New technology for pre-cultivation of forest seedlings under LED lamps – modification of light conditions to mitigate light shock stress after transplanting to open land. Marco Hernandez Velasco, Dalarna University, Sweden.

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Forest restoration aims to cope with the increasing demand on forest products, as well as an aid in fighting climate change and compensating for accelerated deforestation. Funded by the European Commission under the Seventh Framework Program (FP7), the Zephyr project aims to introduce a zero-impact incubator for the pre-cultivation of forest regeneration materials. The consortium, involving 14 organizations of 10 different European countries, is developing innovative and cost-efficient technologies that will allow the production of standardized high quality forest seedlings ready to be transplanted. The technologies will be integrated into a functional and transportable unit not affected by the outdoor conditions and producing minimal emissions. To achieve this, the system will be powered mainly by solar energy and will recycle the water used. Specifically developed devices such as wireless sensors and LED lamps will be used to monitor and enhance the cultivation process, reduce the energy consumption and decrease the overall cost due to their high efficiency, long lifetime and low maintenance.

The LED grow lights used have a continuous spectrum that has been selected and specifically tailored to the plants’ needs. Nevertheless, seedlings pre-cultivated under LED lights could face UV stress after transplanting to open land as these wavelengths are not included in the light spectrum used in the growth chamber. Moreover, light intensity levels during indoor cultivation are usually much lower compared to the outdoor conditions, which can cause a light shock to the plants. Juvenile plants are less efficient in the utilization of the absorbed light, and therefore, prone to photooinhibition by radiation fluxes that usually do not harm mature plants. Plant protective mechanisms against UV radiation and high PAR (400-700nm) light intensity are partly overlapping. Hence, exposure to UV or high light intensity before transplanting, or introducing a transient phase by using shading cloths during transplantation period could help to reduce this stress.

The aim was to reduce the transplanting stress of Picea abies and Pinus sylvestris seedlings grown under LED-lamps for the first 5 weeks of cultivation. We investigated how different methods; UV-A pre-treatment or high irradiance during the indoor cultivation or usage of shading cloths for the first week(s) after transplanting outdoors can be used to mitigate light shock stress. Different methods and exposure times showed varying ability in ensuring good seedling growth and survival.