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RESEARCH PAPER

Nut Component Analysis of Exotic and Indigenous Sources of Oil Palm (*Elaeis guineensis*, Jacq.) Planting Materials

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ABSTRACT

Four hybrid combination each from Costa Rica (Deli × Ekona, Deli ×Avros, Deli×Ghana, Deli×Lame) and Palode (12´266, 128 ×31323, 12 ×313, 65D ×111) two Papua New Guinea (18C×2501, 9C×1001) and one Ivory coast (1M-0069D) sources of planting materials were taken up for assessing kernel and nut characters. Fresh fruits were collected and de-pericarped and soaked for 4 days in water. The seed morphological characters viz., length of seed, width of seed, shell thickness; shell mass and kernel mass were recorded. The oil content per kernel was also estimated using solvent extraction method. All the characters except width of seed were found to be significantly different among various cross combination. Length of the seed was maximum in (3.63cm) in 9×C1001 of Costa Rica; width of seed, shell mass and kernel mass were maximum in Deli × Lame combination. Lowest width of the seed was found in 18C×2501 PNG combination and shell mass was in Deli × Ekona. Highest oil/kernel was recorded in 12×266 of Palode which had kernel mass on per with Deli × Lame. Lowest oil/ kernel were recorded in 9C×1001 of Papua New Guinea and 1M-0069D× P of Ivory Coast. Hence, available variation for nut and kernel can be effectively utilized for selection since heritability for this trait is very high.

Ker words : Exotic planting materials, tenera, ASD Costa Rica, nut components, kernel oil

INTRODUCTION

Oil palm (*Elaeis guineensis* Jacq) produces two distinct oil; the red mesocarp 'palm oil' and the 'palm kernel oil' (similar to coconut oil), which are of edible and industrial importance, respectively. In the oil palm, three fruit forms exist; homozygous dominant thick-shelled dura (Sh + Sh +), homozygous shell-less, recessive pisifera (Sh-Sh-) and the thin shell heterozygous tenera (Sh + Sh-). The pisifera is female sterile while the tenera, owing to its thin shell and thicker oil bearing mesocarp gives more oil than the dura fruit form. Past work in oil palm has emphasized selection for high yield of palm oil i.e. high percentage of mesocarp to fruit ratio and reduced kernel per fruit. In general breeding programme aims to get more mesocarp oil which will results in decrease in kernel content. Due to the high heritability of the kernel characteristics, it is possible to revert the process and to produce materials with a high kernel content. Chan *et al.*, (1988) found high heritability of kernel/bunch. Corley and Tinker (2007) recommended that palm selection can be resorted if it were particularly outstanding for one trait, even though it failed to reach the standards for other characteristics. Variation in kernel oil composition in oil palm has received little attention. Hence, experimental trial planted at National Research Centre for Oil Palm with cross combinations of different sources of planting material were evaluated for nut and kernel components with the purpose of selecting those that would allow for a rapid increase in kernel content and oil in the progenies to be developed.

MATERIALS AND METHODS

Nut component analysis was carried out on palms maintained in a trial at the National Research Centre for Oil Palm, Pedavegi during 2005-06. The experiment was laid out in a Randomized Block Design with three replications with each plot consisting of nine palms. Four combination each from Costa Rica (Deli × Ekona, Deli × Avros, Deli × Ghana, Deli × Lame) and Palode (12D × 266P, 128D × 31323P, 12D × 313P, 65D ×111P) two Papua New Guinea (18C × 2501, 9C

×1001) and one Ivory coast (1M-0069D × P) sources of planting materials were taken up for assessing kernel and nut characters. Fresh Fruit bunches, each exceeding 5.0 kg were harvested from individual palms. A 500g fruit sample from each bunch was analysed for kernel characters following the procedure outlined by Blaak *et al.,* (1963) with required modifications. Fruits were de-pulped and the nuts were surface dried for 3-5 days and cracked before the kernel weights were recorded. The phenotypical characters viz., length of seed, width of seed, shell thickness; shell mass and kernel mass were recorded. The oil content per kernel also estimated using solvent extraction method. The mean values for each source of planting material were obtained.

RESULTS AND DISCUSSION

Variation is the basis for selection. Nut size varies greatly and depends on both the thickness of the shell and size of the kernel. All the characters except width of seed and circumrance were found to be significantly different among various exotic and indigenous hybrids studied. Length of the seed was maximum (3.4cm) in 9C x 1001 genotype and least was recorded in IM 0069 *D* X *P* (Table 1). Width of seed was high (5.14 cm) in Deli x Lame combination of ASD hybrid and kernel mass (1.48 g) was high in Palode hybrid and shell thickness in Deli x AVROS of Costa Rican hybrids. Highest (3.64g) dry nut was recorded in 12D X 266P of Palode hybrid followed by Deli x Lame (2.97g). African tenera nuts are usually 2 cm or less in length and average two grams but very small nuts weighing one gram are not uncommon (Corley and Tinker, 2003). In this evaluation Deli ×AVROS recorded lowest nut weight of 1.86g which was significantly lower from other hybrids. According to Hartley (1988) if kernel size is increased, the percentage of shell will also be increased. Rajanaidu *et al*., (2000), identified individual palms among the Nigerian prospection material with maximum nut and kernel weight and opined that heritability of kernel content is generally quite high. A change in kernel size, if the shell thickness remains the same, will have greater relative effect on shell/fruit in tenera palms. Okwuagwu (1988) postulated the existence of kernel inhibiting and shell inhibiting factors transmitted by the tenera or pisifera parent to its tenera offspring. Where the kernel inhibiting factor is absent, tenera will have kernels as large as their dura sibs.

Oil / kernel was high in 12D x 266P of Palode combination which also had high kernel mass. Lowest oil/ kernel was recorded in 9C x 1001 PNG kernels (Table 2). It is not possible to reduce shell percentage to as low a figure in high-kernel tenera as in high mesocarp tenera; even the thinnest shells usually constitute 50 % of the nut weight. The shell thickness gene has major effects on nut composition (Corley and Tinker, 2003). Sparnaaij (1969) suggested that nut composition in tenera is determined by actual shell plus the unlignified mantle of fibres around the shell and indicated that kernel size was important. Highest shell thickness was recorded in Deli × Lame Costa Rica followed by Deli × Avros. All the Palode hybrids except 65D× 111P was recorded low shell thickness when compared to ASD materials. Lowest shell thickness was found in 18C × 2501 of Papua New Guinea followed by other hybrids of Papua New Guinea. Since shell thickness is controlled by single gene, due to the genetic variability available, and to the high variability of kernel component characteristics, it is possible to produce materials with high kernel content (Alvarado *et al*., 2000). In the different sources of planting material

Table 1 : Nut and kernel variation in exotic and indigenous sources of oil palm planting materials

Exotic & Indian hybrids	Nut length(cm)	Nut width(cm)	Dry Shell wt.(g)	DryKernel wt.(g)	Shell thickness(mm)	Dry Nut weight (g)
12D x 266P	3.02	4.63	2.16	1.48	2.06	3.64
128D x 31323P	2.76	4.93	1.35	1.01	2.02	2.36
12D x 313P	2.44	4.64	1.58	1.13	2.02	2.71
65D x 111P	2.87	4.72	1.31	0.98	2.12	2.29
Deli x Ekona	2.69	4.61	0.93	0.74	2.16	1.67
Deli x AVROS	3.01	4.61	1.02	0.84	2.18	1.86
Deli x Ghana	2.81	4.6	1.47	1.1	2.12	2.57
Deli x Lame	2.94	5.14	1.78	1.19	2.19	2.97
18C x 2501	3.16	4.36	1.18	1.03	1.26	2.21
9C x 1001	3.4	4.62	1.13	1.05	1.59	2.18
IM-0069 D x P	2.37	4.19	0.96	0.81	1.37	1.77
Mean	2.86	4.64	1.35	1.42	1.92	2.77
CD (0.01 %)	0.58	NS	0.63	0.31	0.16	0.32

Table 2 : Nut components in exotic and indigenous source of oil palm planting material

Indigenous & exotic hybrids	Shell to Nut (%)	Kernel to Nut (%)	Oil to Kernel (%)	Oil to Nut (%)
Hybrids from Palode (Indigenous)				
12 x 266	59.34	42.80	30.69	13.14
128 x 31323	57.20	40.66	24.32	9.89
12 x 313	58.30	41.70	26.55	11.07
65 x 111	57.21	42.79	26.53	11.35
Hybrids from Costa Rica (Exotic)				
Deli x Ekona	55.69	44.31	40.54	17.96
Deli x AVROS	54.84	45.16	34.52	15.59
Deli x Ghana	57.20	42.80	24.55	10.51
Deli x Lame	59.93	40.07	23.53	9.43
Hybrids from Ivory Coast (Exotic)				
18C2501	53.39	46.61	33.98	15.84
9C x1001	51.83	48.17	19.05	9.17
IM-0069D	54.24	45.76	25.93	11.86
Mean	56.49	43.51	28.43	12.39

under study, available variation for kernel weight was large enough and thus offers a possibility for effective selection since heritability for this trait is very high. Outstanding palms from Palode material could be utilized in a Crossing programme to generate desirable segregates that possess large kernels or be intergressed into existing populations with large kernel. A point in favour of kernel is that factory kernel extraction is usually more efficient than palm oil extraction, so actual yields will come closer to the bunch analysis figures for kernel than oil. The present report indicates a good potential for improving palm kernel oil utlising different sources of planting materials, but further and more detailed studies are required to ascertain the stability of this venture for ensuring this industrial raw material

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