Proliferation of oil palm (*Elaeis guineensis* Jacq.) Somatic embryos as affected by plant growth regulators

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Abstract

Due to its high commercial value, existing protocols of in vitro propagation of oil palm (Elaeis guineensis Jacq.) cannot be easily accessed. We have been trying to find a protocol of in vitro propagation of oil palm. Embryogenic callus induction and somatic embryo proliferation have been achieved but still need to be optimized. This research aimed to investigate effects of (1) 2,4-D, picloram, dicamba and kinetin on induction of embryogenic callus and (2) dicamba and kinetin on proliferation of somatic embryos. Three sets of treatments were arranged to answer the objectives. In Experiment I, callus was treated with 1 mg/l 2,4-D + 0,2 mg/l kinetin, 2 mg/l 2,4-D + 0,2 mg/l kinetin, 1 mg/l 2,4-D + 0,2 mg/l picloram + 0,2 mg/l kinetin, and 2 mg/l 2,4-D + 0,2 mg/l picloram + 0,2 mg/l kinetin. In Experiment II, callus was subjected to treatments 1 mg/l dicamba, 2mg/l dicamba, 3 mg/l dicamba, 1 mg/l dicamba + 0.1 mg/l kinetin, 2 mg/l dicamba + 0.1 mg/l kinetin, and 3 mg/l dicamba + 0.1 mg/l kinetin. In Experiment III, embryogenic callus was treated with 1 mg/l dicamba, 2 mg/l dicamba, 3 mg/l dicamba, 1 mg/l dicamba + 0.2 mg/l kinetin, 2 mg/l dicamba + 0.2 mg/l kinetin, and 3 mg/l dicamba + 0.2 mg/l kinetin. All the experiments used a control treatment we previously showed to be effective for induction and proliferation of embryogenic callus. Result of the Experimen I showed that mixture of 2,4-D, picloram, and kinetin was effective for induction of embryogenic callus but less effective than the control treatment. In Experiment II, 3 mg/l dicamba was effective for induction of embryogenic callus, but less effective compared to the control treatment. In Experiment III, 1 mg/l dicamba + 0.2 mg/l kinetin was found to be as effective as the control treatment.

Key Words: Eembryogenesis, dicamba, kinetin, 2,4-D, picloram.

Introduction

In vitro clonal propagation of oil palm (Elaeis guineensis Jacq.) via somatic embryogenesis has been established and practiced by several plantation companies to produce clonal seedlings. However, since its commercial value is very high, protocol of in vitro clonal propagation cannot be easily accessed. We have been conducting research on somatic embryogenesis of oil palm which basically consists of five stages i.e. callus induction, embryogenic callus induction, somatic embryo induction and proliferation, somatic embryo germination and acclimatization. Embryogenic callus induction and somatic embryo proliferation have been achieved but still need to be optimized.

This research aimed to investigate effects of (1) 2,4-D, picloram, dicamba and kinetin on induction of embryogenic callus and (2) dicamba and kinetin on proliferation of somatic embryos.

Materials and Methods

Embryogenic Callus Induction

The following treatments were tested for embryogenic callus induction
Experiment I:
(1) 1 mg/l 2,4-D + 0,2 mg/l kinetin, (2) 2 mg/l 2,4-D + 0,2 mg/l kinetin, (3) 1 mg/l 2,4-D + 0,2 mg/l picloram + 0,2 mg/l kinetin, or (4) 2 mg/l 2,4-D + 0,2 mg/l picloram + 0,2 mg/l kinetin.
Experiment II
(1) 1 mg/l dicamba, (2) 2mg/l dicamba, (3) 3 mg/l dicamba, (4) 1 mg/l dicamba + 0.1 mg/l kinetin, (5) 2 mg/l dicamba + 0.1 mg/l kinetin, and (5) 3 mg/l dicamba + 0.1 mg/l kinetin.
Efffects of the treatments were compared to that of the control treatment we previously demonstrated to be effective for callus induction.

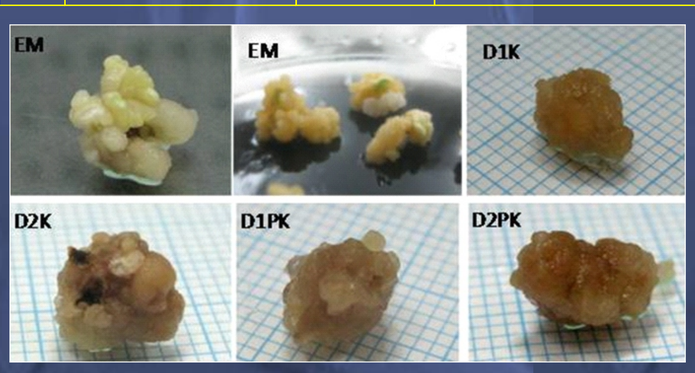
Somatic embryo proliferation

The following treatments were tested for somatic embryo proliferation
Experiment III:
(1) 1 mg/l dicamba, (2) 2 mg/l dicamba, (3) 3 mg/l dicamba, (4) 1 mg/l dicamba + 0.1 mg/l kinetin, (5) 2 mg/l dicamba + 0.1 mg/l kinetin, or (6) 3 mg/l dicamba + 0.1 mg/l kinetin
Effects of the treatments were compared to that of the control treatment we previously demonstrated to be effective for somatic embryo proliferation.

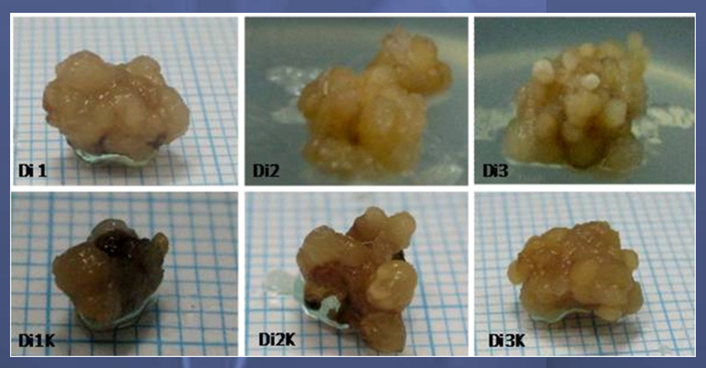
Results

Effects of 2,4-D, kinetin and picloram on the formation of embryogenic callus on primary callus of oil palm (Elaeis guineensis Jacq.) cultured in vitro.

No.	Treatments	Embryogenicity	Description
1	1 mg/l 2,4-D + 0,2 mg/l kinetin	-	Partly compact and slimy, yellow and brownish white.
2	2 mg/l 2,4-D + 0,2 mg/l kinetin	-	Partly compact and slimy, yellow and brownish white.
3	1 mg/l 2,4-D + 0,2 mg/l picloram + 0,2 mg/l kinetin	+	Mostly compact,yellow and brownish white
4	2 mg/l 2,4-D + 0,2 mg/l picloram + 0,2 mg/l kinetin	+	Mostly compact, yellow and brownish white
5	Control treatment	+++	Compact, yellowish white



Appearance of callus of oil palm (Elaeis guineensis Jacq.) as affected by 2,4-D, picloram, and kinetin. EM = control treatment. D1K = 1 mg/l 2,4-D + 0,2 mg/l kinetin, D2K = 2 mg/l 2,4-D + 0,2 mg/l kinetin, D1PK = 1 mg/l 2,4-D + 0,2 mg/l picloram + 0,2 mg/l kinetin, D2PK =2 mg/l 2,4-D + 0,2 mg/l picloram + 0,2 mg/l kinetin.



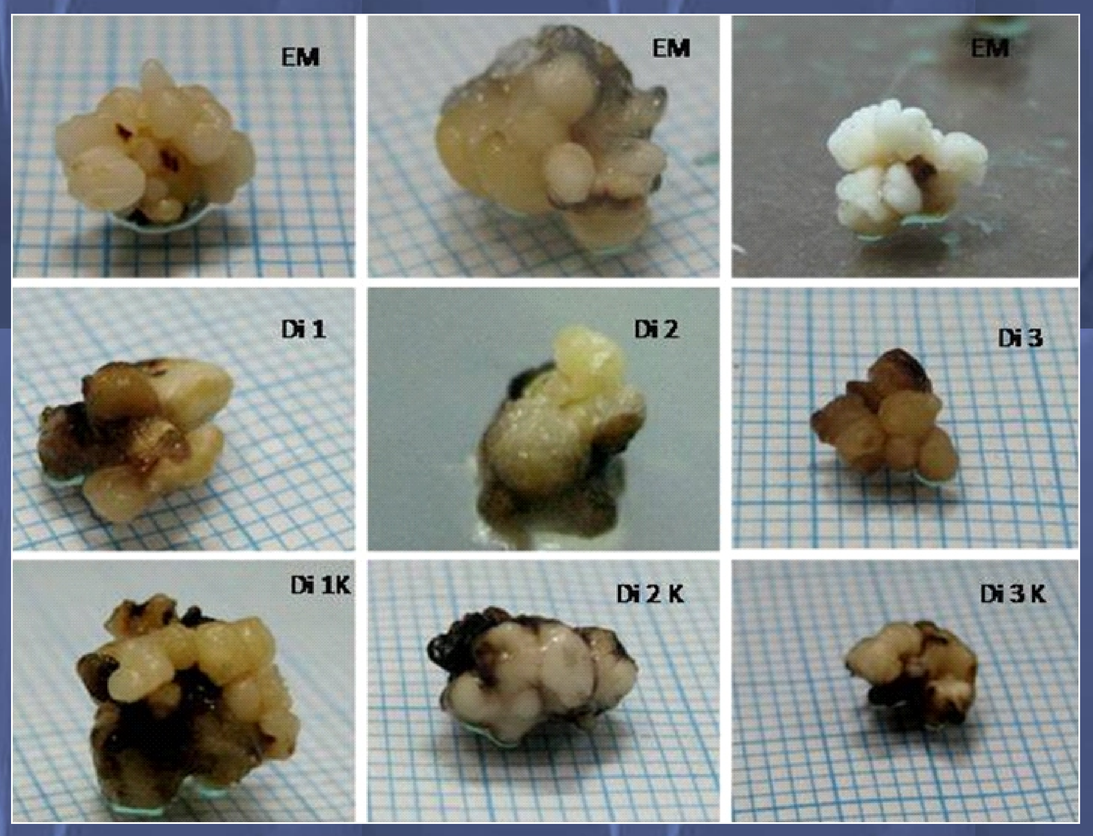
Appearance of callus of oil palm (Elaeis guineensis Jacq.) as affected by dicamba and kinetin. Di1 = 1 mg/l dicamba, Di2 = 2 mg/l dicamba, Di3 = 3 mg/l dicamba, Di1K = 1 mg/l dicamba + 0.1 mg/l kinetin, Di2K = 2 mg/l dicamba + 0.1 mg/l kinetin, Di3K = 3 mg/l dicamba + 0.1 mg/l kinetin.

Effects of dicamba and kinetin on the formation of embryogenic callus on primary callus of oil palm (Elaeis guineensis Jacq.) cultured in vitro.

No.	Treatments	Embryogenicity	Description
1	1 mg/l dicamba	+	Mostly compact, yellow and brownish white
2	2 mg/l dicamba	+	Mostly compact, yellow and brownish white.
3	3 mg/l dicamba	++	Mostly compact, yellow and brownish white, globular embryo-like structure
4	1 mg/l dicamba + 0.1 mg/l kinetin	+	Mostly compact, yellow and brownish white
5	2 mg/l dicamba + 0.1 mg/l kinetin	+	Mostly compact, yellow and brownish white
6	3 mg/l dicamba + 0.1 mg/l kinetin	+	Mostly compact, yellow and brownish white

Effects of dicamba and kinetin on proliferation of somatic embryos of oil palm (Elaeis guineensis Jacq.) cultured for six weeks in vitro.

No.	Treatments	Description
1	1 mg/l dicamba,	No somatic embryo proliferation was detected
2	2 mg/l dicamba	No somatic embryo proliferation was detected
3	3 mg/l dicamba	No somatic embryo proliferation was detected
4	1 mg/l dicamba + 0.1 mg/l kinetin	Somatic embryo proliferation was detected
5	2 mg/l dicamba + 0.1 mg/l kinetin	No somatic embryo proliferation was detected
6	3 mg/l dicamba + 0.1 mg/l kinetin	No somatic embryo proliferation was detected
7	Control treatment	Somatic embryo proliferation was detected



In vitro proliferation of somatic embryo of oil palm (Elaeis guineensis Jacq.) as affected by dicamba and kinetin. EM = control treatment, Di1 = 1 mg/l dicamba, Di2 = 2 mg/l dicamba, Di3 = 3 mg/l dicamba, Di1K = 1 mg/l dicamba + 0.1 mg/l kinetin, Di2K = 2 mg/l dicamba + 0.1 mg/l kinetin, Di3K = 3 mg/l dicamba + 0.1 mg/l kinetin.

Conclusions

This present experiment demonstrated that a critical step in in vitro propagation of oil palm, i.e. proliferation of somatic embryos, has been achieved even though optimization still needs to be done. Dicamba was found to be effective to induce embryogenic callus formation, and together with kinetin it was effective to promote somatic embryo proliferation. The next step would be to do research on factors affecting somatic embryo germination.

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LEMBAR PENGESAHAN

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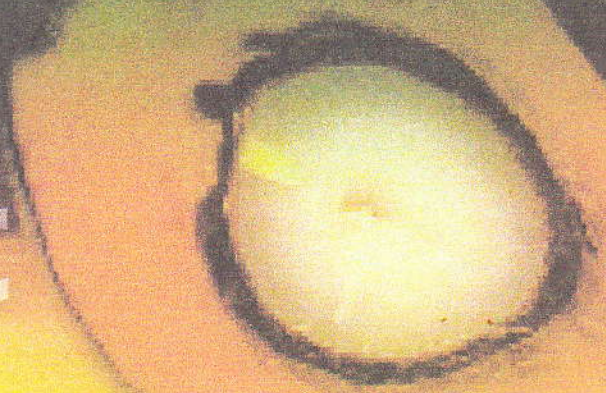

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