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Physicochemical characterization of bunches from American oil palm (*Elaeis oleifera* H.B.K. Cortes) and their hybrids with African oil palm (*Elaeis guineensis* Jacq.)

Caracterización fisicoquímica de racimos de palma americana de aceite (*Elaeis oleifera* H.B.K. Cortes) y sus híbridos con palma africana de aceite (*Elaeis guineensis* Jacq.)

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Abstract

The aim of this study was to carry out a comparative analysis of physical and chemical traits of bunches from genotypes of *Elaeis oleifera* and their interspecific hybrids OxG with *Elaeis guineensis*, establishing values in bunch components and oil potential, as well as oil quality by analyzing fatty acids, vitamin E and carotenes content. Bunches stemmed from inflorescences without assisted pollination and perimeter presence of *E. guineensis*. The experimental design used, was a completely randomized experimental design with three experimental units, each comprised of three bunches. *E. oleifera* Sinú genotype (76.53 %) and OxG hybrid II (72.64 %) obtained the highest fruit set. Regarding oil extraction potential, values were higher in OxG hybrids, finding in hybrid II an outstanding value (20.82%). *E. oleifera* materials showed better fatty acids profiles with the Sinú genotype being the most prominent material with 79.1 % of unsaturated fatty acids, together with hybrid II (70.2 %). Regarding vitamin E content, we confirmed that *E. oleifera* possesses high quality oil especially for genotype Coarí (1,006.7 ppm) and hybrid II (1,549.6 ppm); furthermore, genotype Sinú was the one with the highest total carotene content (1,524.7 ppm).

Keywords: oil extraction potential, oil components, oil quality, fatty acids profile, carotenes, vitamin E.

Resumen

El objetivo de este estudio fue realizar un análisis comparativo de las características físicas y químicas de racimos de genotipos de *Elaeis oleifera* y de sus híbridos interespecíficos OxG con *Elaeis guineensis,* determinando los componentes y el potencial del aceite del racimo, y la calidad de los aceites, analizando el contenido de ácidos grasos, vitamina E y carotenos. En el estudio se utilizaron racimos provenientes de inflorescencias sin polinización asistida con la presencia perimetral de *E. guineensis*. Se utilizó un diseño experimental completamente al azar con tres unidades experimentales, cada una conformada por tres racimos. Los mayores cuajados del fruto se encontraron en el genotipo de *E. oleifera* Sinú (76,53 %) y el híbrido OxG II (72,64 %). Los potenciales de extracción de aceite fueron superiores en los materiales híbridos OxG destacándose el II (20,82 %). Las palmas *E. oleifera* presentaron mejores perfiles de ácidos grasos, destacándose los materiales del genotipo Sinú (79,1 % de ácidos grasos insaturados) y los del híbrido II (70,2 %). Para el contenido de vitamina E se confirmó la alta calidad del aceite de los materiales de *E. oleifera,* sobresaliendo el genotipo Coarí (1.006,7 ppm) y el híbrido II (1.549,6 ppm); el material del genotipo Sinú registró el mayor contenido de carotenos totales (1.524,7 ppm).

Palabras clave: potencial de extracción de aceite, composición del aceite, calidad del aceite, perfil de ácidos grasos, carotenos, vitamina E

Introduction

American oil palm (*Elaeis oleifera* H.B.K. Cortés) has become a strategic genetic resource due to its outstanding morphologic and physiological characteristics as slow growth, tolerance to common pests and diseases for African oil palm, oil with high content of unsaturated fatty acids, and substantial amounts of carotenes and vitamin E (Rivera, Cayón & López, 2013). An important trait that *E. oleifera* processes is its hybridization capacity to form interspecific hybrids with the African oil palm *Elaeis guineensis;* these OxG hybrids produce oil with larger quantities of unsaturated fatty acids, carotenes and vitamin E compared to the highly commercial African oil palm (Guerrero, Bastidas & García, 2011).

For the above-mentioned reasons, OxG hybrids are the only economically viable alternative in those regions where the spear rot (SR) disease is lethal, and according to Suárez, Cayón & Ochoa (2013); furthermore, with an effective and permanent assisted pollination, the hybrids can achieve yields of 35 $t.ha^{-1}$ and an industrial extraction rate of 20-21 %.

A study carried out by Choo, Ma & Yap (1997), found that raw oil extracted from African palm oil has the following compound concentrations: vitamin E ranging from 600-1000 ppm, carotenes between 500-700 ppm, and sterols between 250-620 ppm. Moreover, squalene values range from 200-600 ppm and coenzyme Q concentration between 10-80 ppm; the results showed that vitamin E is the most abundant substance found in palm oil, and is one of the four essential vitamins for human body.

On the other hand, studies carried out by Hazir, Shariff & Amiruddin (2012), and Singh, Tan, Panandam, Rahman, Ooi, Low, Sharma, Jansen & Cheah (2009), found that raw oil obtained from *E. oleifera* has high levels of oleic and linoleic acids, but low levels of palmitic acid, and in top of this, it also has other saturated fatty acids, similar in composition to olive oil.

In addition, the carotene content of this oil is very high (4300-4600 ppm) and is comprised by α and β-carotenes, including *cis* and *trans* forms. Therefore, it also has small quantities of non-cyclic (lycopene, phytofluene, phytoene and neurosporene), and cyclic carotenes (α and β-carotenes with zeaxanthin), and lutein, most of them precursors of vitamin A (Ping, 2006; Tranbarger, Dussert, Joet, Argout, Summo, Champion, Cros, Omore, Nouy & Morcillo, 2011).

When analyzing oil extracted from OxG hybrids, Rincón, Hormaza, Moreno, Prada, Portillo, García & Romero (2013), found that it is an important source of carotenoids (820 $mg.kg^{-1}$), vitamin E (1316 $mg.kg^{-1}$) and phytosterols (941 $mg.kg^{-1}$). Tocotrienols constitute 81-85 % of the total vitamin E content, β-carotene 73 % of the total carotenoids content, and β-sitosterol 63% of the phytosterol content. Furthermore, Rasid, Parveez, Ho, Sambanthamurthi & Napis (2009), found that OxG hybrids have intermediate carotene content, i.e. superior to values found in *E. guineensis* and lower than the ones found in *E. oleifera*. Moreover, vitamin E compound as tocotrienols and tocopherols have antioxidant properties, which have allowed catching damage of free radicals responsible for numerous degenerative cardiovascular diseases as arteriosclerosis or arthritis, cancer and premature aging (Rocha, Prada, Rey & Ayala, 2006).

Given these concerns, the aim of this study was to establish and compare the physicochemical characteristics of bunches and the quality and composition of their oils from five palm materials of *E. oleifera* and three interspecific hybrids of *E. oleifera* x *E. guineensis*. This information will provide tools to select mother parents of *E. oleifera* for breeding new hybrid materials of commercial interest; moreover, this will allow giving solution alternatives to problems that are currently being associated to the oil palm agroindustry in Colombia.

Materials and methods

Study site

The research was carried out in the Indupalma Ltda. plantation located at10°20’ N and 73°11’W in the municipality of San Alberto, Cesar department of Colombia, at an altitude of 125 m.a.s.l., maximum temperature of 34°C and minimum of 22°C, relative humidity of 72.3%, annual rainfall of 2497 mm, annual evaporation of 1208 mm, and 2130 hours of solar brightness per year.

Agroecological conditions of the site corresponds to Tropical Moist Forest according to life zones stated by Holdridge.

Plant material

Eight palm materials, *i.e.* five American palm genotypes and three OxG hybrids of different ages were the plant material used in this study (Table 1).

Table 1. Description of genotypes of American oil palm and their OxG hybrids analyzed in this study

Code	Genotype	Country of origin	Age (years)
A	*E. oleifera* Coarí	Brazil	34
B	*E. oleifera* Peru	Peru	17
C	*E. oleifera* Sinú	Colombia	34
D	*E. oleifera* Coarí x *E. oleifera* Peru	Peru	15
E	*E. oleifera* Sinú x *E. oleifera* Coarí	Brazil	13
I*	(*E. oleifera* Coarí x *E. oleifera* Peru) x *E. guineensis* La Mé	Colombia	10
II*	(*E. oleifera* Sinú x *E. oleifera* Coarí) x *E. guineensis* La Mé	Colombia	6
III*	*E. oleifera* Coarí x *E. guineensis* La Mé	Colombia	7

* hybrids

Physicochemical variables measured

The physical analysis of bunches was carried out using the methodology described by García & Yáñez (2000). Removal and cleaning of normal, partenocarpic and abortive fruits from all genotypes was carried out and their bracts were then cut off; these were then counted, weighed and data was registered. The average fruit weight and number as well as number of rachilae were registered. Fruit sample comprised 30 fruits with an average weight between 250-300 g. Normal fruits were pulped manually until the nut was completely clean. Then the nuts were cleaned and weighed, and by difference, the weight of mesocarp was established.

When establishing the amount of mesocarp in partenocarpic fruits, 30 fruits were selected without kernel and without nut sign; once these were pulped the sample was homogenized; this same procedure was carried out for normal fruits. In both cases, the mesocarp sample was dried in an electric oven; then the oil content was established with a Soxhlet system. To establish the shell/kernel relation in normal fruits, nuts stemming from 30 fruits were placed in a drying recipient and were then taken to the oven during the whole night at 105°C. Next day these were taken out and left to cool down at room temperature, where they cut and the kernel was removed completely, collecting the shell and weighing it.

The chemical analyses of fatty acid, vitamin E and carotenes content were carried out in the oil laboratory of Centro Experimental La Vizcaína of Cenipalma. The fatty acid profiles of the oil samples were carried out according to the AOCS (1994) standards, and establishing the methyl esters of fatty acids with gas chromatography using a flame ionization detector. Oil samples were saponified using KOH/MeOH. Fatty acids were derived to esters using a BF_3 in methanol solution. The esters were extracted and 1 μL was injected to the chromatographic system. The equipment used was a gas chromatograph 7890 A (Agilent Technologies, Wilmington, USA). The column employed in the analysis was a DB-23 (J&W Scientific, Cat. 122-2362) 60 m x 0.25 mm D.I. x 0.25 μm f.e., and the injection was carried out in split mode (50:1). Hydrogen was used as the carrier gas at a constant flow of 33 $cm.s^{-1}$. As a reference pattern for the retention time periods, a Supelco™ 37 component FAME mix (Supelco, Bellefonte, PA, Cat No 47885-U) mixture was employed.

Methyl esters in fatty acids were identified by comparison with the retention times of the standard mixture, analyzed under the same chromatographic conditions; further, quantification was carried out with the normalization of areas method. The results are expressed in mass to mass ($m.m^{-1}$) percentage according to the official AOCS method Ce 1-62 (AOCS, 1997).

The vitamin E analysis (i.e. tocotrienols and tocopherols) was carried out through high performance liquid chromatography (HPLC), using a fluorescence detector and a Merck Chromolith RP-18e column (Prada, Ayala-Diaz, Delgado, Ruiz, & Romero, 2011). To quantify tocopherols and tocotrienols an external standard method was used employing the certified patterns CALBIOCHEM (Tocotrienol Set Cat. No. 613432), and CALBIOCHEM (Tocopherol Set Cat. No. 613424).

Carotene analysis (i.e. α-carotene and β-carotene) was carried out with a HPLC, using the ultraviolet ray detector in the visible region; a Merck Chromolith RP-18e column was used according to Rodríguez (1999). Quantification was carried out using an external standard method and using as a calibration pattern β-carotene at 97% (Sigma-Aldrich C-4582).

The physicochemical variables established with their respective abbreviations can be seen in Table 2.

Table 2. Physicochemical variables measured in palm bunches

Abbreviation	Variable
FS	fruit set
NFB	% normal fruits bunch
RPFB	% red partenocarpic fruits bunch
AFB	% abortive fruits bunch
AWNF	average weight normal fruits
AWRPF	average weight red partenocarpic fruits
MNF	% mesocarp normal fruits
ENF	% endocarp normal fruits
ESNF	% endosperm normal fruits
MRPF	% mesocarp red partenocarpic fruits
HNF	% humidity normal fruits
OPNF	% oil pulp normal fruits
OBNF	% oil bunch normal fruits
HRPF	% humidity red partenocarpic fruits
OPRPF	% oil pulp red partenocarpic fruits
OBRPF	% oil bunch red partenocarpic fruits
OHP	% oil humid pulp
OEP	% oil extraction potential

Statistical analysis

A completely randomized experimental design with three replicates was carried out with three bunches per replicate. Nine bunches were harvested randomly from each palm material that stemmed from inflorescences without assisted pollination, and with perimeter presence of *E. guineensis*.

Data was analyzed through an analysis of variance and averages of the physical analysis variables of the bunch components were compared with Duncan's multiple range test using the SAS® 9.2 software. To establish fatty acids, vitamin E and carotenes profile a descriptive analysis was carried out to construct stacked bar figures.

Results

Physical analysis

Materials A, C and hybrid II showed the highest fruit set (FS) values (Figure 1a). Regarding red partenocarpic fruits from bunches (RPFB), materials A and hybrids II and III showed the highest values, and differed significantly from materials B and D (Figure 1b). Moreover, the highest abortive fruits per bunch (AFB) values were found in inflorescences whose pollination was not assisted. These materials stemmed from *E. oleifera* D material and hybrids I and III while the lowest values were found in the materials C, A, and hybrid II.

Regarding average weight of normal fruits (AWNF), materials B, D, and hybrids I and III showed significantly higher values. In the case of average weight of red partenocarpic fruits (AWRPF), the behavior of the genotypes was similar among these (Figure 1c).

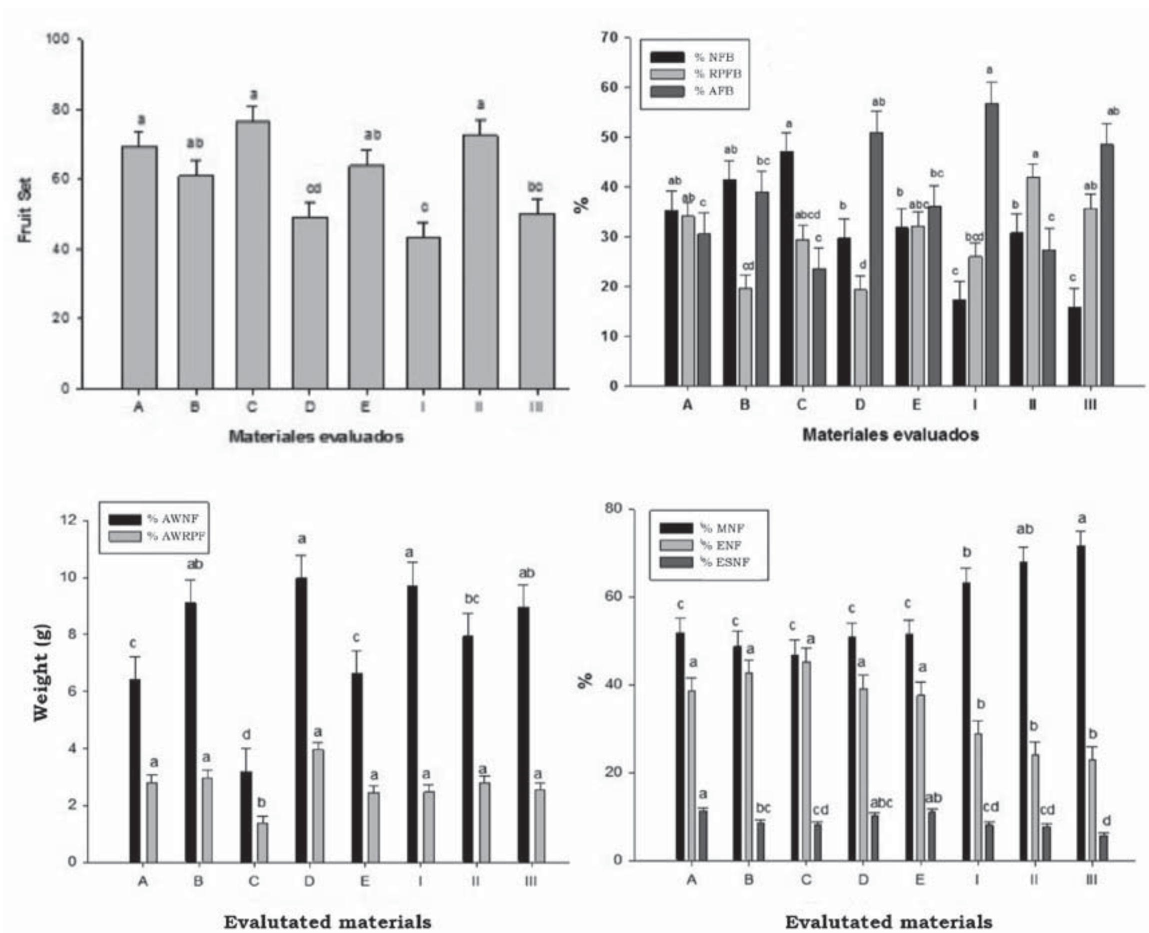

Figure 1. Physical variables measured in American palm bunches (A, B, C, D and E) and their interspecific hybrids OxG (I, II and III). **a)** FS; **b)** NFB, RPFB, and AFB; **c)** AWNF, AWRPF; **d)** MNF), ENF, and ESNF. The vertical lines over the bars show the standard error; averages with the same letter do not show significant differences according to the Duncan test, $p < .05$, $n = 8$.

For percentage of mesocarp found in normal fruits (MNF), hybrid materials showed the highest values, of which hybrids II and III did not show significant differences between each other. Likewise, hybrids II and I did not differ statistically among each other, but showed significant statistical differences with *E. oleifera* materials. Regarding percentage of endocarp in normal fruits (ENF), all hybrid materials registered significantly lower values compared to the American materials. Regarding percentage of endosperm in normal fruits (ESNF), materials A, B, D and E differed significantly from hybrid material III, that shows a lower value (Figure 1d).

The hybrid materials I, II and III showed the highest percentage of mesocarp for red partenocarpic fruits (MRPF) values with significant differences found in *E. oleifera* materials (Figure 2a). Figure 2b shows that *E. oleifera* A, C, E and hybrid I materials showed higher humidity percentages in normal fruits in bunches (NFB).

Regarding percentage of oil in pulp of normal fruits (OPNF), hybrid materials II and III showed significantly superior values compared to other genotypes. *E. oleifera* Coarí genotype showed outstanding percentage of oil from normal fruits in bunches (OBNF).

In Figure 2c, the humidity percentage in red partenocarpic fruits (HRPF) was significantly higher in material D compared to the others. Percentage of oil from pulp and bunches in red partenocarpic fruits (OPRPF and ARFPR) were superior in hybrids compared to all *E. oleifera* materials; nevertheless, hybrids II and III showed significantly different averages compared to other materials.

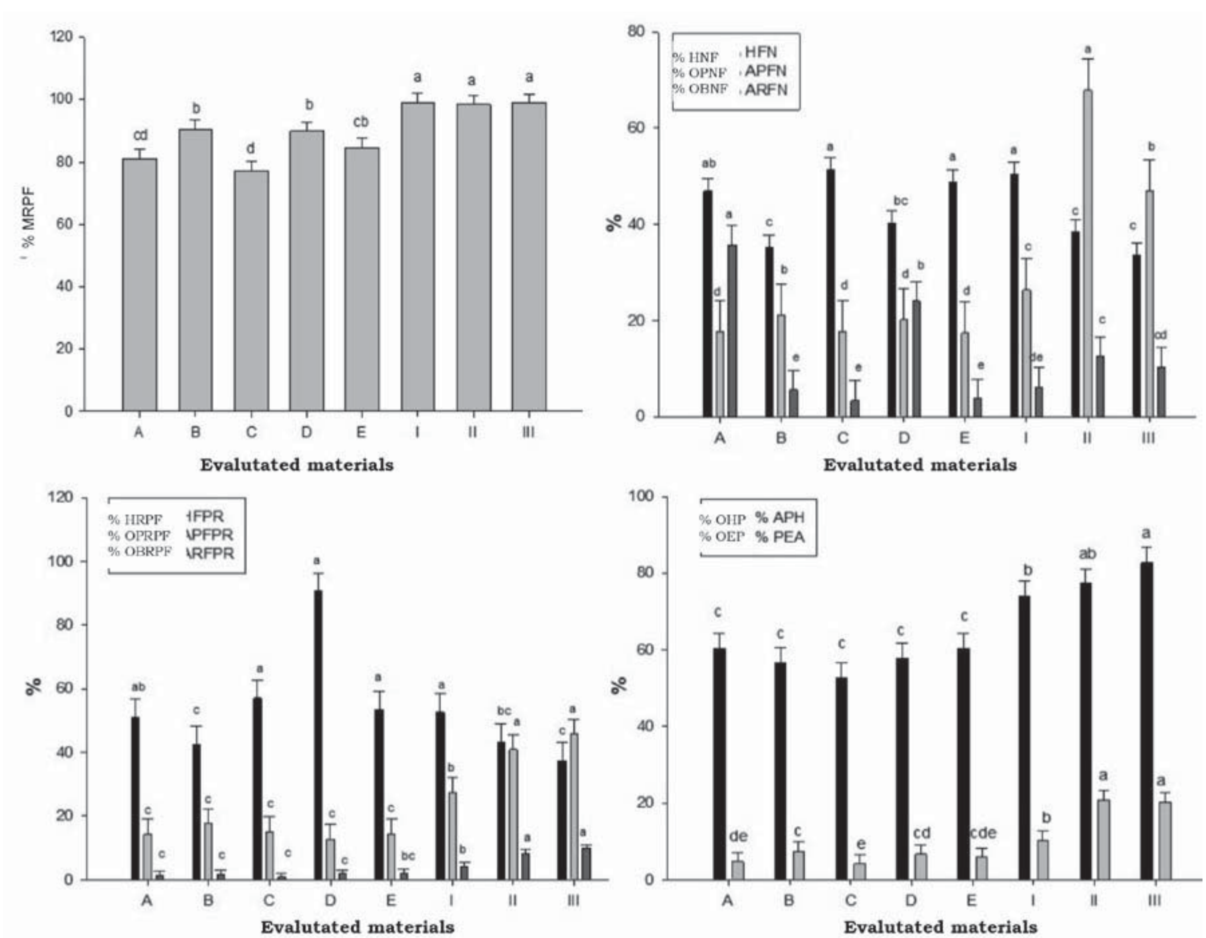

Figure 2. Physical variables measured for bunches of *E. oleifera* and their interspecific OxG hybrids (I, II and III). **a)** MRPF; **b)** HNF, OPNF and OBNF; **c)** HRPF, OPRPF, and OBRPF; and **d)** OHP, and OEP. The vertical lines over the bars show the standard error; averages with the same letter do not show significant differences according to the Duncan test, $p < .05$, $n = 8$.

This is however logic, as OBRPF is a product of OPRPF. Percentage of oil in humid pulp (OHP) and percentage of oil extraction potential (OEP) are presented in Figure 2d; these values were superior in all hybrids compared to *E. oleifera* materials.

It is important to highlight that hybrid II and III showed the highest OPNF and OPRPF values that indisputably is reflected in the highest OEP values.

Chemical analysis

Fatty acids profile

Fatty acid profiles of the oil extracted from materials assessed are shown in Table 3.

Table 3. Fatty acids profile (in percentage) of the oil extracted from E. oleifera and its interspecific OxG hybrids

Fatty acid profile	*Elaeis oleifera*					OxG hybrids		
	A	B	C	D	E	I	II	III
Myristic	0.4	0.3	0.2	0.2	0.3	0.2	0.2	0.3
Pentadecanoic (C15:0)	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.0
Palmitic (C16:0)	27.5	37.5	19.4	29.7	24.2	32.5	26.3	30.1
Margaric (C17:0)	0.0	0.1	0.0	0.1	0.0	0.0	0.1	0.1
Stearic (C18:0)	1.5	2.2	1.0	3.0	1.1	1.5	2.7	4.8
Arachidic (C20:0)	0.2	0.2	0.1	0.3	0.1	0.2	0.3	0.4
Total saturated fatty acids	29.7	40.4	20.9	33.4	25.9	34.5	29.7	35.7
Palmitoleic (C16:1)	1.1	0.5	1.4	1.0	2.1	1.4	0.3	0.1
Oleic (C18:1)	47.3	46.3	56.1	50.8	51.5	47.8	55.6	53.1
Vaccenic (C18:1 *trans*-11)	2.7	1.6	3.8	2.0	4.0	2.6	1.2	0.6
Linoleic (C18:2)	18.3	10.6	16.9	12.2	15.9	13.0	12.5	9.9
α-Linoleic (C18:2)	0.8	0.5	0.9	0.5	0.7	0.5	0.5	0.3
Gondoic (C20:1)	0.1	0.0	0.0	0.1	0.0	0.1	0.1	0.1
Total unsaturated fatty acids	70.3	59.5	79.1	66.6	74.1	65.4	70.2	64.1

Regarding palmitic acid (main saturated fatty acid of the profile), B material outstood with the highest content, and C material showed the lowest content. Among the intraspecific crosses of *E. oleifera* (OxO), D material showed the highest palmitic acid value compared to the E material, tendency that was among interspecific hybrids (OxG); moreover, hybrid I was the material with the highest palmitic acid value, and hybrid II showed the lowest value.

The highest oleic acid values were reported in *E. oleifera* Sinú genotypes and in hybrid II, and the lowest in A, B, and hybrid I. In total unsaturated fatty acids, *E. oleifera* materials were superior compared to the OxG hybrids.

Vitamin E and carotenes

Total vitamin E and carotenes content of oil extracted from the material studied is shown in Table 4. It is apparent that hybrids, especially hybrid I and II, showed significantly higher vitamin E as well as other components compared with *E. oleifera* materials. Material C and all hybrids showed the highest carotene contents, i.e. α-and β-carotene.

Table 4. Vitamin E ($mg.kg^{-1}$) and carotenes ($mg.kg^{-1}$) content of the oil extracted from evaluated materials

Vitamin E and carotenes	*Elaeis oleifera*					OxG hybrids		
	A	B	C	D	E	I	II	III
δ-tocotrienol	4.5	19.2	30.2	3.2	14.7	41.2	42.1	45.6
β+γ-tocotrienol	803.0	543.0	827.5	376.0	770.9	856.9	998.4	666.0
α-tocotrienol	191.8	263.0	45.1	50.2	77.3	258.3	383.9	199.3
α-tocopherol	7.4	169.0	46.3	26.8	35.9	142.8	126.1	26.8
Total vitamin E	1006.7	994.3	949.1	456.1	898.8	1299.2	1549.6	937.6
α-carotene	298.2	190.6	557.5	291.1	210.2	537.8	577.7	447.9
β-carotene	562.8	594.6	967.2	519.7	321.4	911.8	835.4	724.2
Total carotenes	861.0	785.2	1524.7	810.8	531.6	1449.6	1413.0	1172.1

Discussion

Physical analysis

A good behavior of the genotypes Coarí and Sinú as well as hybrid II in relation to FS is explained by the fact that the last two materials have a higher degree of natural pollination by insects. This is because Sinú genotype is native to the region, and therefore, its pollen viability is higher than 80%, guaranteeing good bunch formation (Rivera *et al.*, 2013). Furthermore, the Coarí genotype, due to its age, is better adapted; thus, hybrid material of these two *E. oleifera* sources achieve better natural fructification.

In the case of AFB, the highest values were found in *E. oleifera* material D and hybrids I and III. This suggests that when working with the Coarí genotype, it is of utmost importance to carry out assisted pollination; if this labor is not carried out losses in oil extraction potential in OxG hybrids that are commercially used, will occur. AWNF of materials B, D, and hybrids I and III were significantly higher because these materials have endosperm, shell and mesocarp in their fruits, compared to partenocarpic fruits that only have mesocarp.

The highest MNF values in OxG hybrids can be explained by the contribution of *E. guineensis* var. pisifera as the male parent in hybrids. MNF values in *E. oleifera* materials ranged from 46.7-51.84 %, similar to the one reported by Rey, Gomez, Ayala, Delgado & Rocha (2004), i.e. 30.5–54.7 % in *E. oleifera* palms harvested in Cenipalma.

In like manner, the fact that the three hybrid materials showed the highest MRPF values just as the results for MNF shown above, this probably also obeys to genetic contributions from *E. guineensis* var. *pisifera* as the male parent in interspecific OxG hybrids. The variation among studied genotypes for humidity traits in normal fruits (HNF) could been affected by relative humidity conditions or rainfall during harvest. In the case of OPNF, a good behavior shown by hybrids II and III is coherent with the lower HNF values for these two materials; this indicates that in mesocarps of normal fruits, there is a higher oil content compared to the water content; this is namely an important agronomic characteristic from an industrial point of view. In addition, OBNF is a fundamental characteristic that expresses the total oil production percentage per bunch that guarantees higher oil extraction percentage in palms, finding in this study that *E. oleifera* Coarí genotype was outstanding.

The superior traits of hybrids compared to *E. oleifera* materials in variables OPRPF, OBRPF, OHP and OEP is due to genetic inputs of *E. guineensis* as a male parent. However, data found in this research were higher to the ones reported by Rey *et al.* (2004), in *E. oleifera* from the genetic collection stored in Cenipalma.

Chemical analysis

Fatty acids profile

Cadena, Prada, Perea & Romero (2012), described the fatty acid profile finding a superior palmitic acid values in *E. guineensis* materials (Dura Angola-type with 40.87 % and Tenera-type with 40.69 %) compared to its OxG hybrid (30.19 %) and *E. oleifera* (29.5 7 %). However, Rivera *et al.* (2013), found similar values to the ones shown in this study, where the contents of palmitic acid were higher in hybrid OxG materials compared to *E. oleifera* materials. Choo *et al.* (1997) also found similar values to the ones found in our study, reporting a palmitic acid content of 28.2 % in a hybrid OxG material, and 18.7 % in *E. oleifera* material.

The oleic acid content of the *E. oleifera* Sinú genotype can be highlighted due to its high concentration, character that is transferred to hybrid II. On the contrary, for α-linolenic acid that is also high in *E. oleifera* Sinú genotype, this has not been the case, as this trait has not been transferred to hybrid II combination. A study carried out by Mondragón & Cuellar (2011), reported values slightly superior to the ones found in this study.

The aforementioned behavior suggests that *E. oleifera* parent provides the good oil quality trait found in hybrids, especially due to their unsaturated fatty acids content. Linoleic acid from the American materials in this study ranged between 10.6-18.3 %, and from 9.9-13 % for hybrid materials. In this respect, Mondragón & Cuellar (2011), found values of 21.1 %, which are superior to the ones found for this acid in American oil palms, but similar for hybrid palms.

The results of this study agree with the ones found by Rey, Gomez, Ayala, Delgado & Rocha (2004), who found that the materials of *E. oleifera* have in general, better unsaturated fatty acids characteristics (68–74%), in comparison to an interspecific hybrid (64%) and to *E. guineensis* (49–53%) material. Similarly, Rivera *et al.* (2013), also described higher values for *E. oleifera* materials compares to the OxG hybrids that are similar to the results found in this study. The very low values of the other fatty acids found in oil samples, confirms the low importance that these have in oil palm composition.

Vitamin E and carotenes

In this study, hybrid materials showed higher vitamin E value, including their components, compared to materials of *E. oleifera*. These results agree with the ones published by Rey *et al.* (2004) who described a hybrid material with a superior vitamin E content (1338 ppm) compared to *E. oleifera* (519–1140 ppm) material. On the other hand, Cadena *et al.* (2012), reported an opposite result, as total vitamin E content was superior in *E. oleifera* (1989 ppm) material compared to hybrid material (965 ppm).

In relation to carotenes content, Sinú genotype and all hybrids showed the highest total carotenes content, including α- and β-carotenes contents. This is consistent with results carried out by Cadena *et al.* (2012), and Rey *et al.* (2004).

Moreover, due to the variation in quality and production of bunches found among parental populations of *E. oleifera* and their interspecific hybrids with *E. guineensis* when the physicochemical characterization of palm bunches was carried out, this gives some insight in the agronomical potential of the OxG hybrids for development of oil palm culture in Colombia. This is especially important regarding tolerance potential of oil palm to lethal diseases in America. Furthermore, this research provides valuable input to the knowledge in oil palm breeding that we expect to be of great use for the public and private sectors.

Conclusions

In this study, the best fruit set values were found in the *E. oleifera* Coarí and Sinú genotypes and their hybrid combination, as they are native materials with good adaptation and reproductive traits. However, care has to be taken with the Coarí genotype when combined with other plant material to carry out assisted pollination and avoid losses in oil extraction potential.

Interspecific OxG hybrids showed outstanding traits in percentage of oil and oil extraction, as well as in percentage of mesocarp in normal as well as in partenocarpic fruits, compared to other plant materials probably due to genetic inputs of *E. guineensis* as the male parent.

Hybrids II and II showed important oil percentage values with low humidity percentage that is an important agronomic trait from an industrial point of view. However, considering traits that guarantees higher oil extraction percentage, *E. oleifera* Coarí genotype showed the best values.

Although hybrid materials showed higher values in some components of the fatty acid profile as well as in vitamin E content, the parent *E. oleifera* is the one that provides good oil quality trait found in these hybrids.

Physicochemical characterization of palm bunches carried out in this study suggests that there is an important variation among parental populations of *Elaeis oleifera* and their interspecific hybrids with *Elaeis guineensis*, due to the quality and production of bunches.

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