# MPOB-Eg50: OPTIMISED SNP PANEL TO ACCELERATE GENETIC IMPROVEMENT

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Next-generation sequencing technologies have resulted in the identification of a large number of single nucleotide polymorphism (SNP) markers in the genome. In comparison to other marker systems such as amplified fragment length polymorphisms and simple sequence repeats, SNP markers are amenable to automation, high-throughput, and cost-effective genotyping (Saxena *et al*., 2018). SNP markers are commonly used for genetic improvement through various studies such as construction of genetic map (Ting *et al*., 2023), elucidation of marker-trait associations, genome-wide association studies and genomic selection (Serdari *et al*., 2024; Kwong *et al*., 2017). SNP genotyping was performed using either fixed-arrays or genotyping-by-sequencing platforms. In the oil palm industry, most of the biotechnology research is currently using sequencing-based DNA markers for genomics-guided breeding. Utilisation of sequencing-based DNA markers require additional bioinformatics analysis and the cost per data point is higher compared to array-based with optimised SNP panel. Moreover, genotype calls of sequencing are not consistent across different experiments.

Cost-effective DNA-based markers to accelerate plant breeding for development of new variety is urgently needed. The availability of oil palm reference genome and sequencing of *Elaeis guineensis* germplasm as well as selected advanced breeding lines (ABLs) have enabled the discovery of informative SNP markers. Based on the improved oil palm genome assembly, EG11 (Low *et al*., 2024), we have identified 66,571 SNPs (*Table 1*) that were well distributed across the 16 pseudochromosomes of oil palm (*Figure 1*). This panel formed the Oil Palm 50K SNP Array or MPOB-Eg50. These *E. guineensis* markers have been evaluated with samples from diverse genetic background and were deemed suitable for broad application such as evaluating breeding lines, conducting genomics guided breeding and preserving core germplasm for posterity. The new SNP panel is easy to use, reproducible and cost competitive.

## THE TECHNOLOGY

### Objective of the Technology

SNP panel that works across a wide range of planting materials of various genetic backgrounds.

### Methodology

#### a. Selection and Evaluation of MPOB-Eg50

Short-read sequences from 279 palms were aligned to the latest oil palm reference genome (EG11) for identification of 81,757 SNPs. The SNP

**TABLE 1. COMPOSITION OF THE MPOB-Eg50**

| SNP origin | Number of SNP | Percentage (%) |
|---|---|---|
| PolyHighResolution | 64,012 | 96.1 |
| NoMinorHom | 2,034 | 3.1 |
| MonoHighResolution | 264 | 0.4 |
| Others (*e.g.*, traits related genes) | 261 | 0.4 |
| Total | 66,571 | 100 |

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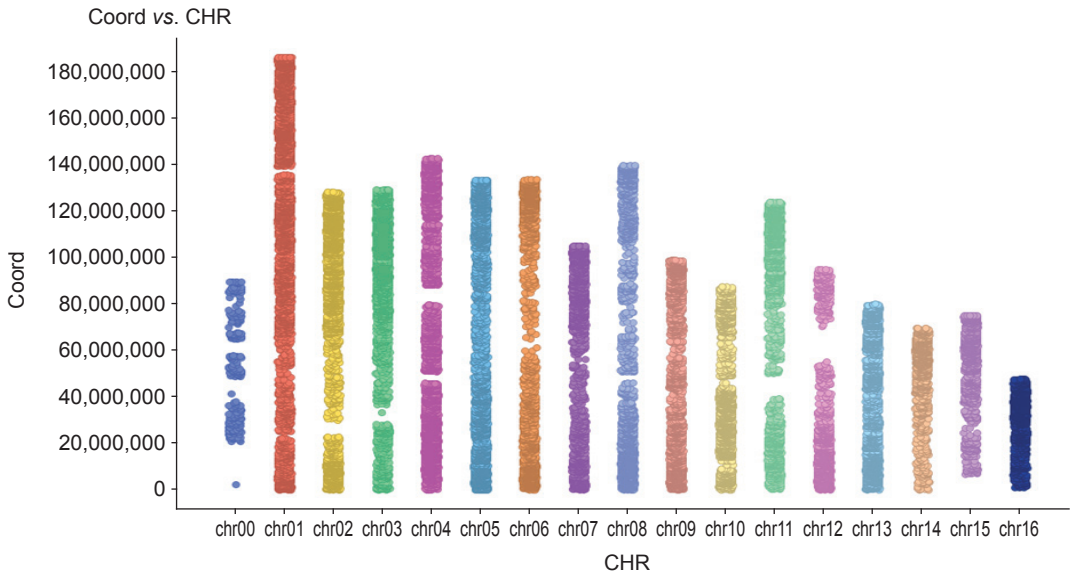


*Figure 1. Distribution of candidate SNPs from MPOB-Eg50 across 16 pseudochromosomes of EG11.*

panel was further genotyped with 480 palms from various genetic backgrounds such as ABL x ABL (10 crosses), ABL x germplasm (6 crosses) and germplasm x germplasm (6 crosses). The results showed that the average cluster call rates are 99.67%. Reproducibility of genotype calls, as determined on 23 replicated samples, is also high at 99.95%. Based on the genotype calls, 66,571 SNP markers were shortlisted to form MPOB-Eg50 (*Table 1*).

**b. Evaluation of MPOB-Eg50 Across MPOB Planting Materials**

MPOB-Eg50 was evaluated across 1,920 palms from MPOB and also 60 palms from industry. The 1,920 palms from MPOB were selected from germplasm (1,730: Nigeria, Cameroon, Zaire, Tanzania), PS1.1 (163: ECPHP207 and ECPHP256) and T128 (11). Performance of array was evaluated based on SNP call rate and reproducibility of the replicated samples. The results revealed that more than 93% of the SNPs are informative across MPOB and industry samples. Result from MPOB's samples is summarised in *Table 2*.

**TABLE 2. PERFORMANCE OF MPOB-Eg50 ACROSS MPOB SAMPLES**

| SNP origin | Number of SNP |
|---|---|
| PolyHighResolution | 60,853 |
| NoMinorHom | 844 |
| MonoHighResolution | 298 |
| CallRateBelowThreshold | 2,579 |
| Other | 1,730 |
| OTV | 202 |

## NOVELTY OF TECHNOLOGY

**MPOB-Eg50 offers;**

i. An improved high-density genotyping SNP panel for genetic studies across *Elaeis guineensis* planting materials from Southeast Asia;
ii. Enable discovery of potential SNP markers associated with important agronomic traits across targeted breeding population from various genetic backgrounds;
iii. Useful SNP panel for studies involving crosses from germplasm and advanced breeding lines; and
iv. Availability of the SNP panel will speed up genotyping of breeding populations by reducing the time spend on bioinformatics analysis.

## BENEFITS TO THE INDUSTRY

The availability of the MPOB-Eg50 SNP panel will benefits industry as below:

i. Utilisation of the same *E. guineensis* SNP panel across oil palm industry will enable comparison of data across various studies;
ii. Expedite research directed towards improvement of breeding and tissue culture efficiency;
iii. Can be used to evaluate breeding lines in seed garden to protect and conserve the important parental palm;
iv. Reduction in genotyping cost for utilisation of large SNP panel on array-based platform; and
v. Accelerate the development of new oil palm varieties.

## COMMERCIALISATION POTENTIAL

MPOB-Eg50 is the first high-throughput genotyping platform for *E. guineensis* that is made available to oil palm scientific researchers through the concept of community array. In order to use the array, researchers will need to get consent from MPOB and MPOB will consolidate all samples to get a better price. The cost per SNP panel is depending on the total number of samples committed to the current array-based platform. The information as below and subject to change per business year;

| No. of samples | Cost per SNP panel (RM) |
|---|---|
| 10-20K | 240 |
| 5-10K | 340 |
| 3-5K | 520 |

Interested party can either send the DNA to MPOB or straight to the appointed service provider.

## IMPACT

The first universally applicable *E. guineensis* SNP panel accessible to the oil palm community in Malaysia.

## IP STATUS

Individual SNP on the panel, which is unique to *E. guineensis*, is filed as trade secret, accessible to oil palm researchers via MPOB.

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