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Full Length Research Paper

Evaluation of the height of some genitors of seed field *Deli Dura* of Oil Palm (*Eleais Guineensis* Jacq) planted in 1998 and 1999 at La Me Station

***Ekra Kouamé TANO[1], Désiré ALLOU[2], Oulo ALLA-N'NAN[1*], Eugène Kouakou KONAN[2],Simon Pierre Assanvo N'GUETTA[1]**

1UFR Biosciences, Laboratory, of Genetics, University Félix HOUPHOUËT BOIGNY, 22 BP 582 Abidjan 22, Ivory Coast, Tel / Fax : 22 44 03 07 / 22 44 37 24

[2]National Center for Agronomic Research (CNRA), Oil palm program, La Me Station, 13 BP 989 Abidjan 13. Tel / Fax :(225) 24 39 11 88

E-mail: desire.allou@gmail.com[2]

*Corresponding Author's E-mail:tanoekrakouam@gmail.com, Tel: (225) 57 42 87 04, Fax : 22 44 03 07

Abstract

The oil palm growth rate is an important factor for the economic profitability of a seed field, because it determines in fact the possible duration of exploitation of the Dura oil palm used as females parents. This study was initiated with the aim of sustainably exploiting Dura female spawners. Its objective is to propose the category and the best strategy to adopt for the establishment of the Dura slow growth seed fields. The plant material used during this study consists of 365 parents of type Deli Dura obtained from parents Deli Dura selfing selected in the 2nd cycle of reciprocal recurrent selection scheme. Two (2) categories were identified for their agronomic performance. The Category C 2501 compound of four (4) progenies grouping 152 parents and the category C 7001 consists of four (4) progenies containing 213 progenitors. In the term of this study, the results showed that of the two (2) categories studied, the category C 2501 with an average height growth rate of 33.60 cm / year gave slow-growing broodstock than those of the category C7001 with an average growth rate of 39.05 cm / year. So, the parents stemming from reproduction of type double AF has an average growth lower than those of the AFSIB. Finally, it has been shown that the growth rate of trees is generally due to the origin of the tree than the type of reproduction carried out for the establishment of the Dura oil palm seed fields.

Key words: Oil palm, reciprocal recurrent selection, reduced height growth

Introduction

The oil palm growth rate is an important factor for the economic profitability of a seed field, because it determines the possible duration of exploitation of Dura oil palm (Jacquemard et al. 1981) used as female relatives. Indeed, as the trees grow up, a certain percentage of them become more bigger and out of reach of the crown by the fertilizing agent, resulting in a gradual decline in the number of Deli Dura sires (Surre 1979). That is why the National Center of Agronomic Research (CNRA) already introduced for more than 10 years the height growth rate as an additional factor for selection in the program for the production of palm from self-fertilization of elite trees (Meunier and Gascon 1972; Konan and al., 2014). The oil palm seeds produced by the CNRA are obtained by grouping crosses reproducing the same hybrid from a self-fertilized parent called "category" (Gascon and al., 1981), which allowed to constitute blocks of seed fields supposed to be homogeneous in terms of performance, quality and quantity of seeds. The selection of these elite parents used in self-fertilization for the reproduction of the spawners Deli Dura must therefore endeavor to make available to the fertilizing agents of the categories of palm combining strong production of efficient seeds and low growth in height while presenting a good homogeneity to increase the operating life of a more

important number of parents. However, the factor growth in height of certain categories of parents Deli Dura would seem to escape this notion of homogeneity obtained by parents self-fertilization identified in selection for parents' reproduction.

This study joins within the framework of the identification of the sources of variation in growth velocity of different categories of spawners used in second-generation seed fields. In general, it will be necessary to identify if certain spawning categories have faster growth speeds than others and, more specifically, to verify whether the cross-breeding use of two brothers from one even selfing favors the acceleration of the height growth.

Materials and Methods

Experimental site

This study was carried out at the National Center for Agronomic Research (CNRA) at the La Mé station in Côte d'Ivoire (5 ° 26 N and 3 ° 50 W). The La Mé station is located in the south-east of Côte d'Ivoire, 26 km east from Abidjan on the Abidjan to Alepe road. The soil of the La Me station is of the ferralitic type. The climate of this region is of the Attiean type. Temperatures are important factors in leaf emission and diet production. Areas where average temperatures are between 28 °C and 30 °C are favorable to the cultivation of the oil palm (Surre and Ziller, 1963).

Planting Material

The planting material used in this study is composed of 365 Dura palm originates of the South-east Asia and retained of the second cycle of the oil palm *Elaeis guineensis*. Its palms are obtained by selfing of eight (8) Deli Dura parents. Two (2) categories from the twelve (12) categories of seed fields planted at the National Agricultural Research Center (CNRA) station at La Mé were identified for their agronomic performance. The category C 2501 composed of four (4) progeny grouping 152 palms distributed on four (4) plots E40, E73, F40, F41 and category C 7001 composed of four (4) progeny grouping 213 palms planted on plots H04. The maternal origins of these two (2) categories are as follows: C2501 (DA5D X DA3D) and C7001 (DA115D X DA3D). All these palms were planted in 1998 and 1999 at a rate of 143 stocks per hectare (Table 1).

Technical material

The technical materiel having to be of use to the realization of our study is constituted by a metallic set square with branch go along of 15 cms, 2 cms wide, thick from 2 to 3 mm and of a double decimeter in textile ribbon.

Table1: Material vegetal; the filiations and planting date of the broodstock

Plots	Progenies	Female parents	Origin	Categories	Planting date	Number of palm
E 40	LM 21189	(LM 3257 D X LM 3053) AF	DA5D×DA3D		1999	25
E 73	LM 20258	(LM 3053 D) AF AF			1999	71
F 40	LM 19614	(LM 3047 D X LM 3604 D) AF		C 2501	1999	24
F 41	LM 19622	(LM 3047 D) AF AF			1999	32
H 04	LM 19955	(LM 5357 D X LM 5373 D) AF	DA115D×DA3D		1998	96
H 04	LM 19759	(LM 5373 D) AF AF		C 7001	1998	28
H 04	LM 19947	(LM 5570 D X LM 5644 D) AF			1998	48
H 04	LM 19640	(LM 5644 D) AF AF			1998	41
TOTAL	8	8	2	2	2	365

LM : La Me ; DA : Dabou ; D : *Dura* ; AF : selfing ; C : Category

Methods

Measuring the height of the stipe

Height observations are usually made when the smallest trees reach 1.50 m. This threshold is chosen to be sure to be placed in a regular vertical growth phase of the palm (Jacquemard, 1980). To measure the height of the stipe, the metal setsquare is attached to the end of a pole using a rubber ribbon. This tape also fixes the double decameter so that its zero coincides with the part of the horizontal arm of the setsquare (**Figure 1**). In order for the observations to have immediate application, the distance separating the ripe regime from

the soil is also measured. The leaf of the mature diet is most often the leaf 33. This leaf has therefore been chosen as a reference mark for the realization of the measurements of the heights on the normal palm (Trunk straight and healthy).

Determination of the height growth rate

The height growth rate is determined from Jacquemard's formula (1980). In this case, where a single observation is made, an approximate estimate of the height growth rate can be obtained by formula

$$Vc = \frac{\mathrm{H}}{\mathrm{N} - \mathrm{P0}}$$

Where N = age of trees, expressed in years and tenth of a year, and P0 = (theoretical zero point), the age of the fictitious take-off of the soil of the first leaf-bearing sheet (leaf 33) of a palm, The growth rate is constant, with the climatic vagaries. Depending on the estimated tree growth rate (function of agronomic and / or genetic conditions), P0 will have different values. For a very slow speed of between 20 and 35 cm / year, the estimated value of P0 is 3.50. For a slow speed of between 35 and 50 cm / year, the estimated value of P0 is 3.75. Finally, for a fast growth rate of between 50 and 65 cm / year, the estimated value of P0 will be 4.50. In our case study of second-generation seed fields, the value of P0 which seems best adapted to the genetic evolution of plants is 3.50. This value was thus noted (P0) = theoretical zero point = age of the fictitious takeoff of the soil of the sheet 33 of Deli Dura palm of the categories C2501 and C7001.

Figure 1: Measurement of the height of the stipe from the base to the sheet 33 (in Konan *et al*, 2014).

Statistical analysis

Descriptive statistics (Biales, 1988) were performed to reveal the position (average) and dispersion (standard deviation) parameters of the different progenies grouped within each category. The SHAPIRO-WILK test was carried out to validate the normal distribution of the observations (Vc) in order to be able to perform a parametric comparison test of the averages following an analysis of variance at the 5% confidence level (Bouroche and Saporta, 1980). The average comparison test used was that of NEWMAN-KEULS (Casin, 1999; Dagnelie, 1975). This test allowed us to verify if the mean height growth rate of Deli Dura sires of the progeny was different from one category to another. This test was also used to verify whether the mode of realization of double self self-fertilization of full brothers affected the rate of growth (Diday and al., 1983). All analyzes were performed using the GENSTAT Release 10.1 software.

Results and Discussions

Results

Description of growth rate according to categories

The height growth rate of palms in category C2501 varied from a minimum of 23.26cm/ year to a maximum of 48.37 cm / year with an average height growth rate of 33.60 cm / year. The calculated variance is 30.21 for a standard deviation of 05.50 with a coefficient of variation of 16.36%. As for category C7001, the growth rate of the palm is between a minimum of 26.15 cm / year and a

maximum of 46.89 cm / year for an average growth rate in height 39.05 cm / year with a Variance of 14.73, a standard deviation of 03.84 and a coefficient of variation of 09.83%.Palm in category C2501 appear to exhibit a lower average growth rate in height with a higher dispersion than that of palm in category C7001 (Table 2).

Description of the rate of growth according to the type of reproduction

The height growth rate of palm of double breeding type (AFAF) varied from a minimum of 23.26 cm / year to a maximum of 46.89 cm / year. The average growth rate of this type of crossbreeding is 34.69 cm / year with a variance of 36.69, a standard deviation of 06.03 and a coefficient of variation of 17.40%. At the level of broodstocks from dual AFSIB cross breeding, the recorded height growth rate is between a minimum of 26.15 cm / year and a maximum of 48.37 cm / year. The calculated average height growth rate is 38.64 cm / year. The variance is 13.66 for a standard deviation of 03.70 and a coefficient of variation of 09.57 (Table 3). The dispersal parameters of the AFAF crossbreedings are significantly higher than those of the AFSIB cross breedings, although their average height growth rate is lower. Breeding spawners of the AFSIB type showed a higher average height growth rate than the spawners. However, these AFSIB spawners appear to be more stable in terms of dispersal than spawners of AFAF breeding.

Table 2: Spreader height growth rate according to categories

Categorie	Origin of the maternal grandparent	Position parameter			Scattering parameter			
		Average (cm/year)	Minimum (cm/year)	Maximum (cm/year)	Amplitude (cm/year)	σ	σ^2	cv (%)
C2501	DA5D×DA3D	**33.60**[a]	23.26	48.37	25.11	05.50	30.21	16.36
C7001	DA115D×DA3D	**39.05**[b]	26.15	46.89	20.74	03.84	14.73	09.83
Total general		36.32	24.70	47.63	22.92	04.67	22.47	13.09

Table 3: Spreading height of broodstock by breeding type

Type of reprodution	Position parameters			Scattering parameters			
	average (cm/an)	Minimum (cm/year)	Maximum (cm/year)	Amplitude (cm/year)	σ	σ^2	Cv(%)
AFAF	**34.69**[a]	23.26	46.89	23.63	06.06	36.69	17.47
AFSIB	**38.64**[b]	26.15	48.37	22.22	03.70	13.66	09.57
Total general	36.66	24.70	47.63	22.92	04.88	25.17	13.52

Cm: centimeter
Cv: coefficient of variation
σ : standard deviation
σ^2:variance

Comparison of the rate of height growth of breeding categories and breeding types

Following the SHAPIRO-WILK test, which allowed to show a normal distribution of the rate of growth in height over all spawners, an Analysis of Variance (ANOVA) was carried out in order to compare the average growth rates In height of the different spawning groups (Table 4). ANOVA revealed significant differences in height growth rates between the different spawning groups. According to the NEWSMAN-KEULS averages test, the C2501 categories would grow at a slower rate of 5 cm / year than the C7001 category. This highly significant difference in growth rate indicates that the DA5D origin appears to induce a lower height growth rate than the DA115D origin. Also, the NEWSMAN-KEULS test showed a difference between the average height growth rates of broodstocks of the double AFAF types and those of the AFSIBs. The AFSIB brooders with a height average of 38.64 cm / year grow faster than those of the

double AFAF type, with a growth rate of 33.78 cm / year. The type of AFAF reproductions appears to induce a significant rate of slower growth in height.

Combined effect of categories and types of reproduction

The significant difference observed in average height growth rates is due to the combined effects of the origin of the maternal grandparent and the type of double AFAF reproduction used. Broodstocks of the double AFAF type of C2501 have an average growth rate of 31.47 cm / year, which is lower than that of broodstocks of double type AFAF in category C7001 with an average growth rate of 39.50 cm / year. Specimens derived from AFSIB reproductions maintain a constant height growth rate whatever the type of category (Table 5).

Table 4: Comparison of the rate of height growth of broodstock categories and breeding types

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Categorie	1	2630.65	2630.65	152.83	< 0.001
Type of reproduction	1	1418.02	1418.02	82.38	< 0.001
Categorie.Type of reproduction	1	1026.65	1026.65	59.64	< 0.001
Residuel	361	6213.89	17.21		
Total	364	10315.07	28.34		

Table 5: Combined effect of breeding category and type on height growth rate of spawners *Deli Dura*

		Type of reproduction		
Categorie	Origin	Growth rate in heigth of AFAF	Growth rate in heigth of AFSIB	Heigth (cm/year)
Growth rate in height of C2501	DA5D×DA3D	**31.47**[a]	**38.08**[b]	34.77
Growth rate in heigth of C7001	DA115D×DA3D	**39.50**[b]	**38.83**[b]	39.16
Growth rate average in heigth (cm/year)		35.48	38.45	36.97

AF: selfing ; SIB : Recombinaition
DA: Dabou
D: *Dura*
cm: centimeter

Discussion

The current study concerned the seed fields Dura of the second cycle of selection for the supply of seeds of the categories C2501 and C7001 of the station of the National Center of Agronomic Research (CNRA) of Mé. The evaluation and the choice of the best category concerned the character speed of growth in height of trees. The speed of growth in height of the feather-grass is a very important factor in the definitive choice of the parents. It is on it that depends the duration of exploitability of an oil palm hence the economic duration of palm plantation. Indeed, the low speed of growth in height of the palm tree decreases the costs of harvest and lengthens the duration of exploitation of the palm plantation. Although the average speed of growth in height is lower in the category C2501, this average speed of growth in height adorned not to be stable and constant from one parent to another one. Indeed, the parameters of dispersal that are the variance and the coefficient of variation are twice higher (bigger) in the category C2501 than in the category C7001 So the number of abandoned (given up) trees becomes more and more important in the category C2501 with a coefficient of 16.36 % variation which amounts to the double of that of the category C7001. The results of our study seem to show that the parent Deli Dura stemming from crossings of parental origin DA115D×DA3D leads a better homogeneity of growth in height than the parents Deli Dura stemming from crossings of parental origin DA5D×DA3D. The disparity in the height of the parents Deli Dura of the category C2501 seems to be more stressed than that of the parents Deli Dura of the category C7001 because of the parent(relative) DA5D. The parent Deli Dura stemming from crossings of parental origin DA115D seems to lead a better

homogeneity of growth in height than the parents Deli Dura stemming from crossings of parental origin DA5D. The importance of the disparity in the height of the parents Deli Dura would mainly be due to the type of crossings reproduced in auto-fecundation. These results show while the size of the feather-grass varies according to the genetic origin of the tree (Noiret and Gascon, 1967; Jacquemard, 1979). Indeed, the parents stemming from crossings of type AFSIB with a speed of higher growth grow faster than those stemming from the crossing of type AFAF. It adorned obvious that the disparity in height of trees is the fact of the ratio between the number of trees AFAF and AFSIB. So the number of abandoned trees observed in the category C2501, can consequently be due to the more important number of its parents stemming from the crossing AFSIB. The low growth of the parents stemming from type AFAF's reproduction can be due to the effect of the depression of consanguinity to the palm tree with oil. These results clearly show that the height growth rate of the oil palm stipe does not depend that of the environment of culture, it is also due to its genetic origin (Le Guen And al., 1990). For example, previous studies have shown that oil palm from "Avros" are known to be very tall and "La Mé" to be of very short plants.

Conclusion

The objective of this report was to propose the category and best strategy to be adopted for the establishment of Deli Dura broodstock fields at slow growth rates. Of the two categories studied, category C2501 with an average height growth rate of 33.60 cm / year yields slow-growing broodstocks than those of category C7001 with an average growth rate of 39, 05 cm / year. Thus, breeding spawners of the double AF type have an average growth rate lower than those of AFSIB. Finally, the results have shown that the growth rate of trees is generally due to the origin of the tree and to the type of reproduction carried out for the establishment of the Dura oil palm seed fields. The current study is atiny contribution to a set of work aimed at producing seeds of high agro-morphological performance.

References

Biales C (1988). Statistical analysis of the data. Chotard and Associés. Dunod. XV, 62 P.

Bouroche JM and Saporta G (1980). Data analysis. Collection Que Sais-Je, PUF. Dunod. XV, 62 P.

Casin P (1999). Analysis of Data and Data Panels "De Boeck Dunod University. XV, 62 P.

Dagnelie P (1975). Multivariate statistical analysis. Agricultural presses of Gembloux.

Diday E, Lemaire J, Pouget P, Testu F (1983). Elements of data analysis. "Dunod, Decision-Paris: Dunod, XV, 62 P.

Gascon JP, Jacquemard JC, Houssou M, Boutin D, Chaillard H, Kanga Fondjo F (1981). La production de semences sélectionnées de palmier à huile. *Oléagineux,* 36(10): 475-486.

Jacquemard JC (1979). Contribution to the study of the heightgrowth of Elaeis guineensis Jacq sire, Study of the LM2T x DA10D crossing, oilseeds, vol. 34, No. 11, p. 492-497.

Jacquemard JC (1980). Méthode d'observation de la croissance en hauteur du palmier à huile. *Oléagineux,* 35(10): 439-442.

Jacquemard JC, Meunier J, Benoit F (1981). Genetic study of the reproduction of a cross in the oil palm Elaeis guineensis jacq. Oilseeds, 36 (7): 543-552

Le Guen v, Ouattara S, Jacquemard JC (1990). Selection of the oil palm to improve the ease of harvesting: first results, Oilseeds, 45 (12), pp. 523-531

Konan JN, Allou D, Diabate S, Konan EP, Koutou A (2014). Evaluation of the introgression of the slow growth character of some Akpadanou (Benin origin) parents in someimprovedoil palm (E. guineensis Jacq.) Origin of La Me (Côte d'Ivoire) origin. Int. J. Biol. Chem. Sci. 8 (5): PP. 2015-2022

Meunier J, Gascon JP (1972). The general pattern of oil palm improvement at IRHO, Oleaginous, 27 (1), pp. 1-12.

Noiret JM, Gascon JP (1967). Contribution to the study of the height and growth of Elaeis guineensis Jacq stems: Application to the selection of oil palm, Oleaginous, 22 (11), pp. 661-664.

Surre C and Ziller R (1963). The oil palm. GP Maisonneuve and Larose: 10-42.