Regeneration dynamics of seedling-origin aspen: implications for forest reclamation

Carolyn M. King

Abstract

Resprouting is an important adaptation to aboveground disturbance, whereby plants develop new shoots after loss or death of a portion of their aboveground biomass. Aspen (*Populus tremuloides* Michx.) is a foundational tree species in the boreal forests of North America and is a prolific resprouter, resprouting either through shoots on the lateral roots(suckers) or the stumps (stump sprouts). Aspen is most commonly found as part of a clonal colony, where many aboveground stems make up one genetic individual that is connected through a common root system; consequently most aspen research has focused on the clonal habit of the species. Recently, aspen have been planted as seedlings on reclamation sites and are no longer part of a connected clonal colony. I assessed the response and mechanisms of sprouting in planted aspen root systems in the field and a controlled environment. To explore the response of planted aspen to disturbance, I applied four disturbance treatments on two sites within Edmonton, AB: two cut heights and one root severing treatment in 2015, and a clearcut treatment in 2016. Treatments were applied to a large diameter and a small diameter stand. Following these disturbances I assessed the type (suckers vs. stump sprouts) and amount of regeneration at the tree and the site level. At the tree level, planted aspen produced 5 suckers each (2015) while at the stand level, this average decreased to approximately 4 suckers per initial planted tree (2016). Smaller trees produced more stump sprouts compared to larger trees, and trees cut lower to the ground produced more suckers (up to an average of eight suckers per tree). I also assessed the degree to which suckering is dependant on stored reserves of total non-structural carbohydrates (NSC, comprised of simple

sugars and starch) and nitrogen (N). Short root segments were placed in a dark growth chamber and were left to sucker under otherwise optimal growth conditions. The darkness ensured that no new carbon could be assimilated, and suckering was thus solely dependent on stored reserves. A measure of initial NSC content and concentration was determined for the entire root section at the beginning of the experiment. Greater initial NSC and N reserve content resulted in a greater production of total sucker mass and total sucker height, with a trend for the production of more suckers. NSC concentration did not have a significant relationship with total sucker production; however, high initial concentrations of starch were positively and significantly related to the *relative* production of suckers (i.e., once the root size had been controlled for). Overall, this research indicates that root system size and initial reserve status will impact the extent and type of resprouting in aspen, with larger roots having greater sucker productivity, and larger trees producing fewer stump sprouts.