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Ekona x Deli *Dura* Materials: Promising High Oil-to-Bunch *Dura* Materials

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ABSTRACT

Most South-east Asian oil palm seed producers currently use Deli dura *as female seed palms to produce commercial seeds. This material is characterised by large bunches and high fresh fruit bunch (FFB) yield. SumBio's Deli* dura *material usually has laboratory % oil-to-bunch (OB) of 18%-22%.*

SumBio is currently developing its dura *breeding materials by introgressing commercial Deli* dura *material with breeding material received from Cameroon and Democratic Republic of Congo. These materials were received as part of the Combined Breeding Programme between Unilever Plc and Harrisons and Crosfield and were planted at Bah Lias Research Station in 1985. Selected Ekona* duras *were crossed with selected Deli* dura *to produce a F1 generation and a trial was conducted in 1995. Palms from selected progenies of Ekona x Deli* dura *from this planting were selfed to produce an Ekona x Deli F2 generation. A trial was conducted in 2003 which compared six Bah Lias Deli* dura *selfed progenies with 28 Ekona x Deli* dura *selfs for potential selection as commercial seed palms. The trial results showed that Ekona x Deli progenies had higher OB compared to Bah Lias Deli* dura *progeny. One Ekona x Deli F2 progeny achieved an OB ratio of 27.7% with high % mesocarp to fruit (67.0%).*

Since these are Ekona x Deli F2 progenies, with high between-palm-within progeny genetic variation, there is optimism that there is considerable potential to make further breeding progress by selecting within progenies (following progeny testing) and by selfing. It will also be possible to rapidly multiply the best dura *palms within these progenies (on the basis of progeny trial results) by cloning.*

ABSTRAK

Kebanyakan pengeluar biji benih di Asia Tenggara kini menggunakan dura *Deli sebagai induk betina untuk menghasilkan biji benih komersial. Bahan tersebut berciri tandan besar dan hasil buah tandan segar (BTS) yang tinggi. Bahan tanaman* dura *Deli SumBio lazimnya mempunyai nisbah minyak-ke-tandan 18%-22%.*

Pada masa ini, SumBio sedang membangunkan bahan biak baka dura *dengan menggabungkan* dura *Deli komersial dengan bahan biak baka yang diterima dari Cameroon dan Republik Demokratik Congo. Bahan tersebut diterima sebagai sebahagian daripada Program Biak Baka Bersepadu di antara Unilever Plc dan Harrisons and Crosfield dan telah ditanam di Stesen Penyelidikan Bah Lias pada tahun 1985.* Dura *Ekona yang terpilih telah dikacukkan dengan* dura *Deli terpilih untuk menghasilkan generasi F1 dan satu percubaan telah dijalankan pada tahun 1995. Penyendirian pokok dari penanaman progeni terpilih Ekona x* dura *Deli telah dilakukan untuk menghasilkan generasi F2 Ekona x* dura *Deli. Satu percubaan telah dijalankan pada tahun 2003 untuk membandingkan progeni enam* dura *Deli penyendirian Bah Lias dengan 28 penyendirian Ekona x* dura *Deli untuk pemilihan berpotensi sebagai pokok induk komersial. Keputusan percubaan menunjukkan bahawa progeni Ekona x* dura *Deli mempunyai nisbah minyak-ke-tandan yang lebih tinggi berbanding progeni* dura *Deli Bah Lias. Satu progeni Ekona x Deli F2 mencapai nisbah minyak-ke-tandan 27.7% dengan nisbah mesokarpa-ke-buah yang tinggi (67%).*

Memandangkan ini adalah progeni F2 Ekona x Deli dengan variasi genetik antara pokok di kalangan progeni yang tinggi, maka terdapat keyakinan tentang potensi untuk mencapai kemajuan biak baka selanjutnya dengan cara memilih di kalangan progeni (susulan ujian progeni) dan menerusi penyendirian. Di samping itu, terdapat kemungkinan untuk menambahkan pokok dura *terbaik di kalangan progeni tersebut dengan cepat (berdasar keputusan percubaan progeni) menerusi pengklonan.*

Keywords: SumBio, *dura* breeding programme, Ekona x Deli *dura.*

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INTRODUCTION

Deli *dura* is extensively used as female seed palms to produce commercial seeds. The earliest record of the introduction of oil palms into South-east Asia was of four seedlings planted in Buitenzorg (now Bogor) Botanic Garden in 1848 in Java in the Dutch East Indies. Two of these were from the Amsterdam Botanic Gardens, but it is not known how they originated and the other two were from 'Bourbon or Mauritius' in the Indian Ocean, Bourbon being on Reunion (Corley and Tinker, 2003; Pamin, 1998). The descendants of these four original palms were distributed for planting in experimental plots and one of these plots was in Deli, North Sumatra.

Deli *Dura* Population

SumBio has developed 'Gunung Malayu' Deli *dura* breeding material. These Deli palms were planted by a Swiss company which started planting oil palms in the Gunung Malayu Estate, North Sumatra around 1919. The selection programme gave emphasis to slow height increment and high oil-to-mesocarp. The original genetic blocks (1936-1942) contained about 2000 palms and 37 palms were selected for further breeding at Bah Lias Research Station.

Ekona Material

The Ekona material was developed at Unilever's Lobe Breeding Programme, in Cameroon. This material was much more variable than AVROS and considerable progress was reported following the selection cycles carried out in Costa Rica. One important characteristic of the Ekona population is its high oil-to-bunch content (Escobar *et al*., 1999). The Ekona materials were received by SumBio as part of the Combined Breeding Programme between Unilever Plc and Harrisons and Crosfield and were planted in the Bah Lias Research Station in 1985.

EXPERIMENTAL DESIGN

F2 Ekona x Deli Materials

Selected Ekona *dura*s have been crossed with selected Deli *dura* to produce a F1 generation and a trial was conducted in 1995. Palms from selected progenies of Ekona x Deli *dura f*rom this planting were selfed to produce an Ekona x Deli F2 generation. A trial was conducted in 2003 which compared six Bah Lias Deli *dura* selfs with 27 Ekona x Deli *dura* selfs for potential use as commercial seed palms and two *dura* clones. The field had four replicates of an alpha design of 35 progenies, five blocks of seven plots per replicate and 16 palms per plot. Yield and vegetative measurements were recorded using methodologies described by Breure and Verdooren (1995). A sample of approximately 60 individual bunches from each progeny was analysed using the methods described by Blaak *et al*. (1963) and Rao *et al.* (1983).

RESULTS AND DISCUSSION

Comparison of Bunch Characters

There were significant differences in oil-to-bunch (OB) between the different materials. The F2 Ekona x Soc Deli material had higher OB ratio compared to the other breeding materials because of high mesocarp-to-fruit, oil-to-wet mesocarp and oil-to-dry mesocarp ratios. *Table 1* shows the mean bunch characters of each breeding material.

Figure 1 shows the predicted mean of percentage OB ratio for each progeny. The F2 progenies of Ekona x Soc Deli material had the highest mean OB ratio. The highest OB ratio was achieved by a F2 Ekona x Soc Deli progeny (27%). There is optimism that there is considerable potential to make further breeding progress by selecting within progenies (following progeny testing) and by further selfing.

Comparison between F1 and F2 Progenies of Ekona x Deli Materials

OB is determined by fruit-to-bunch (FB), oil-to-wet mesocarp (OWM) and mesocarp-to-fruit (MF). A comparison of percentage oil-to-bunch and percentage mesocarp-to-fruit between F1 and F2 progenies of Ekona x Deli *dura* material is shown in *Figure 2*. The figure shows that F2 generation has better mean bunch traits in terms of OB and MF. The F2 progenies of Ekona x Soc Deli material had a higher OB compared to other materials. Five *dura* progenies of F2 Ekona x Soc Deli materials had OB greater than 26% and MF of around 67%. The F2 *dura* Ekona 703 x GM Deli progenies also have higher OB compared to their F1 progenies.

Comparison between Population in Term of Oil and Kernel Yield (OKY)

There is variation in term of oil kernel yield between the population. Bah Lias *dura* clones have a higher oil and kernel yield compared to other population (*Figure 3*).

The F2 Ekona x Deli progenies will have much greater between-palms-within progeny variation than the Bah Lias Deli *dura* selfs and *dura* clone. It was expected that this greater genetic variation would also be reflected in the between-palm-within progeny phenotypic variation. *Table 2* shows the between-palm-within progeny phenotypic variation for a few selected traits but the *dura* clone

TABLE 1. MEAN BUNCH CHARACTER FOR EACH TYPE OF BREEDING MATERIAL

Breeding materials	No. of progeny	FB (%)	MF (%)	OWM (%)	ODM (%)	OB (%)	KB (%)	SK (%)	SF (%)
Bah Lias *dura* selfs	6	71.2	59.4	52.3	81.6	22.1	6.4	3.7	31.7
Dura clone	2	72.5	63.9	52.0	82.4	24.2	4.9	4.4	29.3
F2 Ekona 701 x GM Deli	10	72.0	60.3	58.2	82.2	25.3	6.1	3.9	31.3
F2 Ekona x Soc Deli	13	70.9	63.0	57.0	82.7	25.5	6.3	3.3	28.1
F2 Ekona 703 x GM Deli	4	70.8	58.8	57.5	82.4	24.0	5.5	4.5	33.4

Note: FB = fruit-to-bunch, MF = mesocarp-to-fruit, OWM = oil-to-wet mesocarp, ODM = oil-to-dry mesocarp, OB = oil-to-bunch, KB = kernel-to-bunch, SK = shell-to-kernel, SF = shell-to-fruit.

TABLE 2. MEAN PROGENY VARIANCES FOR BREEDING MATERIAL FOR SELECTED TRAITS

Breeding materials	No. of progeny	Mean annual OKY	HT	FB	MF	OB	KB
Bah Lias Deli *dura* selfs	6	3.85	889	20.2	17.2	8.76	2.18
Dura clone	2	3.05	646	18.5	34.7	21.5	1.80
F2 Ekona 701 x GM Deli	10	2.50	465	22.5	18.7	11.4	1.38
F2 Ekona x Soc Deli	13	2.05	1 391	22.9	17.9	11.0	1.68
F2 Ekona 703 x GM Deli	4	3.98	839	25.3	24.8	7.16	2.23

Note: OKY = oil and kernel yield, HT = trunk height, FB = fruit-to-bunch, MF = mesocarp-to-fruit, OB = oil-to-bunch, KB = kernel-to-bunch.

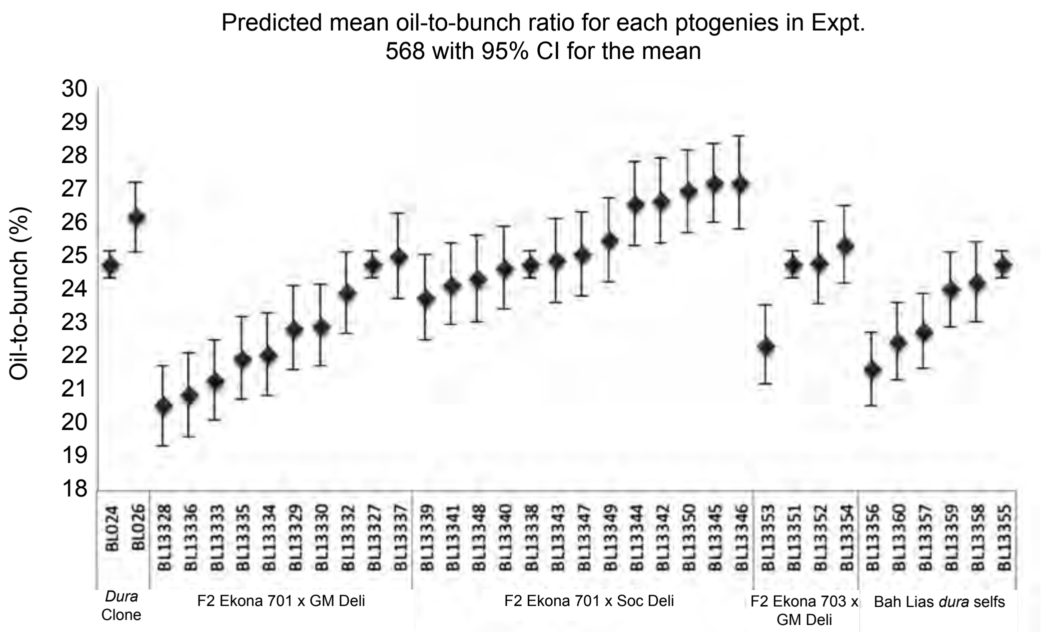

Figure 1. The % oil-to-bunch (OB) ranked for each progeny in each breeding material.

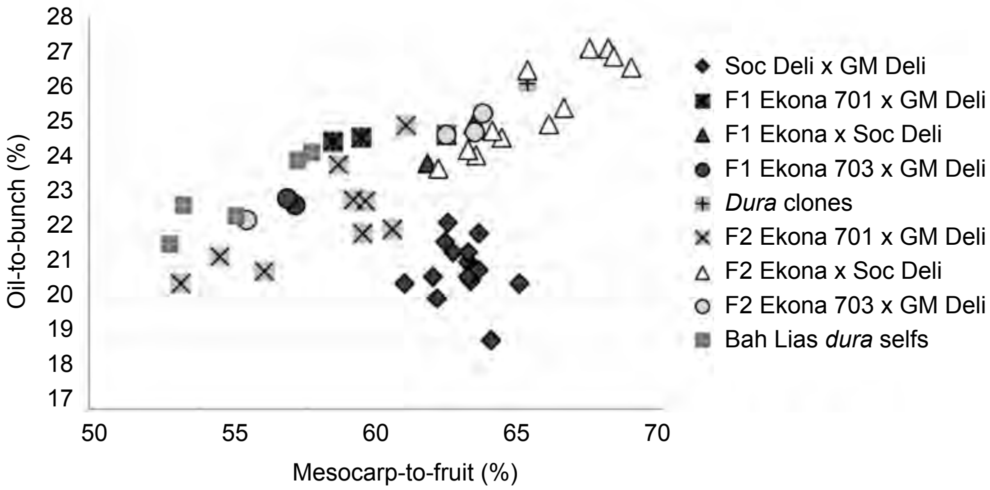

Figure 2. Comparison between F1 and F2 progenies of Ekona x Deli materials for % oil-to-bunch and mesocarp-to-fruit.

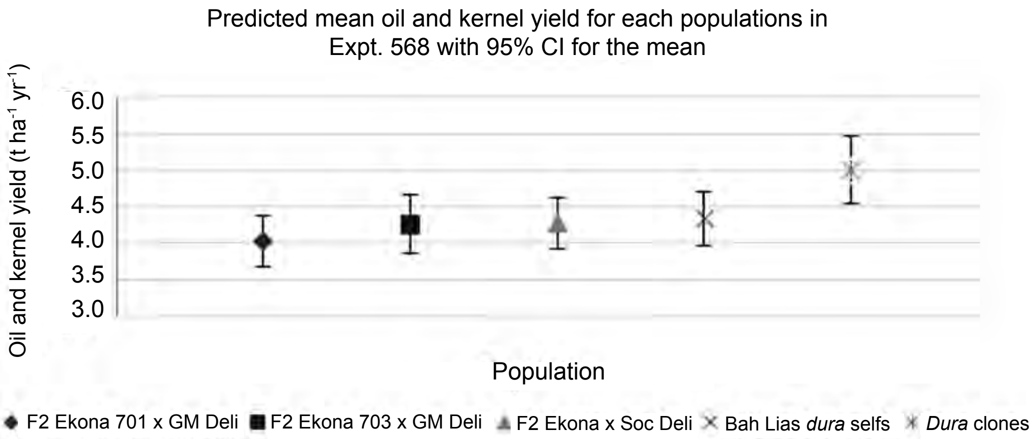

Figure 3. Ranked mean annual of oil and kernel yield (OKY) of each breeding materials.

and Deli *dura* selfs are not less phenotypically variable (do not have a lower progeny variance).

CONCLUSION

F2 progenies of Ekona x Soc Deli material had a higher OB ratios and there is optimism that there is considerable potential to make further breeding progress by selecting within progenies (following progeny testing) and by further selfing. It will also be possible to rapidly multiply the best *dura* palms within these progenies (on the basis of progeny trial results) by cloning.

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