DISSERTATION

PHYSIOLOGICAL STUDIES IN ACCLIMATIZATION OF IN VITRO TOBACCO PLANTLETS

Submitted by

FARIDA SAFADI

Department of Horticulture

In partial fulfillment of the requirements

for the Degree of Doctor of Philosophy

Colorado State University

Fort Collins, Colorado

Spring, 1992

ABSTRACT OF DISSERTATION

PHYSIOLOGICAL STUDIES IN ACCLIMATIZATION OF IN VITRO TOBACCO PLANTLETS

Two acclimatization methods of in vitro tobacco (*Nicotiana tabaccum* 'Wisconsin 38') plantlets (IVP) were studied for their physiological effects upon plantlet response to transplanting: 1) the use of osmotica in rooting medium such as polyethylene glycol (PEG) or salts ($NaCl + CaCl_2$) at different concentrations and durations, and 2) the use of semipermeable closures (SPC) which improves gas permeability of culture vessels.

Concentrations of 1.0%, 2.5%, 5.0%, 10.0% and 15.0% PEG reduced water loss of detached leaves but affected growth adversely especially when above [5%] and 6-day-duration. PEG treatments induced epicuticular wax (EW) build-up and were related to reduced rates of water loss.

Salt treatments reduced water loss at 1.5 and 2.0% over control but caused undesirable growth characteristics.

Leaf diffusive resistance of PEG-treated plants was reduced prior to transplanting and remained lower than that of control. Stomates of IVPs had slower response to reduced humidity and darkness than greenhouse and PEG-treated plants.

The SPC-treated cultures had 2.5 times more evapotranspiration, 2% less relative humidity (RH) and 3 times less medium and plantlet leaf water potential than B-cap-treated cultures.

SPC treatments increased plantlet EW by 35%, reduced water loss by 60%, increased plantlet dry weights, reduced wilting injury and increased initial relative growth rates as compared to B-cap treatments.

Photosynthetic rates of in vitro plantlets were reduced at RH lower than 80-90%. SPC improved photosynthetic rates under desiccating conditions by reducing initial conductance and transpiration. Photosynthetic rates of IVPs from both closure treatments were comparable to those of greenhouse plants at high humidity. Stomates of plantlets from both treatments did not respond to [CO_2] and darkness compared to stomatal responses of greenhouse plants.

Chlorophyll content was increased in the SPC over B-cap plantlets. Better gas exchange of SPC was observed as indicated by CO_2 accumulation.

Although both osmotica and closure treatments reduced moisture loss in detached leaves of IVPs to levels comparable to those of greenhouse plants, the moisture loss curves deviated from normal bi-phasal shape indicating lack of normal stomatal functioning.

Farida el-Safadi
Department of Horticulture
Colorado State University
Fort Collins, CO 80523
Spring, 1992