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Why seedlings survive: influence of plant attributes

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Abstract Seedling survival and successful forest restoration involves many silvicultural practices. One important aspect of a successful forest restoration program is planting quality seedlings with high survival capability. Thus the nursery needs to create seedlings with plant attributes that allow for the best chance of success once a seedling is field planted. Since the mid-twentieth century, research foresters have critically examined plant attributes that confer improved seedling survival to field site conditions. This review describes the value of commonly measured seedling quality material (i.e. shoot height, stem diameter, root mass, shoot to root ratio, drought resistance, mineral nutrient status) and performance (i.e. freezing tolerance and root growth) plant attributes defined as important in answering the question of why seedlings survive after planting. Desirable levels of these plant attributes can increase the speed with which seedlings overcome planting stress, become ‘coupled’ to the forest restoration site, thereby ensuring successful seedling establishment. Although planting seedlings with these desirable plant attributes does not guarantee high survival rates; planting seedlings with desirable plant attributes increases chances for survival after field planting.

Keywords Seedling survival · Forest restoration · Morphological attributes · Drought resistance · Freezing tolerance · Seedling nutrition · Root growth capability

Introduction

Why seedlings survive after planting has long been debated because seedling survival is pivotal in the initial success of a forest restoration program. During the early part of the twentieth century, programs planting nursery-grown seedlings in North America reached an annual size of 10–20 million (Toumey 1916). Due to this silvicultural investment, foresters began examining plantation failures and tried to discern reasons for seedling mortality (e.g. Tillotson 1915; Young 1921; Kittredge 1929; Rudolf 1939). Often seedling

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