CENTRE FOR BOREAL RESEARCH
TECHNICAL NOTE #25
FOREST RECLAMATION AND BOREAL REFORESTATION - APRIL 2019

Handling of Poplar and Willow Cuttings Part 1: Collection, Storage and Pre-planting Preparation



INTRODUCTION

Poplars (e.g. *Populus balsamifera*) and willows (*Salix spp*) are woody species that can be propagated by stem cuttings (Figure 1), and grow across a wide range of site and environmental conditions, including soils with sub-optimal pH and salinity. Both poplars and willows are early successional species that are among the first and fastest growing woody species to colonize sites following natural or human disturbances. These characteristics are useful for reforestation projects, and have been adapted for land reclamation strategies for altered oil and gas landscapes in western Canada (Isebrands et al., 2014).

The technical notes on "Handling of Poplar and Willow Cuttings" are divided into two parts. Part 1 addresses collection, storage and pre-planting preparation of cuttings. Part 2 focuses on transportation and planting of cuttings and can be accessed on the Centre for Boreal Research's website **nait.ca/borealresearch**.

Figure 1. Harvesting cuttings in the field.

FIVE STEPS TO ESTABLISHING CUTTINGS

1. **Collection (part 1)**
2. **Storage (part 1)**
3. **Pre-planting preparation (part 1)**
4. **Transportation (part 2)**
5. **Planting (part 2)**

GOOD TO KNOW

Poplar and willow species with preformed root primordia on stem nodes (e.g. balsam poplar (*Populus balsamifera*)) allow for easy, quick and reliable rooting while species which do not have root primordia on stems, such as aspen (*Populus tremuloides*), are extremely poor rooters (Dickmann & Kuzovkina, 2014).

BENEFITS OF USING CUTTINGS

- Production of genetically identical offspring of the parent plant
- Low-cost mass propagation
- Short planning window
- Ready availability of plant material that is within the same seed zone of deployment

POTENTIAL DRAWBACKS

- High initial mortality in the field (e.g. under high competition, low soil moisture)
- Cost increases with cutting size
- Low genetic diversity

STEP 1: COLLECTION

Legislation, location, timing, harvest and equipment are important considerations for cutting collection.

LEGISLATION

Only cuttings from native woody species (e.g. *Populus balsamifera*) are approved for operational reforestation on Crown land in Alberta, and are required to be sourced locally as defined by seed zones (FGRMS, 2016). Prior to the collection, it is required to apply for authorization with Alberta Agriculture and Forestry if the cuttings are intended for reforestation or reclamation on public land. When harvesting wild cuttings, locate a harvest site in close proximity to the site to be reclaimed. This complies with Alberta Forest Genetic Resource Management and Conservation Standards (FGRMS, 2016) and ensures that the species will be adapted to the local site conditions such as climate, soil, water and nutrients and to the local insect and disease conditions (Ying & Yanchuk, 2006). Similarly, cuttings from coppices and commercial sources need to be compatible with the local planting environment.

LOCATION

Cuttings used in reclamation can be obtained from three different sources:

1. Undisturbed forest stands
2. Coppices grown in cultivated fields
3. Commercial nurseries

GOOD TO KNOW

When cutting willows, always seek out specimens growing in low-lying, wet areas, instead of upland areas, as these have better rooting potential and have shown superior survival (Sobze et al., 2014; Mosseler, Major & Labrecque, 2014).

TIMING

Cuttings can be harvested from mature stems when plants are dormant between leaf senescence in the fall and leaf flush in the spring (Lezberg & Giordanengo, 2008). These dormant cuttings are hardwood cuttings with wood that is firm and does not easily bend. Dormant cuttings will have stored carbohydrates and growth hormones from the previous growing season, and will have the maximum amounts of these "food reserves" necessary for rooting and flushing (Kozlowski, Dramer, & Pallardy, 1991). Spring harvest of softwood cuttings from new growth of woody plants is also a viable option.

HARVEST

No more than one-third of the branches should be removed, and no more than 40% of the canopy cover should be taken (Lezberg & Giordanengo, 2008) to ensure donor plant survival, regardless of a cultivated or undisturbed source location. Harvest new growth only from healthy-looking plants (i.e. free from physical damage and disease) to minimize risk of the cuttings dying from insects or disease.

EQUIPMENT

Cutting harvest equipment includes sharp cutters, pruning saws, hand pruners for trimming secondary branches and smaller cuttings, bundling twine and a method of transporting the cuttings (Figure 2). Sharp cutters are recommended for two reasons: they are easier to work with, and the cutting itself will have a greater chance of survival and growth.

Figure 2. Cutting tools.

STEP 2: STORAGE

Cuttings have to be cold-stored until processing and planting to avoid desiccation, maintain viability and maximize survival. Only dormant cuttings need to be stored in a freezer, while cuttings collected during the growing season will need to be stored at refrigerator temperatures to avoid respiratory losses of stored energy (Keddy & Sidders). Relative humidity during storage should be 60-70% (Lezberg & Giordanengo, 2008) which can be achieved with plastic liners in boxes. Studies have shown that -3°C/ 37°F (Tree Time Services, personal communication) to -4°C/ 39°F is the optimal temperature for rooting success (Cram & Lindquist, 1982). If possible, heel in the cuttings (a method that involves temporary planting of cuttings in a shallow hole) to keep moisture levels high and increase rooting success. Heeling-in should only be done if planting of cuttings can be completed as soon as dormancy breaks in the spring (Cram & Lindquist, 1982). Cuttings should be planted out within eight months of initial harvest to ensure maximum survival.

STEP 3: PRE-PLANTING PREPARATION

Before the cuttings can be planted out, they must be thawed, cut to size, soaked and painted. To avoid breaking dormancy and using up valuable stored carbohydrates in the stems, all processing should be done in a cool (ideally less than 10°C/50°F) environment. Consider removing only as much material from the storage location as can be processed within one hour (Keddy & Sidders).

THAWING

Frozen cuttings need to be thawed at refrigerator temperatures for approximately 3 days prior to soaking (Alex Mosseler, personal communication). Prolonged storage at unfrozen temperatures is not recommended as it will result in stem respiration, reducing potential for growth and sufficient root development.

CUTTING TO SIZE

Trimming the cutting to size depends on the silvicultural requirements of the project, and the quality of site preparation. **Willow cuttings** should be at least 40 cm long and 0.5 cm in diameter. Longer and thicker cuttings will have more carbohydrates and hormones for rooting and flushing and are more resilient to drought (da Costa CT, 2013; Polster, 2002).

The overall size of **poplar cuttings** can be much smaller (30 cm in length and 0.5-1.0 cm in diameter) than willow cuttings, provided the cuttings can be established in a competition-free (or nearly so) environment during the establishment year. Poplar cuttings, unlike willows, need to have a viable dormant bud within 1 cm of the top (Keddy & Sidders). Some studies recommend 2-meter long cuttings (Polster, 2011). Although longer cuttings have shown success, it increases costs and involves greater disturbance on collection sites.

SOAKING

Pre-planting soaking is recommended in order to swell the dormant buds, initiating the rooting process (Lezberg & Giordanengo, 2008), but should not be prolonged to avoid root growth prior to planting out. There are a range of recommended soaking lengths, from three days (Roger Butson, personal communication), 10 days (Schaff, Pezeshki, & Shields, 2002; Hansen & Phipps, 1983) to 14 days (Tilley & Hoag, 2008). Cuttings may be soaked in buckets, streams or lakes by positioning the cuttings vertically and submerging between 50% and 80% of the stem (Lezberg & Giordanengo, 2008).

PAINTING

Painting the tops of the cuttings (Figure 3) serves a number of purposes:

- Provides an instant signal to the planter as to which end is up
- Reduces moisture loss and desiccation, and increases survival (Hoag, 2007)
- Allows for colour-coding by species, lots or clones
- Allows for easier identification of cuttings in the field after planting

To paint the cuttings, dip the top end of the bundle into a bucket containing a 50:50 mix of non-toxic latex paint and water, ensuring that the top 3-5 cm are covered. Alternatively, tops may be painted with a brush.

Figure 3. Willow cutting with painted top.

REFERENCES

Cram, W., & Lindquist, C. H. (1982, Fall). Refrigerated Storage for Hardwood Cuttings of Willow and Poplar. Tree Planter's Notes Volume 33, 1-65.

da Costa CT, d. A.-N. (2013, May). When stress and development go hand in hand: main hormonal controls of adventitious rooting in cuttings. Frontiers in Plant Science, 4, 1-19.

Dickman, D., & Kuzovkina, J. (2014). Poplars and Willows of the World, with Emphasis on Silviculturally Important Species. In J. Isebrands, & J. Richardson, Poplars and Willows: Trees for Society and the Environment (p. 699). Rome: FAO.

Forest Genetic Resource Management and Conservation Standards (FGRMS), Volume 1A – Stream 1, Alberta Agriculture and Forestry, 2016.

Hansen, E. A., & Phipps, H. M. (1983). Effect of soil moisture tension and preplant treatments on early growth of hybrid Populus hardwood cuttings. Canadian Journal of Forest Research, 13, 458-464.

Hoag, J. C. (2007, January). How to plant willows and cottonwoods for riparian restoration. Technical Note Plant Materials(23), p. 22.

Isebrands, J.G.; Aronsson, P.; Carlson, M.; Ceulemans, R.; Coleman, M.; Dickinson, N.; Dimitriou, J.; Doty, S.; Gardiner, E.; Heinsoo, K.; Johnson, J.D.; Koo, Y.B.; Kort, J.; Kuzovkina, J.; Licht, L.; McCracken, A.R.; McIvor, I.; Mertens, P.; Perttu, K.; Riddell-Black, D.; Robins, B.; Scarascia-Mugnozza, G.; Schroeder, W.R.; Stanturf, J.; Volk, T.A.; Weih, M. 2014. Environmental applications of poplars and willows. In Isebrands, J.G.; Richardson, J. (eds.). Poplars and willows: trees for society and the environment. Oxfordshire, England: CABI. Pgs.258-336.

Keddy, T., & Sidders, D. (n.d.). Operator's Guide to Operations for the Establishment and Maintenance of Concentrated Biomass for Energy Plantations. Canadian Forest Service Canadian Wood Fibre Centre Information Report.

Kozlowski, T. T., Dramer, P. J., & Pallardy, S. G. (1991). The Physiological Ecology of Woody Plants. San Diego CA: Academic Press Inc.

Lezberg, A., & Giordanengo, J. (2008, June 20). A Guide for Harvesting, Storing and Planting Dormant Willow Cuttings. Colorado Riparian Association Newsletter, 19(2), p. 4. Retrieved from http://coloradoriparian.org/a-guide-for-harvesting-storing-and-planting-dormant-willow-cuttings-2/

Mosseler, A., Major, J., & Labrecque, M. (2014). Growth and survival of seven native willow species on highly disturbed coal mine sites in eastern Canada. Can. J. For. Res., 44, 340-349.

Polster, D. (2002). Soil Bio-engineering Techniques for Riparian Restoration. Proceedings of the 26th Annual British Columbia Mines Reclamation Symposium (pp. 230-239). Dawson Creek, BC: The Technical and Research Committee on Reclamation.

Polser, D. (2011). Natural Processes: Restoration of Drastically Disturbed Sites. August 2011. Polster Environmental Services Ltd.

Schaff, S. D., Pezeshki, S. R., & Shields, F. D. (2002, June). Effects of pre-planting soaking on growth and survival of black willow cuttings. Restoration Ecology, pp. 267-274.

Sobze, JM., Schoonmaker, A.L. and Pollock, A. (2014). Methods of woody species establishment on reclaimed industrial sites: a discussion of early findings and suggestions for reclamation practitioners. February 26-28. Canadian Land Reclamation Association Meeting, Red Deer

Tilley, D., & Hoag, J. C. (2008, November). Evaluation of fall versus spring planting of dormant hardwood. Riparian/Wetland Project Information Series (25).

Ying, C. C., & Yanchuk, A. D. (2006). The development of British Columbia's tree seed transfer guidelines: Purpose, concept, methodology, and implementation. Forest Ecology and Management, 227, 1-13.

VISIT OUR WEBSITE
nait.ca/borealresearch
ISSN 2371-462X

CONTACT US
boreal@nait.ca
780.648.2600

AUTHORS
Alan Pollock, Amanda Schoonmaker, Jean-Marie Sobze, Jeannine Goehing, Centre for Boreal Research, NAIT.

Photo credits: Allan Pollock, Jean-Marie Sobze, Centre for Boreal Research, NAIT.