

# SureSawit™ VIR - A DIAGNOSTIC ASSAY TO PREDICT COLOUR OF OIL PALM FRUITS

RAJINDER SINGH; LESLIE OOI CHENG-LI; LESLIE LOW ENG TI; MEILINA ONG-ABDULLAH; JAYANTHI NAGAPPAN; TING NGOOT CHIN; MOHD ARIF ABD MANAF; RAJANAIDU NOOKIAH and RAVIGADEVI SAMBANTHAMURTHI



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**F**ruits of the oil palm can vary considerably based on their external appearance, notably the exocarp colour. The most common type of fruit colour is *nigrescens* (*Nig*), which is deep violet to black at the apex and pale yellow at the base when unripe. The colour of the *Nig* fruit varies to some extent on ripening, to either entirely red, or purplish black over the upper half but red at the base (Hartley, 1988). The other fruit colour is known as *virescens* (*Vir*), which is green when unripe and changes to light reddish-orange when ripe (Figure 1). Both *Nig* and *Vir* fruits occur in nature. There is no difference in the yield profile between *Nig* and *Vir*.



Figure 1. *Nigrescens* (unripe and ripe) and *virescens* (unripe and ripe) fruit bunches.

## THE PROBLEM

Currently, *Nig* palms form the bulk of the planting materials in plantations in Malaysia and worldwide. Unfortunately, *Nig* fruits undergo minimal colour change when ripe, resulting in considerable harvesting of under- or over-ripe bunches, both to the detriment of oil productivity. Under-ripe bunches contain less oil while over-ripe bunches, with their fruits already abscised from the bunch, 'splatter' on dropping to the ground, scattering the loose fruits and requiring them to be gathered. With the shortage of harvesters in oil palm plantations, the time spent on collecting the loose fruits is wasteful, and very often the task is incomplete (Hoong and Donough, 1998) - a reason often cited for the low oil extraction rate (OER) in Malaysia (Corley and Law, 2001). Over-ripe bunches are high in lipase activity resulting in release of free fatty acids affecting oil quality.

## THE SOLUTION

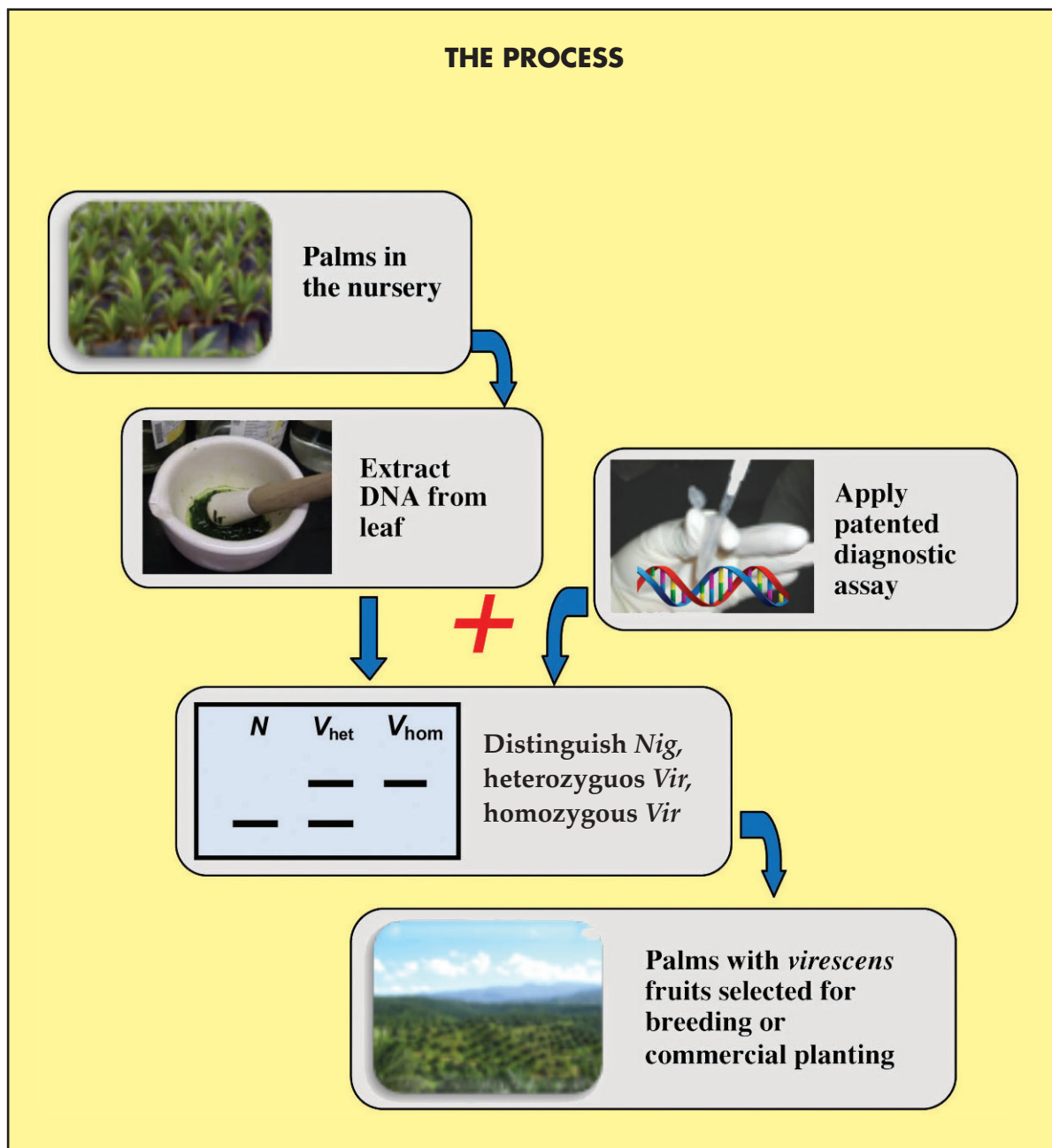
Palms bearing *Vir* fruits are more advantageous to planters as the striking difference in colour between ripe and unripe bunches makes it easier to identify ripe bunches for harvesting (Figure 2). If such palms are planted, it would be easier to harvest bunches at correct ripeness and give maximum oil content while most fruits are still attached to the bunch.

Preferential selection of *Vir* palms can be carried out via a marker assisted selection (MAS) program. To implement MAS, the identification of the gene influencing the trait is desirable. In this respect, MPOB made a major breakthrough when it identified the gene controlling fruit colour and corresponding mutations that give rise to *Vir* fruits (Singh *et al.*, 2014).





Figure 2. A palm bearing *Vir* fruits, green when unripe, orange when ripe.



## TECHNOLOGY DEVELOPED

Identification of the gene allowed for the development of a molecular assay that not only enables early differentiation of *Vir* from *Nig*, long before the fruits are formed, but also allows for the homozygous and heterozygous forms of *Vir* to be clearly distinguished (Figure 3). The assay requires basic laboratory equipment to execute.

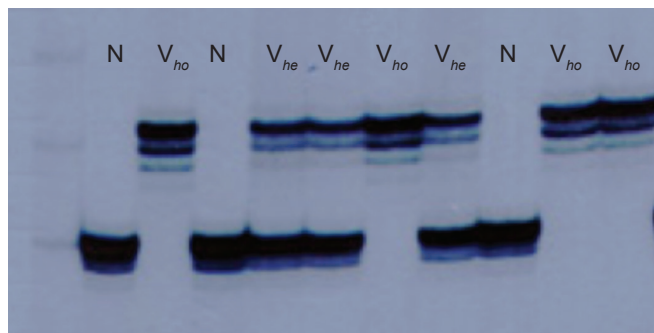


Figure 3. Molecular profiles for *Vir* and *Nig* palms. N: *Nig*;  $V_{ho}$ : homozygous *Vir*;  $V_{he}$ : heterozygous *Vir*.

## IMPACT

The molecular diagnostic assay provides an opportunity to improve productivity by reducing economic losses due to inefficient harvesting.

## PATENTS AND PUBLICATION

The innovation received international recognition when the science behind the discovery was published in the highly respected international journal *Nature Communications* (Singh *et al.*, 2014) (Figure 4). MPOB owns the intellectual property

(IP) rights to the discovery through patents filed in Malaysia (PI 2014700730) and worldwide including the United States (61/809,767, USA).

## WHO WILL BENEFIT

- Breeders who can use the technology to speed up the production of *Vir* planting materials.
- Oil palm plantation companies and smallholders who can plan for planting of *Vir* materials.

## REFERENCES

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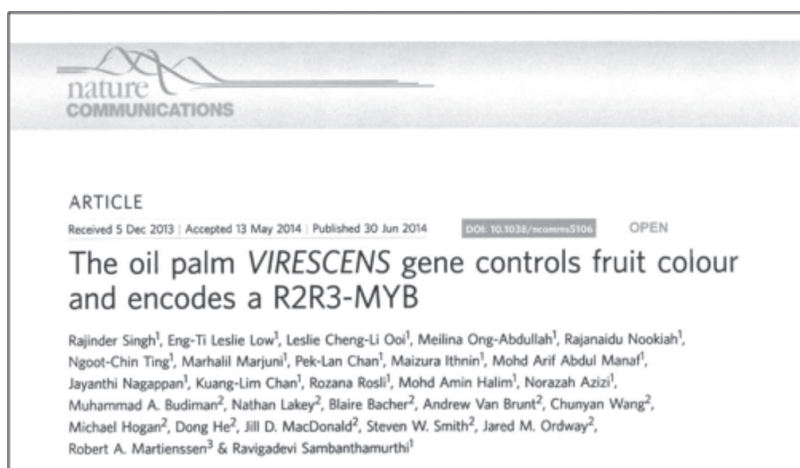


Figure 4. The gene controlling fruit colour with the corresponding mutations that give rise to *Vir* fruits reported in *Nature Communications*.

For more information, kindly contact:

Director-General  
MPOB

6 Persiaran Institusi, Bandar Baru Bangi,  
43000 Kajang, Selangor, Malaysia.

*Tel:* 03-8769 4400

*Fax:* 03-8925 9446

[www.mpob.gov.my](http://www.mpob.gov.my)