Claims

1. A method for increasing oil yield of an oil palm plant comprising:

(i) determining the level of triose-phosphate isomerase and the level of glycerol-3-phosphate dehydrogenase in mesocarp tissue of a fruit of a parental oil palm plant ~~11~~ 14 to ~~21~~ 19 weeks after pollination thereof in comparison to mesocarp tissue of a fruit of a reference oil palm plant ~~11~~ 14 to ~~21~~ 19 weeks after pollination thereof; and

(ii) selecting progeny of the parental oil palm plant based on the level of triose-phosphate isomerase being lower and the level of glycerol-3-phosphate dehydrogenase being higher for the parental oil palm plant in comparison to the reference oil palm plant, to obtain a high-yielding oil palm plant.

2. The method of claim 1, further comprising:

(i) determining at least one of the level of malate dehydrogenase and the level of ATP citrate lyase in the mesocarp tissue of the fruit of the parental oil palm plant 11 to 21 weeks after pollination thereof in comparison to the mesocarp tissue of the fruit of the reference oil palm plant 11 to 21 weeks after pollination thereof; and

(ii) selecting progeny of the parental oil palm plant based also on at least one of the level of malate dehydrogenase being higher and the level of ATP citrate lyase being higher for the parental oil palm plant in comparison to the reference oil palm plant, to obtain the high-yielding oil palm plant.

3. The method of claim 2, wherein the selecting is based on both the level of malate dehydrogenase being higher and the level of ATP citrate lyase being higher.

4. The method of claim 1, 2, or 3, further comprising:

(i) determining at least one of the level of glyceraldehyde-3-phosphate dehydrogenase, the level of fructose-1,6-bisphosphate aldolase, the level of pyruvate kinase, and the level of aconitase in the mesocarp tissue of the fruit of the parental oil palm plant 11 to 21 weeks after pollination thereof in comparison to the mesocarp tissue of the fruit of the reference oil palm plant 11 to 21 weeks after pollination thereof; and

(ii) selecting progeny of the parental oil palm plant based also on at least one of the level of glyceraldehyde-3-phosphate dehydrogenase being lower, the level of fructose-1,6-bisphosphate aldolase being higher, the level of pyruvate kinase being higher, and the level of aconitase being higher for the parental oil palm plant in comparison to the reference oil palm plant, to obtain the high-yielding oil palm plant.

5. The method of claim 4, wherein the selecting is based on all four of the level of glyceraldehyde-3-phosphate dehydrogenase being lower, the level of fructose-1,6-bisphosphate aldolase being higher, the level of pyruvate kinase being higher, and the level of aconitase being higher.

6. The method of any of claims 1 to 5, wherein the triose-phosphate isomerase of the parental oil palm plant comprises a cytosolic isoform comprising SEQ ID NO: 1 or a plastidial isoform comprising SEQ ID NO: 2, and the glycerol-3-phosphate dehydrogenase of the parental oil palm plant comprises a plastidial isoform comprising SEQ ID NO: 3.

~~7. The method of any of claims 1 to 6, wherein the selecting is based on the level of triose-phosphate isomerase in the mesocarp tissue of the fruit of the parental oil palm plant 14 to 19 weeks after pollination thereof being lower in comparison to the mesocarp tissue of the fruit of the reference oil palm plant 14 to 19 weeks after pollination thereof.~~

~~8. The method of any of claims 1 to 7, wherein the selecting is based on the level of glycerol-3-phosphate dehydrogenase in the mesocarp tissue of the fruit of the parental oil palm plant 14 to 19 weeks after pollination thereof being higher in comparison to the mesocarp tissue of the fruit of the reference oil palm plant 14 to 19 weeks after pollination thereof.~~

~~9~~7. The method of any of claims 1 to ~~8~~6, wherein at least one of the levels is determined by a technique selected from the group consisting of an in vitro assay, two-dimensional fluorescence difference gel electrophoresis, antibody-based detection, immunoblot detection, dot-blot detection, liquid chromatography-mass spectrometry, an

enzyme activity assay, reverse transcriptase polymerase chain reaction, RNA-seq, hybridization, and microarray.

~~10~~8. The method of any of claims 1 to ~~9~~7, wherein:

the parental oil palm plant is a *dura* breeding stock plant;

the progeny comprises an oil palm plant selected from the group consisting of a *dura* breeding stock plant and a *tenera* agricultural production plant; and

the high-yielding oil palm plant is selected from the group consisting of a *dura* breeding stock plant and a *tenera* agricultural production plant.

~~11~~9. The method of any of claims 1 to ~~9~~7, wherein:

the parental oil palm plant is a *tenera* breeding stock plant;

the progeny comprises an oil palm plant selected from the group consisting of a *tenera* breeding stock plant, a *pisifera* breeding stock plant, and a *tenera* agricultural production plant; and

the high-yielding oil palm plant is selected from the group consisting of a *tenera* breeding stock plant and a *tenera* agricultural production plant.

~~12~~10. A method for obtaining palm oil from a high-yielding oil palm plant comprising:

(i) obtaining the high-yielding oil palm plant by the method of any of claims 1 to ~~11~~9; and

(ii) isolating palm oil from a fruit of the high-yielding oil palm plant.

~~13~~11. A method for predicting oil yield of a test oil palm plant comprising:

(i) determining the level of triose-phosphate isomerase and the level of glycerol-3-phosphate dehydrogenase in mesocarp tissue of a fruit of a test oil palm plant ~~11~~14 to ~~21~~19 weeks after pollination thereof in comparison to mesocarp tissue of a fruit of a reference oil palm plant ~~11~~14 to ~~21~~19 weeks after pollination thereof; and

(ii) predicting oil yield of the test oil palm plant based on the level of triose-phosphate isomerase being lower and the level of glycerol-3-phosphate dehydrogenase being higher for the test oil palm plant in comparison to the reference oil palm plant.

~~14~~12. The method of claim ~~13~~11, further comprising:

(i) determining at least one of the level of malate dehydrogenase and the level of ATP citrate lyase in the mesocarp tissue of the fruit of the test oil palm plant 11 to 21 weeks after pollination thereof in comparison to the mesocarp tissue of the fruit of the reference oil palm plant 11 to 21 weeks after pollination thereof; and

(ii) predicting oil yield of the test oil palm plant based also on at least one of the level of malate dehydrogenase being higher and the level of ATP citrate lyase being higher for the test oil palm plant in comparison to the reference oil palm plant.

~~15~~13. The method of claim ~~14~~12, wherein the predicting is based both the level of malate dehydrogenase being higher and the level of ATP citrate lyase being higher.

~~16~~14. The method of claim ~~13~~11, ~~14~~12, or ~~15~~13, further comprising:

(i) determining at least one of the level of glyceraldehyde-3-phosphate dehydrogenase, the level of fructose-1,6-bisphosphate aldolase, the level of pyruvate kinase, and the level of aconitase in the mesocarp tissue of the fruit of the test oil palm plant 11 to 21 weeks after pollination thereof in comparison to the mesocarp tissue of the fruit of the reference oil palm plant 11 to 21 weeks after pollination thereof; and

(ii) predicting oil yield of the test oil palm plant based also on at least one of the level of glyceraldehyde-3-phosphate dehydrogenase being lower, the level of fructose-1,6-bisphosphate aldolase being higher, the level of pyruvate kinase being higher, and the level of aconitase being higher for the test oil palm plant in comparison to the reference oil palm plant.

~~17~~15. The method of claim ~~16~~14, wherein the predicting is based on all four of the level of glyceraldehyde-3-phosphate dehydrogenase being lower, the level of fructose-1,6-bisphosphate aldolase being higher, the level of pyruvate kinase being higher, and the level of aconitase being higher.

~~18~~16. The method of any of claims ~~13~~ 11 to ~~17~~15, wherein the triose-phosphate isomerase of the test oil palm plant comprises a cytosolic isoform comprising SEQ ID NO: 1 or a plastidial isoform comprising SEQ ID NO: 2, and the glycerol-3-phosphate dehydrogenase of the test oil palm plant comprises a plastidial isoform comprising SEQ ID NO: 3.

~~19. The method of any of claims 13 to 18, wherein the predicting is based on the level of triose-phosphate isomerase in the mesocarp tissue of the fruit of the test oil palm plant 14 to 19 weeks after pollination thereof being lower in comparison to the mesocarp tissue of the fruit of the reference oil palm plant 14 to 19 weeks after pollination thereof.~~

~~20. The method of any of claims 13 to 19, wherein the predicting is based on the level of glycerol-3-phosphate dehydrogenase in the mesocarp tissue of the fruit of the test oil palm plant 14 to 19 weeks after pollination thereof being higher in comparison to the mesocarp tissue of the fruit of the reference oil palm plant 14 to 19 weeks after pollination thereof.~~

~~21~~17. The method of any of claims ~~13~~ 11 to ~~20~~16, wherein at least one of the levels is determined by a technique selected from the group consisting of an in vitro assay, two-dimensional fluorescence difference gel electrophoresis, antibody-based detection, immunoblot detection, dot-blot detection, liquid chromatography-mass spectrometry, an enzyme activity assay, reverse transcriptase polymerase chain reaction, RNA-seq, hybridization, and microarray.

~~22. A kit for increasing oil yield of an oil palm plant or predicting oil yield of a test oil palm plant comprising:~~

~~an antibody for detection of triose-phosphate isomerase;~~

~~an antibody for detection of glycerol-3-phosphate dehydrogenase; and~~

~~an extract of a mesocarp tissue of a fruit of a reference oil palm plant.~~

~~23. The kit of claim 22, wherein the triose-phosphate isomerase comprises a cytosolic isoform comprising SEQ ID NO: 1 or a plastidial isoform comprising SEQ ID NO: 2, and~~

~~the glycerol-3-phosphate dehydrogenase comprises a plastidial isoform comprising SEQ ID NO: 3.~~

~~24. The kit of claim 22 or 23, wherein the kit further comprises instructions indicating use of the antibodies for:~~

~~(i) determining the level of triose-phosphate isomerase and the level of glycerol-3-phosphate dehydrogenase in mesocarp tissue of a fruit of a parental or test oil palm plant 11 to 21 weeks after pollination thereof in comparison to the extract; and~~

~~(ii) selecting progeny of the parental oil palm plant or predicting oil yield of the test oil palm plant based on the level of triose-phosphate isomerase being lower and the level of glycerol-3-phosphate dehydrogenase being higher for the parental or test oil palm plant in comparison to the reference oil palm plant.~~