Growth of Ginseng Seedlings Cultivated in a Plant Factory With Artificial Light as Affected by Volume of Cultivation Vessel Using Sub-Irrigation System

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Korean ginseng (Panax ginseng C.A.Meyer), a major medicinal root plant, has not been fully studied for applicability to sub-irrigation system for seedling production comparing to other vegetables. As ideal form of seedling’s roots, the straight, long and pencil-typed roots are desirable, but the cultivation trays or vessels used for commercial seedling production such as pots and plug trays are not thought to be suitable for the ideal growth of seedling’s roots. In this study, therefore, we tested the applicability of polyvinyl chloride (PVC) pipes that have different diameters and heights, in other word, different root volumes with different dimensions as a prototype of vessel for ginseng seedling production. In this experiment, stratified ginseng seeds of ‘Chunpoong’ cultivar were sown into the cylindrical PVC pipes filled with commercial growing medium (Golden Root, Nongkyung Co., Ltd., Korea) and consequently grown for 15 weeks. In the first experiment, seedlings were grown in PVC pipes with six different diameters (ø12, 15, 20, 30, 50, or 75 mm) with a same height (20 cm). In the second experiment, seedlings were grown in PVC pipes with four different heights (15, 20, 25, or 30 cm) with a same diameter (ø 50 mm). The ginseng seedlings were cultivated under PPF of a 130 µmol·m⁻²·s⁻¹ using cool-white LEDs (T5, Parlux, Incheon, Korea) with 10 h photoperiod at averages in air temperature of 23.2°C, and relative humidity of 65.6%. After confirming that the sets of true leaves were fully unfolded, the seedlings were fertigated by sub-irrigation method with irrigation interval of 12 days (20 min/each fertigation) using the ginseng hydroponics nutrient solution (NIHHS, RDA, 2015) having pH of 6.5 and EC of 0.85 dS·m⁻¹. Larger diameter of PVC pipes resulted in the longer shoot and root lengths, thicker root diameter, larger leaf area, and greater shoot and root fresh and dry weights. The greatest root growth of ginseng seedling was found in ø50 mm PVC pipe. Also, higher height of PVC pipe showed the longer shoot and root lengths and greater shoot fresh and dry weights. The greatest root growth of ginseng seedling was found in 25 cm high PVC pipe. Results indicate that providing optimal root volume with a PVC pipe vessel results in the better growth of ginseng seedlings compared to the conventional cell- or flat-type trays, especially when they are cultivated using sub-irrigation system in a plant factory with artificial light.