ± 0.92	2.74 ± 0.92	86.82 ± 4.00	6.09 ± 1.31	6.09 ± 1.31
Jatrpha gossypifolia	72.77 ± 4.51	0.83 ± 0.26	0.83 ± 0.26	90.44 ± 2.75	7.07 ± 2.38	7.07 ± 2.38
P.value	0.0606	0.2780	0.278	0.0606	0.2780	0.278

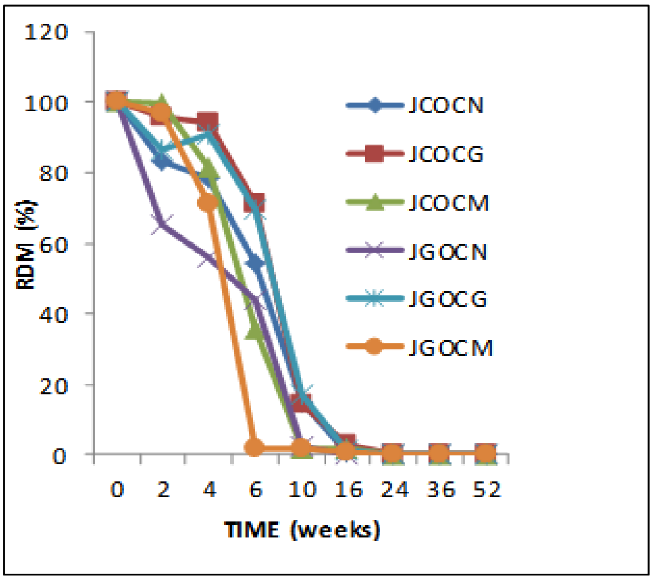
For station by micro station interaction, the percentage of the remaining dry mass after four weeks of incubation in the field varied significantly from 0.51 ± 0.06% out canopy at Ngaoundere station to 15.02 ± 2.69% under canopy at Maroua (0.001<0.01) (Table 9). This result follows the same trend as above-mentioned. Litter decomposition is faster in the humid station than in the dryness one. In general, it appears that the percentage of the remaining dry mass of litters incubated out canopy is low compared to that obtained under canopy. Sixteen weeks after incubation of litters, the percentage of remain dry mass show significant difference (0.0010<0.01).

Table 9: Percentage of the remaining dry mass of litter during litter decomposition

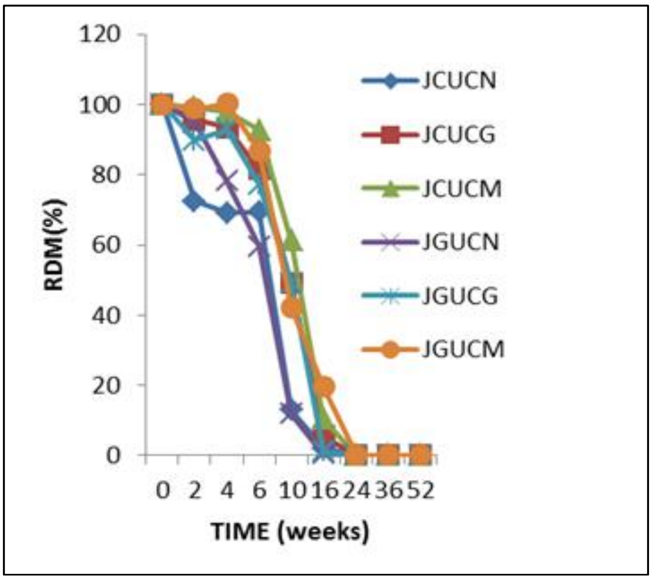
Station/Micro station	Out canopy			Under canopy		
	2	4	16	2	4	16
Ngaoundere	67.11 ± 4.91a	0.51 ± 0.06a	0.51 ± 0.06a	73.68 ± 3.29a	1.28 ± 0.33a	1.28 ± 0.33a
Gong	92.54 ± 2.23a	2.26 ± 0.68b	2.26 ± 0.68b	93.19 ± 1.96a	3.45 ± 1.61b	3.45 ± 1.61b
Maroua	2.60 ± 1.03a	2.60 ± 1.03b	2.60 ± 1.03b	99.02 ± 3.75a	15.02 ± 2.69c	15.02 ± 2.69c
P.value	0.083	0.0010	0.0010	0.083	0.0010	0.0010

In column, means follow by the same letter are not significant

Concerning the interaction species*micro station*station, litters were totally decomposed after 4 months (16 weeks) without exception (Fig 1). Litter mass loss was fast at the beginning of incubation then diminished with time. These results corroborate those of many authors who work on the similar problematic [28, 29 26, 30, 40]. The fast loss of mass corresponds to the departure of hydro soluble substances whereas reduction of decomposition rate coincides with the increase of lignin in litters during the process [26, 27]. The two types of litters are labile. Despite the variability noted, there was no significant difference after two (0.3384 > 0.05), four (0.0518 > 0.05) and sixteen (0.0518 > 0.05) weeks of incubation. However, these litters are not resistant to decomposers.



a: out canopy (OC);



b: under canopy (UC)

Fig 1: Dynamic of remaining dry mass during litter decomposition in *J. curcas* (JC) and *J. gossypifolia* (JG) in Ngaoundere (N), Gong (G) and Maroua (M) stations.

Conclusion

The litter thickness plays an important role during litter decomposition. Litters of *J. curcas* are rich in carbon, cellulose and polyphenols than *J. gossypifolia* whereas that of this last species are rich in Phosphorous. The initial content of the two litter quality was similar in terms of Ca, Mg, N and lignin whereas they differ in C, P, cellulose, polyphenols, organic matter and ashes. The climatic gradient effects litter decomposition in the two jatropha species. The ratio C/N in the two species is less than 20 indicating that decomposition of the two species is very fast irrespective of climatic station. Generally, decomposition is very fast in humid station than in intermediate and dry one. The remaining dry mass is low in Ngaoundere (0.89%), high in Maroua (8.80%) and intermediate in Gong (2.85%). The rate of litter decomposition was fast in the humid climate and low in the dry one comforting on the effect of climatic gradient in the process. Litters decompose rapidly out of canopy than under canopy. Litters of the two species are both labile. In addition to the contribution of these two species in the improvement of the heath of the local population, they could play an important role in soil fertility.

Acknowledgements
The authors are indebt to the anonymous reviewers who edited the manuscript and whose comments improved its quality.

References

1. Boukar SL, Floret C, Kuoh MH, Pontanier R. Dégradation des vertisols dans le Nord-Cameroun: modification du régime hydrique des terres et tentative de réhabilitation. *Utilisation rationnelle de l'eau des petits bassins versants en zone aride.* Ed. AUPELFUREF. John Libbey Eurotext, Paris. 1991, 287-294.
2. Mapongmetsem PM, Ibrahima A. *Sesbania pachycarpa* et jachère améliorée en zone soudano-guinéenne(Cameroun). *In Floret C et Pontanier R.* (eds), La jachère en Afrique tropicale. IRA, Dakar, Sénégal. 1999, 32.
3. Delleré R. Exposé introductif. Journée d'étude: intensification agricole et environnement en milieu tropical. Delleré R. et Symoens J. J. (eds), Bruxelles, Belgique. 1991, 13.
4. Mapongmetsem PM, Tchiegang-Megueni C, Nkonmeneck BA, Kapseu C, Kayem GJ. Agrofroestry potentials of indigenous tree species in northern Cameroon. Cam. J. Bioch. Sc. 1997 ; 7(1):24-29.
5. Molenaar JW, Kessler JJ. CATALIST *:* Catalyser l'Intensification Agricole Accélérée pour la Stabilité Sociale et Environnementale dans la Région des Grands Lacs de l'Afrique Centrale, Manuel de formation sur l'Agroforesterie dans le cadre de l'intensification agricole, Kigali. 2008, 43.
6. Anguessin B. Caractérisation botanique et ethnobotanique du genre *Jatropha* dans le département du Mayo- Louti (Nord Cameroun). Mémoire de Master Université de Ngaoundéré. 2010, 49.
7. Kaho F, Yemefack M, Feujio-Teguefouet P, Tchantchaouang JC. Effet combiné des feuilles de *Tithonia diversifolia* et des engrais inorganiques sur les rendements du maïs et les propriétés d'un sol ferralitique au Centre Cameroun. Tropicultura. 2011; 29(1):39-45.
8. Ahuja LR. Quantifying agricultural management effects on soil properties and processes, Geoderma. 2003 ; 116:1-2.
9. Zhang Z, Guo X, Liu B, Tang L, Chen F. Genetic diversity and genetic relationship of *Jatropha curcas* between China and Southeast Asian revealed by amplified fragment length polymorphisms. African Journal of Biotechnology. 2011; 10(15):2825-2832.
10. Singh p, Singh S, Mishra PS, Bathia S. Molecular Characterization of Genetic diversity in Jatropha curcas. L. Genes, Genomes, and genomic. Global science books. 2009, 8.
11. Heller J. Physic nut. *Jatropha curcas* L. In: International Plant Genetic Resources Institute (IPGRI), Promoting the conservation and use of underutilized and neglected crops. Prom Underused Crops. 1996; 1:1-66.
12. Sanou F. Productivité de *Jatropha Curcas* L. et impact de la plante sur les propriétés chimiques du sol : Cas de Bagre (Centre Est du Burkina Faso). Université polytechnique de Bobo-Dioulasso. Mémoire, Diplôme d'ingénieur du développement Rural. 2010, 72.
13. Geerling C. Guide de terrain des ligneux sahéliens et soudano-guinéens. Université agronomique. Wageningen (NL). Netherlands. 1982, 340.
14. Hamawa Y. Etude ethnobotanique et écologique de *Vepris heterophylla* en zone soudano-sahélien du Cameroun. Thèse de Doctorat PhD. Université de Ngaoundéré, Cameroun. 2005, 178.
15. Payne WA, Wendt CW, Hossner LR, et Gates CE. Estimating pearl millet leaf area and specific leaf area. Agronomy Journal. 1991; 83:937-941.
16. AFNOR (Association Française de Normalisation),. Recueil des normes françaises des produits dérivés des fruits et légumes. Jus de fruits. 1ére édition. Paris, France. 1982, 327.
17. Rodier J. L'analyse de l'eau: Chimie physico-chimie, bactériologie, biologie. Dunod Technique. 6ème édition, Paris (France). 1978, 1136.
18. Updegraff DM. Semi-micro determinate of cellulose in biological material. Analytical Biochemistry. 1969; 32: 420-424.
19. Johnson DB, Moore WE, Zank LC. The spectrophotometric determination of lignin in small wood samples. Tappi. 1961; 44:793-798.
20. Morrison IM. A semi-micro method for the determination of lignin and its predicting the digestibility of forage crops. Journal of the Science of Food and Agriculture. 1972; 23:455-463.
21. Marigo G. Méthode de fractionnement d'estimation des composés phénoliques chez les végétaux. Analysis. 1973 106-110.
22. Chadda D. Influence des matières organiques (feuilles, châtons et racines) du noyer (*Juglans regia* l.) Sur le comportement de jeunes plants de pommier (*Malus domestica borkh*) dans la région de r'haouat (hidoussa) (belezma). Mémoire de magister. Université El Hadj Lakhdar, Algérie. 2008, 173.
23. Ikbel Z, Chaabane A, Foued H, et Brahim H. Dynamique de la décomposition des litières dans les sols forestiers. Actes du 1er Colloque International "Ressources Sylvo pastorales et Développement Durable en Méditerranée, tenu à Tabarka du 19 au 21 Octobre 20 10. Annales de l'INRGREF 18, Numero Spécial. 2013, 63-75.
24. Mangenot F, Toutain F. Les litières. Actualité d'Ecologie forestière: Sol, flore et faune. Gauthier - Villars, Paris. 1980, 345.
25. Bertrand I, Chalbert B, Kurek K, Recours S. Can the biochemical features and histology of wheat residues explain their decomposition in soil? Plant and soil in Press, 2005.

26. Melillo JM, Aber J, Muratore J. Nitrogen and lignin control of hardwood leaf litter decomposition dynamics. Ecology. 1982; 63:621-626.
27. Tardif A. Prédiction des taux de décomposition des litières végétales par les traits fonctionnels agrégés. *Sciences agricoles*. Université Blaise Pascal - Clermont-Ferrand II; Université de Sherbrooke. Département de biologie, 2013, 2014. Français. <NNT : 2013CLF22409> 184 p.
28. Lavelle P, Blanchart E, Martin A, Martin S. A hierarchical model for decomposition in terrestrial ecosystem: application to soils of a humid tropic. Biotropica. 1993 ; 25:130-150.
29. Osono T, Takeda H. Organic chemical and nutrient dynamics in decomposing beech leaf litter in relation to fungal ingrowth and succession during 3 years decomposition processes in a cool temperate deciduous forest in Japan. Ecological Research. 2001; 61:649-670.
30. Mapongmetsem PM, Loura Bengellah B, Nkongmeneck BA, Ngassoum M, Gubbuk H, Baye Niwah C. Longmo J. Litterfall, decomposition and nutrient release in *Vitex doniana* and *Vitex madiensis* in the Sudano-Guinea savannah. Akdeniz Üniversitesi Ziraat Fakültesi Dergisi. 2005; 18(1):63-75
31. Epstein HE, Burke IC, Lauenroth WK. Regional patterns of decomposition and primary production rates in the US Great Plains. Ecology. 2002; 83:320-327.
32. Meentemeyer V. Microclimate and lignin control of litter decomposition rates. Ecology. 1978; 59:465-472.
33. Berg B, Ekbohm G, Mc Claugherty C. Lignin and holocellulose relation during long term decomposition of some forest litters. Long-term decomposition in a Scots pine forest IV. Can. J Bot. 1984; 62:2540-2550.
34. Hobbie SE. Effects of plant species on nutrient cycling. Trends in Ecology and Evolution. 1992; 7:36-39.
35. Aerts R. Climate, leaf litter chemistry and leaf litter decomposition in terrestrial ecosystems: a triangular relationship. *Oikos*, 1997; 79: 439-449.
36. Kazakou E., 2006. Vie, mort et décomposition des feuilles d'espèces de succession secondaire méditerranéenne: vers une intégration de la gestion des éléments minéraux par les végétaux. Centre d'Ecologie Fonctionnelle et Evolutive (CNRS)-UMR 5175. Montpellier, France, Université de Montpellier II. PhD: 166.
37. Fogel R, Cromack K. Effect of habitat and substrate quality on Douglas fir litter decomposition in western Oregon, Canadian Journal of Forest Research, 1977; 55:1632-1640.
38. Quentin P. Effets de la diversité des essences forestières sur la décomposition des litières et le cycle des éléments. Forêt wallonne n. 2010 ; 106 :10.
39. Seneviratne G. Litter quality and nitrogen release in tropical agriculture: a synthesis. Biol. Fertil. Soils. 2000; 31:60-64.
40. Ibrahima A. Relation entre la qualité de litière et vitesse de décomposition. Mémoire de DEA. Université de Montpellier II. 1991, 34.