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Role of Biotechnology in Improving Oil Palm Productivity*

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Biotechnology offers tremendous opportunities for a qualitative and quantitative leap in the oil palm. There are several areas of biotechnology that have been applied to the oil palm. These include genetic engineering, genomics and phenolics technologies. Genetic engineering allows for the introduction of foreign genes into an organism by the process of transformation. In addition to its high productivity, the oil palm has the advantage of being a perennial crop. Its inherent high productivity can be channelled towards the production of high value products. The oil palm can thus be viewed as a green factory and a transgenic oil palm will 'manufacture' the product continuously over its economic life of 20-30 years. The oil palm genome programme gives an opportunity to decode the blueprint of the oil palm. MPOB has successfully sequenced three oil palm genomes, namely those of the dura, pisifera *and* oleifera. *The sequences provide a valuable resource for improvement of the oil palm using genomics-guided strategies. The sequences have been used to develop important genomic platforms, such as single nucleotide polymorphism (SNP) array, oligoarray and methylarray. This will lead to opportunities to screen and select for palms with superior characteristics through molecular markers. MPOB has developed comprehensive genetic maps for the oil palm. These genetic maps will facilitate the positioning of the genes controlling important agronomic traits. Based on these maps, MPOB has already identified genetic markers that can predict for fruit colour, fruit form (presence/absence of the shell) and oil quality. Other markers of interest include those for disease resistance, short height increment and tissue culture amenity.*

Tissue culture abnormality is known to be an epigenetic phenomenon. With the availability of the oil palm genome sequence (also known as the first genetic code), MPOB also embarked on unravelling the epigenetic or second genetic code in efforts to understand the mechanism of somaclonal variation and abnormality.

Methylation plays an important role in epigenetics. A novel microarray approach was successfully applied to detect DNA methylation alterations in oil palm tissue culture. The oil palm mesocarp contains water-soluble bioactives, mainly phenolics. During the palm oil milling process these bioactives find their way into the palm oil mill effluent (POME). MPOB developed a simple procedure enabling production of a proprietary phenolic-enriched extract. Oil palm phenolics present an exceptional opportunity to position the Malaysian oil palm industry in the vibrant and rapidly growing, hundred billion dollar nutraceutical market. A number of studies already suggest and support potent health and therapeutic benefits of oil palm phenolics, which include antioxidant and preventive effects against cancer, atherosclerosis, neurodegenerative diseases, diabetes and inflammation. We have recently discovered that the oil palm phenolic extract and palm oil mill effluent also contain significant amounts of shikimic acid, the substrate for tamiflu synthesis. The large volume of POME generated makes this the largest potential source of shikimic acid in the world. Currently the main source of shikimic acid is star anise from China but supplies are limited.

Keywords*: Oil palm, genetic engineering, tissue culture, genome and phenolics*