THE EFFECT OF LIGHT ON \textit{in vitro} MICROTUBERIZATION OF POTATO CULTIVARS

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Abstract

The effect of an 8 h light/day or total darkness photoperiod on the \textit{in vitro} microtuberization of cultivars "Red Pontiac," "Shepody," "Kennebec" and "Yukon Gold" was investigated using a medium consisting of Murashige and Skoog salts, vitamins, high sucrose and high benzylamino purine levels and cultured at 16\degree C for 12 weeks. Percent tuberization of the single-node leaf cuttings averaged over all 4 cultivars was initially lower, with the 8 h photoperiod at 4 weeks, but later was similar to the total darkness photoperiod at 8 and 12 weeks. Microtubers from all cultivars had a higher mean fresh weight when treated with an 8 h photoperiod as compared with total darkness, though the difference was not significant with "Yukon Gold." "Red Pontiac" and "Shepody" produced microtubers that were well over twice the fresh weight of those produced in the total darkness treatment. Delayed leaf senescence, microtuber greening, and nodal rooting were evident with the 8 h light treatment.

Introduction

Potato microtubers produced \textit{in vitro} can be used as a source of germplasm for conservation, transfer between countries, and seed certification schemes. Larger microtubers withstand adverse planting conditions and produce more vigorous plantlets in the succeeding generation than smaller microtubers (8). Photoperiod plays an important role in the tuberization process (2) and should be optimized in order to enhance tuber size. The focus of this study was to determine the effect of different photoperiods on \textit{in vitro} microtuberization of four potato cultivars.

Incubation of tissue cultured potato explants in total darkness is commonly used for microtuber propagation. Several studies, however, have indicated that significant improvements in percent tuberization can be achieved by introducing a light cycle during the incubation period (4, 6, 7). In the present study, \textit{in vitro} microtuber yields, number and size, from an 8 h light/day photoperiod and a total dark cycle were compared. It is difficult to define optimum microtuberization conditions by reviewing previ-

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Accepted for publication September 11, 1989

ADDITONAL KEY WORDS: Photoperiod, tuberization, microtubers.
ous experiments because of the use of different cultivars, types of potato explant tissue, environmental conditions, and concentrations of exogenous plant growth regulators. Investigations must therefore focus on the cultivars of greatest importance in a particular geographic area in order to determine the optimum cultural parameters (6). The four cultivars used in this study were chosen for their relevance to the Canadian potato industry.

Materials and Methods

"Virus-free" potato stock plants of the cultivars "Red Pontiac," "Yukon Gold," "Kennebec," and "Shepody" were multiplied by subculturing single-node leaf cuttings on Murashige and Skoog (MS) medium (3) with 30.0 g/l sucrose. Single-node leaf cuttings from this stock material were placed on "tuberization" medium consisting of MS salts and vitamins, 80 g/l sucrose, and 10 mg/l benzylamino purine (BAP) (6). Eighty test tubes of each cultivar containing one single node cutting and capped with Magenta 2-way caps (Magenta Corp., Chicago, IL), were then exposed to either total darkness or 8 h of light/day at 73-83 ME PAR. The "total darkness" treatment was maintained by wrapping the racks of tubes in black plastic bags. The plastic was removed for 8-10 hours once every week during the dark period of the light treatment to allow for air circulation. Temperature rise under the black plastic varied up to a maximum of 1.5°C. The test tube racks were placed in growth chambers (Sherer model CEL 255-b) at 16±2°C, fitted with fluorescent cool-white lights. Data were collected on the number and diameter of microtubers formed at 4, 8, and 12 weeks. Microtubers were harvested at 12 weeks and fresh weight was determined. The experiment was repeated once.

Results and Discussion

Microtuberization data taken at 4 weeks showed that nodal cuttings of all cultivars exposed to the 8 h light/day photoperiod were slower to tuberize than nodal cuttings maintained in total darkness (Table 1). In the total darkness treatment, 47% of the nodal cuttings which produced microtubers had done so by 4 weeks whereas only 20% of those from the 8 h light/day treatment tuberized during the same period, however, by 8 weeks tuberization percentages were similar in both treatments. Ortiz - Montiel and Lozoya-Saldana (4) found a slight delay in tuberization with some cultivar/media combinations in their light/dark regime. In the present study, earlier tuber initiation was not linked to higher mean fresh weights or to higher percent tuberization. Microtubers which were produced in the 8 h light/day treatment were initially slower to form but at 12 weeks had a significantly higher fresh weight than those produced in total darkness (Table 2). When studying the effect on tuberization it is noteworthy to consider