A NEW, MORE EFFICIENT METHOD TO EVALUATE ROOT GROWTH POTENTIAL OF PLANTING STOCK USING A ROOT AREA INDEX

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ABSTRACT

Root growth potential (RGP), the ability of seedlings to promptly and abundantly initiate and elongate new roots after transplanting, is an important and useful attribute of planting stock performance. However, it is generally laborious, tedious, and subjective to measure. A method was developed that employs aeroponic culture of seedlings in a root mist chamber (RMC) and measurement of root growth by changes in root area index (RAI) with a TV camera-based microprocessor area measurement system. The area meter scans each horizontal TV line and sums the segments that are traversed by roots. A high resolution camera was used for accurate area measurement of roots. The method consists of:(1) premeasuring RAI of individual seedlings, (2) growing seedlings in the RMC for ca. 2 weeks (depending on species), (3) staining new roots to make them visible to the camera, and (4) remeasuring RAI of individual seedlings.

An experiment was conducted to compare xylem water potential (XWP) of seedlings grown in the RMC with that of seedlings grown in pots of medium and seedlings grown in hydroponic culture. XWP, measured with a pressure chamber, of seedlings grown in the RMC was similar to that in potted seedlings, and increased (became less negative) when new roots were initiated. Seedlings in the RMC initiated new roots 1 week sooner than potted seedlings. XWP in hydroponically grown seedlings steadily decreased and very few new roots were present after 20 days.

A second experiment determined the relationship between root growth quantified by difference in RAI and that quantified by direct measurement of new root number and length. A range in RGP was accomplished by placing groups of 10 jack pine 2-0 seedlings in a forced-air oven (40°C, 30% RH) for 0, 10, 20, 30, and 40 min, then growing them in the RMC for 17 days. Root growth of individual seedlings was evaluated by the RAI method and by counting and visually estimating length of all new roots & 0.5 cm. Linear regression of individual seedling data revealed r^2 values of 0.88 and 0.90 for predicting number of new roots and length of new roots, respectively, from difference in RAI. Eleven seedlings/person/hr were completed using the visual estimation method compared to 32 seedlings/person/hr using the RAI method.

This research documents the accuracy and productivity of the RAI method. Observer subjectivity is nearly eliminated.