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Impact of cold storage on aspen seedling quality

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As both a native and drought tolerant tree species, aspen offers advantages over other non-native hardwood species currently used in deciduous plantations throughout Alberta. However, the outplanting success and early performance of aspen plantation stock has generally not met expectations. As a result, aspen has been rarely planted in reforestation programs in the western boreal forests even though there is an extensive breeding program for aspen. The biggest barrier to the use of aspen seedling stock in a broader application is that seedlings often suffer from planting check after outplanting. In many planting programs dormant seedling stock is outplanted in the spring after extended periods of in cold storage. In this study we examined what impact the length of cold storage has on the quality of container and bareroot planting stock.

We measured root to shoot ratio (RSR) and other structural features of container (PSB 4-10A and PSB 5-12A) and bareroot (BR plug+1) planting stock. Changes in root carbohydrate reserves and bud dormancy were measured during frozen storage. Seedlings were grown at three nurseries, lifted, stored frozen at -3°C and sampled for carbohydrate reserves, dormancy status and root growth potential after 10, 75 and 150 days of cold storage. The following spring seedlings were planted into an open field to evaluate establishment and growth performance one-year after outplanting.

Findings: Prior to frozen storage, BR stock had higher root to shoot ratios (RSR) than both container stock types. During cold storage, the root carbohydrate reserves declined by 7.2% in the container stock while reserves declined by only 5.2% in the BR stock. When flushed prior to storage none of the nursery stock had shoot dieback. After 150 days in storage, all stock types exhibited stem dieback; 4-10 stock had 20% of stem dieback while BR and 5-12 stock had less than 5% stem dieback.

75 days of cold storage were sufficient for seedlings to overcome dormancy, to reach maximum root growth potential (RGP), and to allow for a rapid development of leaf area. Overall, BR stock grew the most roots in the RGP test, while the 4-10 stock grew the least roots.

After field planting in the spring, all BR seedlings survived, whereas survival was 93% for 5-12 and 90% for 4-10 stock. New growth of roots and shoots was the highest for BR seedlings (17 g dry mass) and lowest for 4-10 stock (6 g dry mass). At the end of the first growing season root and shoot carbohydrate reserves were the highest for the BR seedlings and the lowest for 5-12 stock.

Implications: The BR stock appears to have the best root and shoot growth performance after the root growth potential trials and after outplanting compared to the container stock. High initial root reserves and RSR, and hardier shoots which showed little dieback during storage are likely important drivers.

Cold storage of 75 days for appears to be sufficient for aspen seedlings to overcome dormancy and reach maximum root growth potential. Stock handling regimes should avoid long periods of cold storage. Especially in the container stock, longer storage resulted in further declines of TNC reserves, less root growth and more stem dieback in container stock.

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Further Information:

Martens, L.A., Landhäusser, S.M. and Lieffers, V.J. 2007. First-year growth response of cold-stored nursery-grown aspen planting stock. New Forests 33: 281-285.

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