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PRIORIA BALSAMIFERUM (HARMS) BEHAVIOR STUDY. J. LEONARD PLANTS IN LAYONS IN THE FOREST PLANTATIONS OF YANGAMBI, RD CONGO.

Dep's Boumo Lisagola and Ispt-Yahuma

RESUME

The purpose of this work is to study the behaviour of exploitable gasoline; Prioria Balsamiferum (TOLA), planted in let's wash in Yangambi's condition.

Our study planting was established by the lay on method, which consists of opening parallel and equidistant lay on in dense forest and introducing nursery caretakers at a regular interval. Total inventory (100%) to be made and all the stems of Prioria Balsamiferum, planted in the E-2A plot, since 1938; this study is the subject of this study.

After the analysis, the 79-year-old Prioria Balsamferum "TOLA" plantation presents the following results:

- The survival rate is 51.4%; that is, on the 500 feet of Prioria Balsamiferum planted in layon, 257 were found alive during our field studies;
- The average annual increase in DHP is 0.57 cm/year;
- The average annual increase in total height is 0.31 m/year;
- The average annual increase in height was 0.14m/year;
- The average annual increase in volume was 0.13m3/year; [3]
- The land surface is 28.23m2/ha; [2]
- The average coefficient of form is 0.62;
- The volume was 171,181m3/ha;
- The price of cubage at a selected entry is power-shaped:

$V = 0{,}00070\ DHP^{2}, ^{495}$.

It is shown from this study that the behavior of Prioria Balsamiferum "TOLA" planted in layons in the forest plantation in Yangambi, since 1938, has not been famous due to lack of maintenance.

It is uneconomic to create forest plantations without taking forestry precautions; because the success of a forest plantation depends on respecting the calendar of forestry activities.

ABSTRACT

This research paper aims at studying the behavior of Prioria balsamiferum saved in layons in this paper is not only our deepened knowledge contribution in the behavior of Prioria balsamiferum in plantations, but it deals with data to compare further researches. Our research in plantations lying on Layons method, consisting of sowing in parallel and equidistant layons ways. Then, we introduce through regular intervals young plants from farmland in them.

The total inventory realized and trunks of Prioria balsamiferum saved in parcel E-2A remain the main issue of our research.

The approaches used are:

- The breast height diameter (BHD)
- The end of barrel height diameter (EBDH)
- The crown diameter (CD)
- The total height
- The barrel height
- The houppier height and the average annual rate of growth are parameters which are taken in to account when analyzing.

After analyzing many cases of Prioria balsamiferum which is 71 years old, the following results are observed:

- The rate of Prioria balsamiferum's life is 51,54
- The annual average rate of growth in breast height diameter is 0,57 Cm per year
- The annual average rate of growth in total height is 0,31 m per year
- The annual average rate of growth in barrel height is 0,14 m per year
- The average rate of growth in volume barrel is 0,13 m3 per year
- The ground surface is 28,23 m2/ha
- The average coefficient of form is 0,62
- The volume barrel is 171,181 m3/ha
- The volume's power from entry is V0,00070BHD2.495

As conclusion according to what is said above:

- The Prioria balsamiferum saved in layons through plantations behave badly in Yangambi area.
- The lack of financial possibilities to entertain plantation and the carelessness of the latter are two main causes of this failure.

Thus, they recommend taking precautions before initiate any project mainly in sowing seeds for a good crop.

KEYWORDS: study, behavior, prioria balsamiferum, layon, plantation, yangambi.

ISSN: 2582-6271

Vol.1 No.3; 2020

1. INTRODUCTION

Forests are complex ecosystems capable of providing a wide range of economic, social and ecological benefits. Whether dense or clear, they are essential to human life, but their benefits and services are differently appreciated by people and groups. Local, national and international interests in forest resources also differ greatly depending on the landscape. In addition, the many roles that forests are expected to play in local, national and global development change dramatically over time (D. POORE, 1988)[1].

The importance of forests to local communities led governments, non-governmental organizations and donors to consider various rights, obligations, incentives and supports that would encourage people to invest in forestry and forest management and the ability of communities to manage them in the direction of national interests (A.V. KOROTKOV and T. J. Peck, 1993)[2].

Everyone is well aware now of the extent of deforestation in the intertropical zone and the serious dangers it poses to the survival of our planet (F.A.O. 2001)[3].

The exploitation of precious species, usually heliophile species, do not regenerate on itself, leaves the forest often battered and impoverished (DURST, 2003)[4].

As a result of economic growth, the population's wood needs will increase significantly (Marien and Mallet, 2004). Natural forest will not be able to meet this increase in human needs, so it is clear that the wood needs of the population go through that of forest plantations, relying mainly on timber species (Marien and Mallet, 2004)[5].

Current resources in wood forest products and other diverse forest products come mainly from natural formations, as forest plantations are still recent and areas are limited, while forest plantations could produce more quality wood than natural forest (Brigitte and Al. 1990)[6].

In order to boost the economy of the Democratic Republic of Congo, in terms of forest resources tending towards the fall in precious gasoline; forestry techniques for enriching forests with precious essence should be encouraged (F.A.O. 1997)[7].

This work is based on the study of the behavior of *Prioria Belsamiferum Harms* planted in let's layons in the forest plantations of Yangambi. Such a study is seen as a means or a way to improve the quality of the cask and the growth of the species in order to preserve the fall and disappearance of species of values.

The planting of some forest species in Yangambi, in particular the *Prioria Balsamiferum harms*, was carried out by INEAC/Yangambi for specific purposes.

The purpose of this study is to determine increases in diameter, height, tree shape and volume assessment; planted according to the let's do in Yangambi.

Thus, our concerns can be summarized through the following questions:

- What would be the behavior of *Prioria Balsamiferum* planted in let's wash in forest plantations of Yangambi?
- Would the average coefficient of form of *Prioria Balsamiferum* tend to what form?
- What would be the cubage rate regression equation?

Based on these questions raised by the problem, we try to answer the assumptions below:

- The behavior of *Prioria Balsamiferum harms* planted in layons in Yangambi plantations would be satisfactory;
- The average coefficient of form of *Prioria Balsamiferum* would tend towards the paraboloid form;
- The cubage tariff regression equation would be of the power form

This work not only contributes to the in-depth knowledge of *Proria Balsamiferum's planting* behaviour, but will also serve as a database for better comparison with subsequent studies.

The geographical area of our investigations was the Yangambi region bathed by the Congo River, is located in the northeastern part of the central basin at 0-45' north latitude and 24-29' of east longitude at about 470 m altitude (Vangu 1974)[8].

The plot in which we conducted this research is in the northeast at 00-46' north latitude, 24-20' east longitude and 425 m altitude.

The area of the plantation was one hectare (1 ha), 500 feet since January 1938; 2m x 10m. During our visit in 2017, the plantation of *Prioria Balsamiferum* in the E-2A plot has only 257 feet or an oversp rate of 51.4% on the mortality rate of 48.6% in a period from 1938 to 2017; or 79 years of existence of said plantation.

The botanical characteristics of *Prioria Balsamiferum*, according to (Gautire, Poulin and Theriaut, L. tée 1977) presents itself as follows:

- Port: deciduous tree reaching 50m high and 200cm in diameter. Wide hemispheric top, open with erect and tortuous branches;
- Case: Right-cyclical from the low-scrolling base, 20 to 25m long, with diameters of 100 to 150cm;
- Ecorce: Grey, smooth, superficially cracked with horizontally stretched lenticels, then rough, crevice, flaking in thick, elongated plates. The slice of thickness varies to a red-brown hue, lighter in the inner part, very finely fibrous and weakly resinous;
- Leaf: imparipennées (sometimes paripennée), alternates. Petiole and long spine, 5-18cm long. Petiole bulging at the base, sometimes canalicule, 1.5-2cm long. Rachis canalicule, 3-10-16cm long. Petiole often twisted, 3-4mm long. 6-10 alternate leaflets. Elliptical limb, sometimes more or less sickleform, 3-13cm/2-5cm, obtusely acumed at the top, rounded cuneiform and more or less asymmetrical at the base, papyracic, riddled with translucent dots. Protruding primary rib in

ISSN: 2582-6271

Vol.1 No.3; 2020

10-20 pairs of unspecred secondary ribs; campto-dromes, connected from the margin. The foliage spreads in successive planes at different heights;

- Flowers: in axillary panicules in the senior years, hermaphrodites, white, very small petals, 4 sepals, 10 stamens;
- Fruits: Sacaroid pod, 9-17cm/3-5cm, yellow-brown with right membrane wing on one curved side on the other. A seed at the top;
- Wood: A fairly thick aubier, 8 to 10 cm thick, or $1/_3$ $1/_4$at diameter; this proportion is a little smaller for large dimensions, from a slightly yellowish to brownish white, less coloured than the perfect wood. Duramen of a light yellowish brown, slightly pinkish, rosy by exposure to air and especially to light, radial section (Wood on quarter) weakly ribboned and moist, with sometimes wavy wire, discreetly veined in places of vertical streaks more brown than the whole, abundant mesh, formed of thin strokes, numerous vascular traces, medium thick and generally short.
- Cross section a little darker than the previous one, dark circles sometimes slightly marked by an accentuation of hue to their limit; barely distinct rays to the naked eye; numerous, open pores.
- Family: *Fabaceae*
- Subfamily: *Caesalpinoidae*

In Democratic Congo, *the Prioria Balsamiferum (harms)*is known by several different names depending on the ethnic group:

- *Divuiti*, Kiyumbe dialect in Lower Congo (Flaminga);
- Bojomba to befalo in the equator;
- Boulu (Turumbu), Bogulu (Topoke) in Tshopo Province (Ichale, 1994);
- Libungu in Kikwit, Bandundu;
- *Tshimbundimbu-tshitoke*, lulwa dialect in Kasai.

In the European market, the wood of this species is known for quite a long time. It is marketed in Congo-Kinshasa, under the pilot name of "Tola" and in Nigeria, under the name "Agba", as well as in Great Britain. In Portugal, he is known as "Tola Branca" (Fourge and Gérard in ISSOSI, 1977).

The plantation of *Prioria Balsamiferum* was installed on November 25, 1938, with 10 lines of 50 plants, spread 2 x 10m. Plants 10 to 40 cm high, transplanted with bare roots.

The forestry method used is the layons method of opening in dense forest, parallel and equidistant layons and introducing seeds or plants from nurseries at the interval (SINDANI, 2006).

The parcel that is the subject of our study is the E-2A parcel, which measures 100m x 100, or an area of 10,000m^2 or one hectare.

The crop care for gasoline consisted of dome flashes and ground clearances every 6 months, for 12 years. But after the departure of the researchers of INERA/YANGAMBI, (from 1960), the forest division was

ISSN: 2582-6271

Vol.1 No.3; 2020

on hold.

2. MATERIALS AND METHOD

2.1.Materials

The biological material in our study consists mainly of *Prioria Balsamiferum*trees, planted in layons in the Yangambi forest plantation, of which 257 individuals have been the subject of this study.

The technical equipment used in our study consists of:

- 1 Narrow-bandEd Bitterlich relascope, for the measurement of reference diameter (Dr) or diameter at chest height (DHP), diameter at the base of the crown (Db) or diameter at the end end (Dfb);
- 1 3m pole to measure horizontal distance;
- 1 pole of 1.30 m to measure the level of Dr or DHP;
- Blood to indicate the level of Dr or DHP;
- Two circumferential stripes of 50 m and 10 m, used to measure the distance of the layons and the size of the study plot;
- Machetes to cut and clean the bases of the essences and open all around the foot;
- 1 GPS (Global Position System) for the taking of the geographic coordinates of the terrain or study plot, located in the northeast part at 00-46' north latitude, 24-20' east longitude and 425 m altitude.

The plot that was the subject of our study is 100 m long and 100 m wide (10,000^{m2}) or an area of one hectare. With 10 plant lines spread out 2 x 10 m, and that gives 500 feet planted for the entire planting.

2.2.Method

This plantation was established by the let's method. It consists of opening parallel and equidistant layons in dense forest and introducing plants from nurseries at a regular interval.

We open layons of at least 2 m at ground level, but much wider at the height of the dominant floor. The layons are open at 2 to 2.5 or 5 m, each other.

The orientation of the weeds may be east-west, or depending on the level curves. The dominant canopy must be removed from the beginning by felling, cancelling or poisoning trees (SINDANI, 1990).

Total inventory (100%) was carried out, and all the stems of *Prioria Balsamiferum*, planted in the plot were the subject of this study, given the reduced area.

The parameters selected during this study are:

- Reference diameter (Dr) or chest-height diameter (DHP);
- Diameter at the base of the crown (Db) or diameter at the end (Dfb);
- Height at the base of the crown (Hb) or height (Hf);
- Total height (Ht);

- Diameter of the crown (Dc);
- Height houpier (Hh);
- The rectangular coordinates in relation to the positions of the feet in the plantation.

2.3.DATA PROCESSING

2.3.1. TRANSFORMATION OF MEASURES TAKEN AT BITTERLISH RELASCOPES

a. Diameters:

The relationship used is:

D - 2U.a where D - diameter (cm);

U - rescopic unit;

a - horizontal distance (m).

b. Heights:

The relationships used are:

Ht - $\frac{(LS-Li)Dh}{100}$where Ht - Total height of the tree (m);

LS - Higher reading of tree measurement in (m);

Li - Lower reading (m);

Dh - Horizontal distance (m).

Hf - $\frac{(LS-Li)Dh}{100}$where Hf - Height was (m).

2.3.2. Calculating a few parameters

1. CLASS NUMBER DETERMINATION AND CLASS INTERVAL.

We used the STRUGE formula for our work (SINDANI, 2006).

K - 1 - 3.3 logN where K - Class number, No.

The class interval is obtained by the following **formula: I**$\frac{LS-Li}{K}$

Where I - class interval;

LS - Upper limit;

ISSN: 2582-6271

Vol.1 No.3; 2020

Li - Lower limit;

K - Class number.

- **E-type (S)**

S - $\sqrt{\frac{\sum(x-\bar{x})^2}{N}}$ where: X - class index

$\bar{x}$ Average

Number of stems

- **Variation coefficient (CV)**

CV - $\frac{S}{\bar{x}}$ **x 100** where S - standard deviation

$\bar{x}$ Average

2. SURVIVAL RATE (TS%) AND MORTALITE (TM)

TS - $\frac{N'}{N}$ **x 100** where: N - number of stems installed during planting;

N' Number of live stems.

$\boldsymbol{Tm}$**100 TS** where: TS - Survival rate (%)

Tm - Mortality rate (%)

3. TERRIER SURFACE CALCULATION

The relationship used to calculate the land surface is as follows:

S.T = $\frac{\pi}{4}$ **(Dr)^2 ou S.T = (DHP)^2**

Where: 3.1416; Dr or DHP - diameter at chest height, or 1.30 m from the ground. π

4. VOLUME FUT (m^3)

Vf - $\frac{\pi}{4}$**Dm^2 x Hf** where: Dm - median diameter;

Hf - height was (SINDANI, 1991)

Vs. $\frac{\pi}{4}$**. . . . Hb** $\frac{(D_1^2+D_2^2)}{4}$ where: Vs - Smalien Volume

Vc. Hb $\frac{\pi}{4}\boldsymbol{Dr^2}$ Vc - Cylinder Volume

D_1 - diameter at chest height or reference

D_2 - diameter at the base of the crown

Hb - height at the base of the crown

5. CALCULATING THE AVERAGE ANNUAL INCREASE (AAM)

AAM - $\frac{\frac{\sum Dr}{N}}{Age\ de\ la\ plantation}$ where: No.

AAM - Average annual increase

Dr. - reference diameter

6. EXPLOITABILITY TERM

T.E . . $\frac{DMU}{AAM\ (DHP)}$where DMU - Minimum diameter of use (60 cm)

AAMDHP - Average annual diameter increase at chest height.

7. FORM OF PROPOSED REGRESSION EQUATIONS

The following methods have been proposed for analysis to select those that would deliver the desired results (Jaffart, 1986, cited by Kambale, 2006):

- ✓ Linear regression model: 'a' bxγ
- ✓ Logarithmic regression model: a blnxγ
- ✓ Exponential regression model: a.γe^{bx}
- ✓ Power regression model: a.γx^b
- ✓ Inverse regression model: a$\frac{b}{x}$
- ✓ Quadratic regression model: a 'bx' and 'cx$^{2'}$

3. RESULTS AND INTERPRETATIONS

3.1.SURVIVAL RATE

Data on the number of rods installed and surviving, as well as the mortalityrate, were recorded in

Table 1: Survival and mortality rates observed in our plot

Parcel	N	N'	T.S (%)	Tm (%)
Layons (10,000m$^{2)}$or 1 ha	500	257	51,4	48,6

Legend:

ISSN: 2582-6271

Vol.1 No.3; 2020

Number of stems installed during planting;

N'Number of live stems;

T.S. - Survival rate;

T.m. - Mortality rate.

The results of Table 2 note that survival and mortality rates are 51.4 and 48.6%, respectively. This low survival rate is justified by the lack of maintenance and monitoring of this plantation.

2.1.DIAMETRES

2.1.1. DIAMETRES AT CHEST HEIGHT

The distribution of stems in the DHP classis shown in Table 2.

Table 2: Distribution of stems by DHP class

DHP class	Freg. Obs.	Freg. rel. (%)	Frequency cum.
≤ 10	15	5,84	5,84
10 – 20	67	26,07	31,91
20 – 30	67	26,07	57,98
30 – 40	27	10,51	68,49
40 – 50	28	10,89	79,38
50 – 60	26	10,12	89,5
60 – 70	17	6,61	96,11
≥ 70	10	3,89	100
Average	**32,12**		
Ecart-type	**18,98**		
CV	**59,09**		

ISSN: 2582-6271

Vol.1 No.3; 2020

Table 2 shows that the stems of diameters between 10 and 20 to 20 - 30 cm are the most presented followed by classes ranging from 30 to 60 cm. This proves that the distribution of stems by class of DHP is heterogeneous.

3.2.2. DIAMETRE AT THE BASE OF THE CROWN OR DIAMETRE AT THE END.

The distribution of the stems in diameter class at the end is shown in Table 3.

Table3: Distribution of stems by fine-end diameter classes.

Total Height Class	**Frequency obs.**	**Frequency rel.**	**Cumulative**
1.23 to 7.21	93	36,19	36,19
7.21 to 13.19	74	28,79	64,98
13.19 to 19.17	36	14,01	78,99
19.17 to 25.15	15	5,84	84,83
25.15 to 31.13	16	6,23	91,05
31.13 to 37.11	10	3,89	94,94
37.11 to 43.09	2	0,78	95,72
43.09 to 49.07	7	2,72	98,45
49.07 to 55.05	4	1,56	100,00
Average	**28,55**		
Ecart-type	**11,10**		
C.V	**38,87**		

ISSN: 2582-6271

Vol.1 No.3; 2020

Table 3, we generally find that the number of stems decreases with the increase in diameters at the end. The stems at the end of the end between classes of 1.23

7.21 and 7.21 to 13.19 cm are the most represented followed by classes ranging from 13.19 to 31.13 cm

3.2.3. DIAMETRE OF THE COURONNE (Dc).

The diameter class distribution of the crown represented in Table 4.

Table 4: Distribution of Stems by Crown Diameter Class (DC) In (Cm)

Total Height Class	**Frequency obs.**	**Frequency rel.**	**Cumulative**
3,315 to 7,635	152	59,14	59,14
7,635 to 11,995	32	12,45	71,59
11,995 to 16,275	29	11,28	82,88
16,275 to 20,595	23	8,95	91,82
20,595 to 24,235	9	3,50	95,33
24,235 to 29,235	9	3,50	98,83
29,235 to 33,555	2	0,78	99,61
37,875 to 42,195	1	0,39	100,00
Average	**6,02**		
Ecart-type	**4,37**		
C.V	**72,69**		

Table 4 generally shows that the number of stems decreases with the increase in the diameters of the crown. The crown diameter stems between the class of 0.3 to 5,668 cm are the most represented followed by classes ranging from 5,668 to 12,772 cm

ISSN: 2582-6271

Vol.1 No.3; 2020

3.3. Heights

3.3.1. HAUTEUR WAS

Table 5, represents the distribution of stems by barrel height classes.

Table 5: Distribution of stems by height classes (Hf in m)

Hf class	Frequency obs.	Frequency rel.	Cumulative
3,315 to 7,635	50	19,46	19,46
7,635 to 11,995	64	24,90	44,36
11,995 to 16,275	47	18,29	62,65
16,275 to 20,595	33	12,84	75,49
20,595 to 24,235	30	11,67	87,16
24,235 to 29,235	19	7,39	94,56
29,235 to 33,555	12	4,67	99,23
33,555 to 37,875	1	0,39	99,62
37,875 to 42,195	1	0,39	100,00
Average	**14,80**		
Ecart-type	**7,71**		
C.V	**52,11**		

From this table, it is easy to see that there is not a clear trend in the distribution of stems according to the height of the barrel. There's a saw tooth variation. But it emerges from this figure that classes with stems between 5,125 and 7,125 m are the most represented, followed by those with stems between 9.125 and 11,125 m, as well as those with 3,125m.

3.3.2. TOTAL HEIGHT

ISSN: 2582-6271

Vol.1 No.3; 2020

Table 6, shows the distribution of stems in classes of total height.

Table 6: Distribution of stems by classes of total height (Ht) in (m)

Total Height Class	Frequency obs.	Frequency rel.	Cumulative
3,315 to 7,635	50	19,46	19,46
7,635 to 11,995	64	24,90	44,36
11,995 to 16,275	47	18,29	62,65
16,275 to 20,595	33	12,84	75,49
20,595 to 24,235	30	11,67	87,16
24,235 to 29,235	19	7,39	94,56
29,235 to 33,555	12	4,67	99,23
33,555 to 37,875	1	0,39	99,62
37,875 to 42,195	1	0,39	100,00
Average	**14,80**		
Ecart-type	**7,71**		
C.V	**52,11**		

It is clear from this table that, in general, the frequencies or numbers of the stems decrease with the increase in the total height. The total height stems between the class of 7,605 to 11,895 m are the most represented, followed by those in the class of 3,315 to 7,605 and the classes ranging from 11,895 to 24,765 m.

3.3.3. HEIGHT CROWN

Table 7, shows the distribution of stems by height class of crown;

Table 7: Distribution of stems by height classes of the crown (Hh in m)

Total Height Class	Frequency obs.	Frequency rel.	Cumulative
0.375 to 3,349	96	37,35	37,35
3,349 to 6,323	62	24,12	61,47
6,323 to 9,297	42	16,34	77,82
9,297 to 12,271	22	8,56	86,38
12,271 to 15,245	19	7,39	93,77
15,245 to 18,219	7	2,72	96,49
18,219 to 21,197	7	2,72	99,22
21,197 to 24,167	1	0,39	99,61
24,167 to 27,141	1	0,39	100,00
Average	**6,33**		
Ecart-type	**4,96**		
C.V	**78,41**		

In general, Table 7 shows that the number of stems decreases with the increase in the height of the crown.

The stems of the crown height between the class of 0.375 to 3,349 m are the most represented, followed by that in the class of 3,349 to 6,323 m, in our study plantation after 71 years of age.

3.4. LAND SURFACE

The land surface is a practical measure that gives indications of the amount of woody material actually available in the surveyed part. It varies according to the number of stations (BOURDRU, 1989, cited by LOKOMBE, 1996).

The land surface of a stand is the sum of the land surfaces of all the trees that make up it. It is expressed in (m2) reduced to the hectare; it provides a good indication of the density of the stand at a given age (Rondeaux, 1993).

The results for land surface by class of DHP are presented in Table 8.

Table 8: Land surface distribution by diameter class at chest height.

DHP class	Freg. Obs.	Freg. rel. (%)	S.T (m^2)
≤ 10	15	5,84	0,064
10 – 20	67	26,07	1,245
20 – 30	67	26,07	3,264
30 – 40	27	10,51	2,5548
40 – 50	28	10,89	4,474
50 – 60	26	10,12	6,318
60 – 70	17	6,61	5,489
≥ 70	10	3,89	4,822
Total	**257**	**100**	**28,234**
Average			**3,529**
Ecart-type			**2,152**
C.V			**0,609**

The results of this table show that the total land area per hectare is 28,234; the average land surface is 3,529m^2; the standard deviation is 2,152 and with the coefficient of variation is 0.609%.

3.5. VOLUME

The results for the volume (Vf) per class of DHP were presented in Table 9.

Table 9: Volume Distribution Was by DHP Class

DHP class	Freg. Obs.	Freg. rel. (%)	Volume was
≤ 10	15	5,84	0,245
10 – 20	67	26,07	3,708
20 – 30	67	26,07	12,012
30 – 40	27	10,51	10,488
40 – 50	28	10,89	25,416
50 – 60	26	10,12	39,287
60 – 70	17	6,61	41,967
≥ 70	10	3,89	38,058
Total	**257**	**100**	**171,181**
Average			**21,398**
Ecart-type			**16,921**
C.V			**79,080**

This table shows that the average volume was 21,398m^2; its standard deviation is 16,921 and 79.080 % of coefficient of variation.

SHAPE COEFFICIENT

The coefficient of shape is the average of the coefficients of shape of a cylinder lot having as height those of their stems and bases their sections and chest height (PARDE, 1961).

ISSN: 2582-6271

Vol.1 No.3; 2020

In commercial practice, it is accepted that the volume was of a tree is to be likened to that of a revolution cylinder. But in reality, a tree never has a cylindrical shape. The stem of trees is a variable and often irregular shape that brings one of the following geometric figures closer or closer: cylinder, paraboloid, cone and neloid (C.T.F.T. 1981 and Massenet, op. cit).

C.T.F.T (1978), establishes the different values of the coefficient of form that can be attached to the dendrometric types of the cask of an essence:

γ1 for a cylinder
γ$0.555 for a dish
γ0.407 for a cone
γ$ 0.388 for a neloid
The coefficients of form are of great importance for estimating the volume of standing wood trees and forest stands. This estimate becomes quick and easy if for each forest species is established, a table where these coefficients are stored according to the height of the trees (Bentouati, 2006, op. cit).

The relative distribution of coefficient of form according to DHP classes is presented in Table 10.

Table 10: Shape coefficient distribution by DHP class

DHP class	Freg. Obs.	Freg. rel. (%)	Shape coefficient
≤ 10	15	5,84	0,746
10 – 20	67	26,07	0,611
20 – 30	67	26,07	0,577
30 – 40	27	10,51	0,572
40 – 50	28	10,89	0,578
50 – 60	26	10,12	0,591
60 – 70	17	6,61	0,653
≥ 70	10	3,89	0,665

ISSN: 2582-6271

Vol.1 No.3; 2020

Average			**0,624**

shows in this table that the average coefficient of form is 0.6243. We specify that our average coefficient of form is related to the dendrometric type of the barrel of an extralus-shaped species.

3.7. AVERAGE ANNUAL INCREASE

The average annual increase corresponds to an average annual production since the first year of the settlement or planting.

3.7.1. AVERAGE ANNUAL INCREASE IN DHP

The results for the distribution of the average annual increase per class of DHP, is presented in Table 11.

Table 11: Distribution of average annual increase per class of DHP

DHP class	Freg. Obs.	Freg. rel. (%)
≤ 10	15	0,102
10 – 20	67	0,212
20 – 30	67	0,348
30 – 40	27	0,487
40 – 50	28	0,634
50 – 60	26	0,782
60 – 70	17	0,902
≥ 70	10	1,103
Average		**0,571**

It emerges from this table that the average annual increase in DHP of Prioria Balsamiferum, planted in Yangambi under the layons method is 0.571 cm/year. This small increase is believed to be due to lack of maintenance. For years, Yangambi's artificial plantations have been unmaintained.

3.7.2. AVERAGE ANNUAL INCREASE IN HEIGHT WAS

The height increase data were presented in Table 12.

Table 12: AAM Distribution by Hf

H.F. CLASS	FREQ. OBS	AAM in H.F (M/AN)
1,125 to 3,125	14	0,037
3,125 to 5,125	41	0,061
5,125 to 7,125	62	0,088
7,125 to 9,125	32	0,117
9,125 to 11,125	43	0,144
11,125 to 13,125	30	0,173
13,125 to 15,125	25	0,203
15,125 to 17,125	9	0,225
17,125 to 19,125	1	0,269
Average		**0,146**

Table 12, shows that the average annual increase according to the classes of height was Prioria Balsamiferum planted in let's in the plantation in Yangambi is 0.146 m/year.

3.7.3. AVERAGE ANNUAL INCREASE IN TOTAL HEIGHT

Table 13, presents data on average increase by class of total height.

Table 13: AAM Distribution by Total Height Class

H.T. CLASS	FREQ. OBS	AAM in H.T (M/AN)

3,315 to 7,605	50	0,037
7,605 to 11,895	64	0,061
11,895 to 16,185	47	0,088
16,185 to 20,475	33	0,117
20,475 to 24,765	30	0,144
24,765 to 29,055	19	0,173
29,055 to 33,345	12	0,203
33,345 to 37,635	1	0,225
37,635 to 41,925	1	0,269
TOTAL	**257**	**2,853**
Average		**0,317**

This table shows that the average annual increase in class-based height of our species, planted in layons in Yangambi, is 0.317 m/year.

3.7.4. AVERAGE ANNUAL INCREASE IN VOLUME-FUT

The data on average increase by DHP classes by volume are shown in Table 14.

Table 14: Distribution of AAM by dhp class by volume was ($m^{3/year}$). /an).

Classes de DHP	FREQ. OBS	Flight was	AAM in V.F (m^3/year)
≤ 10	15	0,245	0,003
10 – 20	67	3,708	0,052
20 – 30	67	12,012	0,169
30 – 40	27	10,488	0,147
40 – 50	28	25,416	0,357

50 – 60 60 – 70 ≥ 70	26 17 10	39,287 41,967 38,058	0,553 0,591 0,536
TOTAL	**257**	**171,181**	**2,41**
Average		**21,397**	**0,30**

Table 14, shows that the average annual increase according to the classes of DHP by volume was of Prioria Balsamiferum, planted in layons in Yangambi is 0.30m3/year,and the total per hectareis 2.41m3/ha/year.

CUBAGE FARE

The cubage tariff is an encrypted table, formula or graph that gives an estimate of the volume of a tree or tree set based on the various variables that are theprice increases (SINDANI, 2007).

FORM AND TYPE OF REGRESSION EQUATIONS

To retain the model of the regression equation that will be subject to the cubage tariff, it is recommended to rely on the choice of the equation which has a coefficient of determination greater than or equal to 80% ($R2 \geq 80\%$), Mabiala, (1981) in Liandja (2006).

Table 15, presents data on the characteristics of the proposed regression equations.

Table 15: Characteristics of Proposed Regression Equations

EQUATIONS	MODELING PARAMETER					
	N	**a**	**B**	**c**	**R**	**R^2 (%)**
Linear	257	-0,897	0,051	-	0,906	82,1
Logarithm	257	-3,576	1,319	-	0,771	59,5
Reverse	257	1,586	-17,964	-	0,547	30,0
Quadratic	257	0,097	-0,017	0,001	0,956	91,4

ISSN: 2582-6271

Vol.1 No.3; 2020

Power	257	0,0070	3,5	-	0,969	94,0
Exponential	257	0,019	0,080	-	0,940	88,4

Caption: a, b and c: coefficient of variation;
r: correlation coefficient;
A2: coefficient of determination.

It appears from this table 15, that among the proposed regression equations, we retain the regression equation of the type "Power", that equation has just given a coefficient of determination superior to the other equations of regression, i.e. 94.0%.

3.8.2. The price of the different models on offer

Table 16, presents the cubage tariffs of the different models of the proposed regression equations.

Table 16: The cost of the various models on offer.

EQUATION MODELS	R	R^2	TYPE D'EQUATIONS
Flight - 0.897 - 0.051. D	0,906	84,1	Linear
Flight - 3,576 - 1,319 logD	0,771	59,5	Logarithm
Flight - 1,586 - 17,964 x$^1/_D$	0,547	30,0	Reverse
Flight - 0.097 - 0.017D - 0.001 x D^2	0,956	91,4	Quadratic
Flight - 0.00070 x$D^{2,495}$	0,956	94,0	Power
Flight - 0.019 x$e^{0,080D}$	0,940	88,4	Exponential

It appears from this table that the cubage tariff of the selected equation is given by the equation of the Power form below:

Flight - 0.00070. D^^{2,495}
Power Equation: V - a.D^b

3.9 QUALITY WAS

The results for the number of stems based on the quality of the barrel were shown in Table 17.

Table 17: Number of stems inventoried based on quality was

Quality-cas	Freg. Obs.	Freg. Rel (%)	Freg. Cum (%)
A	57	22,18	22,18
B	38	14,79	36,97
C	58	22,57	59,53
D	104	40,47	100,00
TOTAL	**257**	**100%**	**100%**

Caption: A - Very good quality
B - Good quality
C - Pretty good quality
D - Mediocre

The quality distribution of cask according to relative frequency gives us 22.18% for Class A, 14.79% for Class B, 22.57% for Class C, and 40.47% for Class D. These results show us that planting is characterized by moderately good barrels; due to lack of maintenance and some crop care, the said plantation of Prioria Balsamiferum.

4. DISCUSSION

The discussion of the results obtained relates to the barrel in average coefficient of form; as well as comparing the dendrometric characteristics of Prioria Balsamiferum planted in different methods in the Yangambi region, on the one hand and according to the years on the other hand.

Table 18, presents data on the comparison of the average annual increase in diameter of Prioria Balsamiferum introduced in the different methods (layons, and dense places) in Yangambi plantation.

Table 18: Comparison of AAM in diameter of Prioria Balsamiferum introduced in different methods in Yangambi.

ISSN: 2582-6271

Vol.1 No.3; 2020

Forest type	Locality	Age (years)	AAM/DHP (cm/an)	Source
Planting in let's	Yangambi	71	0,57	This article 2009
Planting in let's	Yangambi	56	0,53	ICHALE, 1994
Planting in dense up-and-forth	Yangambi	56	0,31	ICHALE, 1994
Planting in let's	Yangambi	39	0,77	ISSOSI, 1977

The average annual increase in DHP of Prioria Balsamiferum, in the layons plantation, at the E-2A plot, with a spread of 2 x 10 m is 0.57 cm/year at the age of 71 years, this value is lower than that found by ISSOSI, in the other parcel of layons 2A, with a spread of 10 x 5 m, which was 0.77cm/year at the age of 39 years, is also higher than that found by ICHALE in the layons method and that of dense places, respectively 0.53 cm/year and 0.31cm/year at the age of 56 years.

This average annual increase in DHP found by ICHALE in the dense place method is due to the approach of the tree feet in the plantation, vis-à-vis the spread adopted (2 x 2 m - 4 m^2)
The average annual increase in total height of Prioria Balsamiferum introduced in the various methods in Yangambi, are represented in terms of comparison in Table19.

Table 19: Comparison of the average annual increase in total height of Prioria Balsamiferum introduced in the various methods in Yangambi

Forest type	Locality	Age (years)	AAM/DHP (cm/an)	Source
Planting in let's	Yangambi	71	0,31	This article 2009
Planting in let's	Yangambi	56	0,36	ICHALE, 1994
Planting in let's	Yangambi	39	0,59	ISSOSI, 1977
Planting in dense squares	Yangambi	56	0,21	ICHALE, 1994

This table shows that as the age of planting increases the total height growth of Prioria Balsamiferum decreases. Compared to that found by ISSOSI, in plot 2A in let's wash at the age of 39 years is 0.59 m/year higher than that found in this work, which is 0.31 m/year, at age 71 years in plot E-2A.

The volume of Prioria Balsamiferum of this planting work is compared with that found by ICHALE in the other methods: its represented in Table 20.

Table 20: Volume comparison was by Prioria Balsamiferum from this work to that of other methods.

Forest type	Locality	Age (years)	Number of stems/ha	VF (m^3/ha)	AAM/DHP (m^3/ha/an)	Source
Planting in let's	Yangambi	71	257	171,180	0,1312	This article
Planting in let's	Yangambi	56	310	214,173	3,8941	ICHALE, 1994
Planting in dense squares	Yangambi	56	91	79,819	1,4515	ICHALE, 1994

The results of this table show that as plantations age, age progresses and the number of stems decreases, the volume and average annual increase in volume was per hectare also decrease.

This work yields a volume and an annual increase in volume was at lower hectares: 171,180 m3/ha and 0.1312 m3/ha/year, at the age of 71 years with 257 stems in plot E-2A, let us lay to that found by ICHALE i.e. 214,173 m3/ha/yearat the age of56 years with 310 stems. This difference is influenced by the spreads applied in the two parcels, 2A (10 x 5 m) and parcel E-2A (2 x 10 m). So, plot 2A in let's wash, the tree feet in the plantation are spaced and each foot benefits from solar radiation for a good realization of chlorophyll activity (photosynthesis), for its normal increase. While, in the E-2A plot let's wash, the spread to the trees absorb the solar radiation in order to carry out the Photosynthesis. In this case, the more giant tend to colonize or dominate on the shorter ones. This is competition.

In relation to the average form coefficient, Table 21 gives the average coefficient of form of Prioria Balsamiferum introduced in the different planting methods of Yangambi.

Table 21: Comparing the average coefficient of form of Prioria Balsamiferum introduced in the different methods in Yangambi

Forest type	**Locality**	**Age (years)**	**Average coefficient of shape**	**Source**
Planting in let's	Yangambi	71	0,62	This article
Planting in let's	Yangambi	56	0,68	ICHALE, 1994
Planting in dense squares	Yangambi	56	0,58	ICHALE, 1994

This table shows that the average coefficient of form in this article of 0.62% is higher than that found by ICHALE in the dense places method, i.e. 0.58%, and that found by ICHALE in let's wash in parcel 2A is higher than that of this article in let's leave in the E-2A plot and that of the dense places method (ICHALE).

Table 22: Summary of the main dendrometric characteristics of Prioria Balsamiferum on plantation in Yangambi, compared to the results obtained by ICHALE, 1994 in layons methods and dense places.

No	Features	VALUES/METHODS		
		Layons E-2A (2009)	Layons 2A (1994)	Dense squares
1.	Age (Years)	71	56 – 1	56 – 3
2.	Surface (Ha)	1,00	1,00	0,25

3.	Spread (M^2)	2 x 10m	10 x 5m	2 x 2m
4.	Tiges/Ha	257	310	356
5.	Survis rate (%)	51,4	62	15,48
6.	Mortality rate (%)	48,6	38	84,52
7.	DHP moyen (Cm)	32,26	29,22	17,08
8.	Medium H.T (m)	14,80	16,33	11,57
9.	Medium H.F (m)	8,55	13,04	9,98
10.	Medium Hh (m)	6,33	-	-
11.	Dfb moyen (m)	13,82	-	-
12.	DC Medium (m)	6,02	9,00	7,00
13.	AAM en DHP (cm/an)	0,57	0,53	0,31
14.	AAM in Hf (m/year)	0,14	0,23	0,18
15.	AAM in HT (m/year)	0,31	0,36	0,30
16.	AAM in VF (m^3/year)	0,30	3,89	1,45
17.	VF (m^3/an)	171,18	214,17	79,81
18.	S.T (m^3/an)	28,23	25,54	11,50
19.	Average-shape coefficient	0,62	0,68	0,58
20.	Indice de volume en DHP (m^3/an)	2,62	-	-
Source		**This article**	**ICHALE 1994**	**ICHALE 1994**

Table 22, generally shows that, compared to the different methods used for planting Prioria Balsamiferum,the layons method that gives higher dendrometric characteristics compared to the method of dense squares.

ISSN: 2582-6271

Vol.1 No.3; 2020

Mortality rates are higher in densely placed planting compared to the layons method; 56 years and one month for the two plantations. Indeed, very small spreads in the plantation in dense places are the basis of high mortality rates, 84.52%.

The average values of DHP observed at age 55 years in the layons and densely placed plots are 29.22 and 17.08 cm, respectively. These values are lower than those found in this layons method work in parcel E-2A at the age of 71 years is 32.26 cm

CONCLUSION

The purpose of this article was the behavior study of Prioria Balsamiferum planted in let's wash in Yangambi conditions.

To do this, we carried out a total inventory on an area of 1 ha. All planted Prioria Balsamiferum stems were studied at 71 years of age, from 1938 to 2009.

Chest-high diameters, low diameters, total height, height, crown height, crown diameter, and all calculated parameters are the dendrometric parameters used to conduct this study.

After analysis, the Priora Balsamiferum layons plantation has the following dendrometric characteristics at the age of 71:

The survival rate is 51.4%;
The average annual increase in DHP is 0.57 cm/year;
The average annual increase in height was 0.14 m/ha;
The average annual increase in volume was 0.30 m3/year; ^{3}
The land area is 28.23 m^2/ha;
The average coefficient of form is 0.62;
The volume was 171,181 m^3/ha;
The cubage rate at a selected entry is power-shaped
V= 0.00070.DHP^{2}, ^{495}.

Average annual increases in diameter, height and volume vary with age.
The average annual increase in diameter increased from 0.77 cm/year (ISSOSI, 1977) to 0.53 cm/year (ICHALE, 1995) to 0.51 cm/year in 2009 (this article).

Based on our results, we can say that the first hypothesis is rejected, because the behavior of Prioria Balsamiferum in wease in the Yangambi region has not been good.

ISSN: 2582-6271

Vol.1 No.3; 2020

Indeed, after 71 years of age, our plantation has only 27 stems that have reached the minimum diameter on the farm (DME ≥60 cm), or 10.116% on 257 feet of Prioria Balsamiferum.

The remains of stems 230, or 89.884% of the plantation, still have the minimum diameter of development (DMA).

These results confirm the other two assumptions relating to average coefficients of form and the price of cubage.

Indeed, it is anti-economic to create forest plantations without taking forestry precautions, because the success of a forest plantation depends on respect for the timetable of forestry activities.

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