

Acclimation of in vitro-Propagated Apple Plantlets as Affected by Light Intensity

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Abstract : Environmental control of in vitro-propagated apple plantlets is required for successful acclimation to ex vitro due to its low survival rate. This study aimed to determine the proper lighting condition for ex vitro acclimation of the apple plantlets in plant factories. In vitro-propagated M9 apple plantlets treated with pre-acclimatization for 1 week were exposed to following light treatments for additional 6 weeks; 60 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ (A), 100 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ (B), 140 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ (C), 180 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ (D), 60 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1} \rightarrow 100 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ at 2 weeks (E) or 4 weeks (F), 60 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1} \rightarrow 100 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ at 2 weeks $\rightarrow 140 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ at 4 weeks (G) and 60 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1} \rightarrow 140 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ at 4 weeks (H). Shoot height, total leaf area, soil-plant analysis development (SPAD) value, root length, fresh and dry weights of shoots and roots were measured every 2 weeks after transplanting. In addition, the photosynthetic rate was measured at 5 weeks after transplanting. At 6 weeks after transplanting, shoot height of B was significantly higher than the other treatments. SPAD value, total leaf area and root length of B and F were relatively higher than the other treatments. Root fresh weights of B, D, F, and G were relatively higher than those in the other treatments. D induced the highest value in shoot fresh weight probably due to stem hardening, but it also resulted in shoot damage in the early stage of acclimation. Photosynthetic rate at 5 weeks after the transplanting was significantly increased as the light intensity increased. These results suggest that 100 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ for 6 weeks (B) or gradually increased treatment from 60 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ to 140 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ at 2 weeks interval (F) were the proper lighting conditions for successful acclimation of in vitro-propagated apple plantlets. Acknowledgment: This work was supported by Korea Institute of Planning and Evaluation for Technology in Food, Agriculture, Forestry and Fisheries (IPET) through Agri-Bio industry Technology Development Program, funded by Ministry of Agriculture, Food and Rural Affairs (MAFRA) (315003051SB020).

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