Summary

The dissertation presents the results of research on the effect of different levels of peat substrate density in the cells of nursery containers on growth of Scots pine (*Pinus sylvestris* L.) and European beech (*Fagus sylvatica* L.) seedlings. The research assumed that the density of the peat substrate would affect the growth of seedlings, and by determining this effect through biometric tests and laboratory analyzes of the content of elements, it will be possible to indicate the density appropriate for growing seedlings with specific parameters. It was assumed that the best parameters reflecting the quality of the seedling will be two synthetic indices, i.e. the shoot-to-root ratio (S/R) and the sturdiness quotient (SQ). For pine seedlings it was assumed that the SQ should not exceed 70, for beech 65 and the S/R should be below 2 for both species. Pine and beech seedlings were grown through one production cycle in a peat substrate at 9 different levels of bulk density. Scots pine seedlings grew in the substrate in the current bulk density range of 0.208 - 0.342 $g \cdot cm^{-3}$ in Hiko V120 SS containers, and beech seedlings in the substrate in the range of 0.196 - 0.317 $g\ cm^{-3}$ in Hiko V265 containers. Each of the 9 variants was prepared in 3 repetitions, a total of 120 seeds were sown for each variant of pine and for each variant of beech 84. After the cultivation period, the number of viable seedlings was determined, the diameter in the root collar and the height of the seedling were measured. In each repetition of the variant, 3 seedlings closest to the average height of the seedlings were selected, which were used for the analysis of the root system. Roots obtained were scanned and, on this basis, the length of roots assigned to three compartments based on their diameter was determined: very fine, fine and skeletal. Leaves from each beech seedling was measured. All parts of the seedlings (assimilation apparatus, shoot, roots) and the substrate were dried, and then weighted. The SQ, which is the proportion of the height of the seedling to the diameter in the root collar, and the S/R, which is the ratio of the dry mass of shoots to the dry mass of roots were calculated. Dried samples of the substrate and plant material (assimilation apparatus, shoots and roots) of both species from each density variant were ground and then their content of: N, S, P, K, Ca and Mg. The research was shown that the compaction of the substrate had a significant effect in the case of pine and beech seedlings on them biometric features. Pine seedlings from all variants met the assumed SQ criterion. Apart from the seedlings from the lowest density, the pine seedlings from the other variants met the assumed S/R criterion. Beech seedlings from all variants did not meet the SQ and only seedlings from lowest variant met the assumed S/R criterion. It was found that compaction affects the content of macroelements in pine and beech seedlings. High density limited the uptake of elements by

seedlings of both species. In the case of pine, both low and high substrate density limited the growth of seedlings. Due to the desired parameters of synthetic indices the number of pine seedlings meeting both criteria was the highest at medium density. The number of fine roots responsible for nutrient uptake was the highest in medium densities, which resulted in the highest allocation of elements. Taking into account the physical and chemical parameters obtained, the current bulk density of the peat substrate from 0.258 $g \cdot cm^{-3}$ to 0.292 $g \cdot cm^{-3}$ turned out to be optimal for the growth of pine seedlings. In the case of beech seedlings, the lowest substrate density allowed for the best root growth of the seedlings, which resulted in higher magnesium and potassium uptake, and this resulted in a better S/R. The lowest density of the peat substrate (0.196 $g \cdot cm^{-3}$ current bulk density) is the best for beech cultivation.

Keywords: nursery container, bulk density, seedling biometrics, seedling quality, seedling root traits, root to shoot ratio, sturdiness quotient, root distribution, fine roots, macronutrients.