POSTER

Proceedings of
The 3rd Annual International Conference Syiah Kuala University (AIC Unsyiah) 2013
In conjunction with
The 2nd International Conference on Multidisciplinary Research (ICMR) 2013
October 2-4, 2013, Banda Aceh, Indonesia

Growth and proline content of potato *Solanum tuberosum* L. in vitro candidate tolerant to drought of origin callus

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Abstract.Screening of candidate tolerant potato (*Solanum tuberosum* L.) to drought *in vitro* from callus was aimed to determine the growth and proline content of potato plants. This research was conducted at the Laboratory of Tissue Culture of Dinas Pertanian of North Sumatra Province, Jl Karya Jasa No 6 Gedung Johor Medan, in May 2012 until May 2013. The initial research was callus formation followed by organogenesis. Then, was treated by PEG, 1000, 2000 and 3000 ppm. The result indicated that increased concentration of PEG decreased the amount of leaves and number of internodes. The higher the PEG concentration, the higher the proline content of potato *in vitro*.

Keywords: growth, drought stress, proline.

Introduction

Potatoes were one of the alternative commodities that support government programs for food security. In recent years, the need for potatoes was likely to increase and this plant was one of the priority commodity development. Potatoes in Indonesia was used as a source of carbohydrate in the food diversification program. Polyethylene Glycol (PEG) was reported able to hold water so that it becomes not available to plants. The amount of PEG solution to hold water depends on the molecular weight and concentration (Mexal et al., 1975), it is soluble in water, not toxic to plants, and is not easily absorbed making PEG as an effective compound to simulate drought conditions (Mullahey et al., 1996, Dami & Hughes, 1997, Kaur et al. 1998). Selection methods were developed with a solution of PEG to identify potato plants respond to drought stress *in vitro*, thus might also consistent *ex vitro*. Callus is a mass proliferation of undifferentiated tissue, cell mass is formed around the surface of the wedge so that the surface area explant slices the quicker and the more forms the potential to generate a lot of plants with a variety of new variants.

Materials and Methods

The experiment was conducted at the Tissue Culture Laboratory Unit Laboratorium Kultur Jaringan UPT/Balai Benih Induk Hortikultura Dinas Pertanian of North Sumatra, Karya Jasa St No. 6 Gedung Johor Medan in May 2012 to May 2013. This study used the basic media of

Murashige and Skoog (MS). The study uses CRD (completely randomized design) non factorial with PEG treatment of 3 level which repeated 3 times, namely: PEG 1 = 1000 ppm, PEG 2 = 2000 and PEG 3= 3000 ppm. Granola potato explants of callus origin obtained of Dinas Pertanian Provinsi Sumatera Utara. Explants were obtained then planted on liquid MS medium with the addition of PEG 6000 at a concentration of 1000 ppm, 2000ppm and 3000 ppm. The parameters observed at the end of the study were number of Leaf, number of Internodes and Proline content. Analysiys of proline following the procedures of Laboratory of Indonesian Biotechnology Research Institute for Estate Crops-Bogor**.**

Results and Discussion

In many literatures, physiological aspects of water stress, lower cell growth and synthesis of cell wall, protein synthesis, nitrate reductase level, stomatal opening, C02 assimilation but higher in abscisic acid, proline accumulation and sugar accumulation.

The Number of Leaf. Table 1 shows that the higher concentration of PEG averages number of leaves getting smaller.

Table 1. Number Leaf of *Solanum tuberosum* L. *in vitro* at the ages of Two Weeks with Treatment of PEG

Treatment (ppm)	Average
PEG 1000	6.96[a]
PEG 2000	6.53[a]
PEG 3000	5.46[a]

Note: number followed with small letter,not significant (α .05)

The Number of Internodes. Table 2 shows that the higher concentration of PEG the lower number of internodes obtained.

Table 2. Number Internodes of *Solanum tuberosum* L. *in vitro* at the Ages of Two Weeks with Treatment of PEG

Treatment (ppm)	Average
PEG 1000	3.30[a]
PEG 2000	3.20[a]
PEG 3000	2.56[a]

Note: number followed with small letter, not significant (α .05)

***Proline*.** In contrast to the number of leaves and number of internodes, Table 3 shows that the higher concentration of PEG, the higher proline content in potato plants *in vitro*.

Table 3. Proline Content of *Solanum tuberosum* L. *in vitro* (uM/g*)* at the Ages of Two Weeks with Treatment of PEG

Treatment (ppm)	Average
PEG 1000	139.14[a]
PEG 2000	331.88[a]
PEG 3000	810.65[a]

Note: number followed with small letter, not significant (α .05)

Conclusion

Increasing the concentration of PEG reduce number of Leaves and number of Internodes. The higher PEG concentration the higher proline content. Suggestions. Drought Tolerant (*in vitro)* needs to be evaluated in physiological and biochemical character and molecular testing. The higher the PEG concentration, the higher the proline content of potato *in vitro*.

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Appendix 1. Number Leaf of *Solanum tuberosum*, L i*n vitro* at the ages of Two Weeks with Treatment of PEG

Treatment (ppm)	Replication			Average
	I	II	III	
PEG 1000	7.6	7.3	6.0	6.96
PEG 2000	6.5	7.3	5.8	6.53
PEG 3000	5.8	6.0	4.6	5.46

Appendix 2. Number Internodes of *Solanum tuberosum*, L i*n vitro* at the Ages of Two Weeks *in vitro* with Treatment of PEG

Treatment (ppm)	Replication			Average
	I	II	III	

PEG 1000	3.5	3.1	3.3	3.30
PEG 2000	3.5	2.8	3.3	3.20
PEG 3000	2.3	2.3	3.1	2.56

Appendix 3. Proline Content of *Solanum tuberosum*, L (uM/g*) in vitro* at the Ages of Two Weeks with Treatment of PEG

Treatment (ppm)	Replication			Average
	I	II	III	
PEG 1000	88.05	140.74	188.64	139.14
PEG 2000	262.01	360.52	373.12	331.88
PEG 3000	383.51	597.35	1451.10	810.65

Appendix 4. Chart of Experiment