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The effect of sugar and different growth regulators on the tuberization of potato (*Solanum tuberosum* L. cv. Desiree)

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Abstract: The sprouts of potato variety *Solanum tuberosum* L. cv. Desiree were used as explants to regenerate *in vitro* plantlets. The best regenerated shoots were treated for their growth in sugar solution with different concentration (2.5, 5, 10 & 12 g/L) in MS Medium with 0 and 2 mg/L Benzyl amino Purine (BAP) concentration to examine tuber induction during 1st, 2nd and 3rd week. The results regarding number of tubers, the highest number of tubers were recorded in media containing 2 mg BAP+10.0 g and 12.0 g sugar concentration, *i.e.*, 8.66 and 9.00 tubers per plant and tuber weight in this study indicated that the highest weight of tubers were in the media containing 2 mg BAP+10.0 g and 12.0 g sugar concentration produced tubers of 94.80 and 91.73 mg/plant, respectively.

Keywords: *Solanum tuberosum*, Benzyl amino purine, tuberization, sugar and Desiree.

1. INTRODUCTION

The potato (*Solanum tuberosum* L.) is a common man vegetable as well as major economic crop worldwide. It is cultivated after wheat, maize and rice food crops. It is the most valuable dicotyledonous tubers crop (Jones, 1994). In Pakistan, potato growers produce about 2083 thousand tons in 2000-10 (Khaliq-uz-Zaman, 2011). It is propagated asexually by tubers. It is the conventional method of vegetative propagation and potatoes are usually affected by pathogens, which reduced the yields as well as quality. Nowadays lot of attention has been focused on the virus-free potatoes production through *in vitro* condition (Mellor and Stace–Smith, 1977). Usually meristem culture carried out in combination with heat and chemical treatments, which is useful to produce virus-free stocks (Wang and Hu, 1985). The *in vitro* micropropagation methods are very important for rapid distribution and maintenances of existing cultivars. It is used to produce new breeding lines for germplasm storage and transport. Potter and Jones (1991) reported that the molecular analysis of stored plantlets showed genetically stable plantlets produced by *in vitro* techniques. Another approach for micropropagation of potatoes is the *in vitro* induction of microtubers. Tovar *et al.*, (1985) and Abbott and Belcher (1986) have carried out the considerable research on microtubers while their use on commercial basis in the potato industry has been rarely formulated by Wang and Hu (1982). However, the cost of producing microtubers is relatively higher than *in vitro* plantlets and it has restrained the use only for gene resources preservation (Daesang Hi-Dea, 1998).

The aim of this study is to evaluate the factors controlling the tuberization process for the development of rapid and cost effective methods of producing microtubers on large scale basis.

2. MATERIAL AND METHODS

An *in vitro* study was conducted to examine the factors effecting optimum tuberization. The experiment was conducted in the tissue culture laboratory, Department of Biotechnology, Sindh Agriculture University, Tandojam. An experiment was conducted by growing tubers of potato cultivar "Desiree". The potato tubers of this cultivar were obtained from Horticulture Research Institute Mirpurkhas.

Potato tubers conserved at 9-11^{o}C, furnished the sprouts with distinct nodes and internodes in about two months dissected segments of sprouts (nodes and internodes) were used as the experimental plant material. The explants were initially washed in running tape water and the shoot tips were disinfected by a quick dip in 70% ethanol followed by emersion in 10% sodium hydroxide (NaOCl) plus 2-3 drops of tween-20 per 100 ml for 10 minutes. Tween-20 was added to break the surface tension of water.

The sprouts were washed three times in sterile distilled water to remove any traces disinfectant under aseptic condition using sterilized laminar air flow cabinet. The culture was done in glass jars containing solid full strength MS medium (Murashige and Skoog, 1962), vitamins and different concentrations of growth

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regulator and sugar. The culture condition for growth of sprouts was a temperature of 25-27°C, a photoperiod of 8 hours per day and a light intensity of 1000 lux. The photoperiod was maintained by an automatic timer system.

The parameters were investigated such as, number of tubers/plant and weight of tubers/plant during 1st, 2nd and 3rd week.

3. RESULTS AND DISSCUSSION

In case of number of tubers, the highest number of tubers was recorded in media containing 2 mg BAP+10.0 g and 12.0 g sugar concentration, *i*.e., 8.66 and 9.00 tubers per plant, respectively. Sugar is basic energy and carbon source will definitely enhance tuberization and weight of tubers and the optimum sugar concentration for higher rate of tuberization.

Table-1: Mean number of tubers per plant in media containing different BAP and sugar concentrations

Media	Sugar concentration (g/L)	Weeks			Average
		1st	2nd	3rd	
MS + 0 mg/L BAP	02.5	-	-	-	-
	05.0	-	-	-	-
	10.0	-	5.00	05.00	3.33
	12.0	-	3.00	05.00	2.66
MS + 2 mg/L BAP	02.5	-	-	03.00	1.00
	05.0	-	5.00	07.00	4.00
	10.0	7.00	9.00	10.00	8.66
	12.0	7.00	9.00	11.00	9.00

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Table-2: Weight of tubers (mg) per plant in media containing different BAP and sugar concentrations

Media	Sugar concentration (g/L)	Weeks			Average
		1st	2nd	3rd	
MS + 0 mg/L BAP	02.5	-	-	-	-
	05.0	-	-	-	-
	10.0	-	66.40	69.10	45.16
	12.0	-	65.60	68.66	44.75
MS + 2 mg/L BAP	02.5	-	-	71.12	23.70
	05.0	-	77.12	79.39	52.17
	10.0	91.4	94.10	98.90	94.80
	12.0	89.0	91.30	94.89	91.73

The above results are in agreement with Sawicka (2000), who used growth regulators at 10 mg/L by spraying seed tubers before planting and found that both growth regulators increased tuber yields; while in a similar study, Al-Abdallat and Suwwan (2002) investigated the microtuberization of potato cv. Spunta and reported that 6% sucrose level recorded the highest microtuber number per shoot and microtuber weight per shoot (Mw). Tábori and Dobránszki (2002) reported that the increase in explant size resulted in the increase in the number of microtubers with large diameter (up to 16 mm) and in the average fresh weight of tubers. The results suggested that explants with two nodes should be used to produce microtubers with high average fresh weight (250 mg) and to increase the number of large microtubers (79% was larger than 6 mm and 53% was larger than 8 mm); while Tariq, *et al.* (2004).

In the present study results of tuber weight indicated that the highest weight of tubers was in the media containing 2 mg BAP+10.0 g and 12.0 g sugar concentration produced tubers of 94.80 and 91.73 mg per plant, respectively. It is due to optimum sugar concentration for higher rate of tuberization. These results are partially supported by the findings of Al-Abdallat and Suwwan (2002), who investigated the microtuberization of potato cv. Spunta and reported that 6% sucrose level recorded the highest microtuber number and microtuber weight, while Magyar-Tábori and Dobránszki (2002) found increased number of microtubers with large diameter (up to 16 mm) and in the average fresh weight of tubers. Similarly, Zhang *et al*. (2005) investigated the effect of BA and IBA on the formation of micro tubers of potato and reported that growth regulators improved the yield of potato micro-tubers, with 3 mg BA/L ± 0.05 mg, IBA/L, 3 mg BA/L + 3 mg IBA/L and 1 mg BA/L + 0 mg IBA/L as the most optimum concentration of BA and IBA for micro tubers.

4. CONLUSION

The highest weight of tubers was in the medium containing 2 mg BAP+10.0 g and 12.0 g sugar concentration produced tubers of 94.80 and 91.73 mg per plant, respectively. It is due to optimum sugar concentration for higher rate of tuberization. Most of the results reported from different parts of the world on aspects embodied in present study, were in agreement with the findings of the author irrespective of the locations and conditions of research. However, this area of research has no end and continuation of studies is suggestible for knowing certain effects of growth regulators and sugar contents on *in vitro* micro tuberization in potato.

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