BRIEF COMMUNICATION

Influence of light-induced greening on storage of potato microtubers

P.S. NAIK and D. SARKAR

Division of Genetics & Plant Breeding, Central Potato Research Institute, Shimla - 171001, India

Abstract

The effect of light-induced greening of microtubers on their storage behaviour was studied in 16 genotypes of potato. Greening improved the storage of microtubers in terms of shrinkage, biomass loss and sprout emergence. A significant genotype × treatment interaction for shrinkage was observed.

Additional key words: *in vitro* tuberization, micropropagation, microtuber induction and storage, post harvest, *Solanum tuberosum*.

In India, potato (*Solanum tuberosum* L.) microtubers have been successfully used in basic seed production at the Central Potato Research Institute, Shimla (Singh *et al.* 1994). In practice, the harvested microtubers are treated with fungicide, dried in the dark at 20 °C and stored at 5 °C in a refrigerator. Microtuber loss due to shrinkage and drying is observed during storage (Annual Report 1988). Excessive biomass loss results in deterioration of seed quality and poor sprout emergence (Singh and Naik 1993). The present investigation was undertaken to study the effect of light-induced greening on the storage of potato microtubers.

Sixteen potato genotypes used in this study were received from the pathogen tested *in vitro* collection of the International Potato Centre, Lima, Peru. These included cultivars, advanced breeding lines, true potato seed parental lines, and provided a wide genetic base.

The *in vitro* grown plants of all the genotypes were multiplied through nodal cuttings on semisolid [8 g(agar) dm^{-3}] MS medium (Murashige and Skoog 1962)

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containing 8.39 μM D-calcium pantothenate, 0.29 μM gibberellic acid (GA_3), 0.054 μM 1-naphthaleneacetic acid (NAA) and 3 % saccharose. The cultures were maintained at 26 °C and 16-h photoperiod (photon flux 30 μmol m^{-2} s^{-1}; cool white fluorescent tubes). Microtubers were produced in 250-cm^3 Erlenmeyer flasks in the dark following the method suggested by Wang and Hu (1982). Within 50 d of incubation, 20 - 30 microtubers developed in each culture flask.

The effect of light-induced greening of microtubers was tested against the ungreened control. For greening of microtubers, flasks containing 50-d-old induction cultures were maintained at 20 °C and 16-h photoperiod (30 μmol m^{-2} s^{-1}) for 10 d. The microtubers were harvested, stored in Petri dishes sealed with parafilm and kept at 5 °C in a refrigerator. After 4 months of storage, smooth microtubers (microtubers showing no apparent shrinkage) and biomass loss were recorded. Sprout emergence was studied after incubating the microtubers at 24 °C for one week.

The experiment was conducted in a factorial completely randomized design involving 16 genotypes and 2 treatments. There were 5 replicates for each treatment with single 250-cm^3 culture flask per replicate. The experiment was repeated twice. Before analyses, the data [%] were subjected to arcsine transformation. As the experiment was repeated twice, the homogeneity of error variance from the individual *ANOVA* was tested through *F*-test and the analyses of variance were pooled over time according to the standard procedure. In absence of any significant interaction between time and any of the factors, these terms were pooled over respective errors.

The analysis of variance (Table 1) showed significant variation due to genotype and treatment for smooth microtubers, biomass loss and sprout emergence. Genotype × treatment interaction was significant only for smooth microtubers, suggesting that

Table 1. Pooled analysis of variance of the microtuber storage characteristics [%] after 4 months of storage. The analysis is carried out on the basis of mean values of 5 replications repeated twice. Pooled error (*a*) comprises time and time × genotype terms; pooled error (*b*) comprises time × treatment and time × genotype × treatment terms. ** - significant at $P = 0.01$, * - significant at $P = 0.05$.

	d.f.	Smooth microtubers	Biomass loss	Sprout emergence
Genotype	15	2585.89**	612.30**	1994.80**
Pooled error (*a*)	144	372.81	39.85	446.14
Treatment	1	2146.81**	667.37**	3259.92**
Genotype × treatment	15	437.47*	58.86	248.31
Pooled error (b)	144	221.27	35.52	319.30

the effect of light-induced greening on microtuber shrinkage differed with the genotypes. However, for biomass loss and sprout emergence, the effect of light-induced greening was uniform over the genotypes. Thus light-induced greening significantly improved the recovery of smooth microtubers, reduced the biomass loss, and increased the sprout emergence as compared to the control (Fig. 1).

As to the best of our knowledge, there are no reports on the effect of greening of microtubers on their storage behaviour. Greening of tubers, however, improves keeping quality in potato (Ziglevich 1965). Tubers stored in diffused light perform better in terms of biomass loss and sprouting behaviour (Annual Report 1983, Potts *et al.* 1983, Garg 1987). In present study, the microtubers started greening after 2 d of irradiation and did not lose chlorophyll during subsequent dark storage.

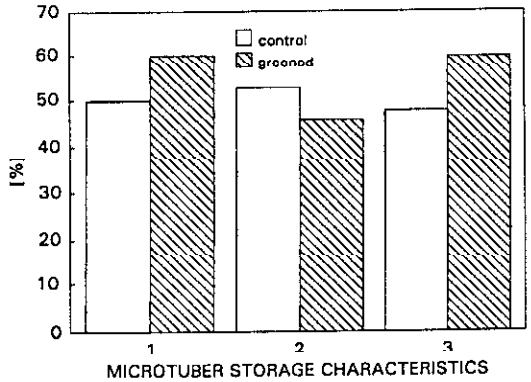

Fig. 1. Effect of light-induced greening on smooth microtubers (*1*), biomass loss (*2*) and sprout emergence (*3*) after 4 months of storage.

The better performance of greened microtubers during storage may be due to: (*1*) the altered endogenous levels of growth promoters and inhibitors, which regulate the tuber growth and dormancy in seed potatoes (Garg 1987, Van der Plas 1987), and (*2*) the accumulation of glycoalkaloids on exposure to light (Baerug 1962, Sukumaran *et al.* 1975); these glycoalkaloids act as antimicrobial agents to protect the microtubers from storage diseases (Allen and Kuc 1968, Thirumalachar and Narasimhan 1970). The growing tuber has a periderm which in part is unsuberized and hence less resistant to water loss than the suberized periderm of the mature tuber (Burton 1989). It appears that microtubers produced *in vitro* have the characteristics of growing tubers and are, therefore, more liable to water loss, particularly immediately after harvest. Probably, greening thickens or suberizes the periderm of microtubers making them more tolerant to evaporative water loss.

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