Research Forest

Cottonwood establishment on a wet SBSdw1 site using three methods of artificial regeneration

Research Project # 95-11

Quick Sheet #10

March, 99

Introduction

This research trial was installed in 1997 to examine the effectiveness of three different methods of cottonwood *(Populus trichocarpa* Torr. and Gray*)* establishment. This species can be difficult to artificially regenerate, although it grows naturally on a variety of disturbed sites from root sprouting and seeds. This report summarises two-year growth and performance results and discusses some of the initial problems we encountered.

Pioneer hardwood species have historically been considered a bane to successful conifer plantations and the object of competing vegetation management. In British Columbia today, however, there is an increasing interest in regenerating hardwoods, including cottonwood, for several reasons.

There is a range of non-timber benefits from maintaining deciduous and mixed species stands. Deciduous species contribute to stand and forest level diversity, important wildlife habitat, site productivity and forest health. Cottonwood is an important species for riparian area restoration and can be used to regenerate wet, degraded, or unstable soils where it is difficult to grow conifers. In addition, technology and markets have increased the commercial potential for utilising cottonwood fibre (McLennan *et al.* 1992).

Cottonwood thrives on nutrient-rich soils with fresh to very-moist soil moisture regimes and will aggressively colonise moist, mineral soils. It will tolerate flooding during the dormant season although prolonged flooding during the growing season will reduce productivity. Cottonwood is poorly adapted to drought and very shade intolerant. Under appropriate growing conditions, it is the fasted growing tree in BC (McLennan *et al.* 1992).

Study sites/Methods

The trial was established on a very wet SBSdw1/09 site on the Gavin Lake Block of the Research Forest. The site was clearcut in 1991 and planted predominantly to lodgepole pine. In 1994 the project area was declared NSR (not satisfactorily restocked) due to palludification and unsuitable for pine re-establishment due to a very high water table and heavy gleysolic and organic soils. In 1997, the site was replanted with cottonwood using three different establishment methods:

1) *Whips*

One-year-old shoots (1-1.5 m long, 1-2 cm diameter) were collected in February, before planting. Seeded plants were preferred and stock from layered and roadside thickets was avoided. The whips were stored in sealed plastic bags at -2 degrees Celsius and cool-thawed before planting.

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2) Plugs

Whips were collected in February, cut into 60 cm lengths and shipped in airtight plastic bags to a Pacific Regeneration Technologies nursery where they were rooted in 615 size plugs.

3) *Naturals*

Two-three year old natural seedlings were dug up and transplanted immediately in spring 1997. These seedlings were much shorter than the whip stock but had a nicely balanced root-shoot ratio.

All stock was locally collected. One hundred of each stock type was spring planted, favouring higher microsites and avoiding standing water.

Results

Condition

Condition of all sample trees was assessed annually. The vigour of all stock deteriorated rapidly. Thirty-two percent of the sample trees died in the first growing season. Mortality was highest in the natural and plug stock and overall condition was best in the whip stock (72% assessed as good). In the first year, 6 % of the sample trees suffered mechanical damage due to hare, vole, and moose browsing. Poor vigour was noted in 8% percent of the naturals and 10% of the plugs due to vegetation competition and flooding. Only 3% of the whips were affected by these factors.

After two growing seasons, damage agents had severely affected every stock type (Figure 1).

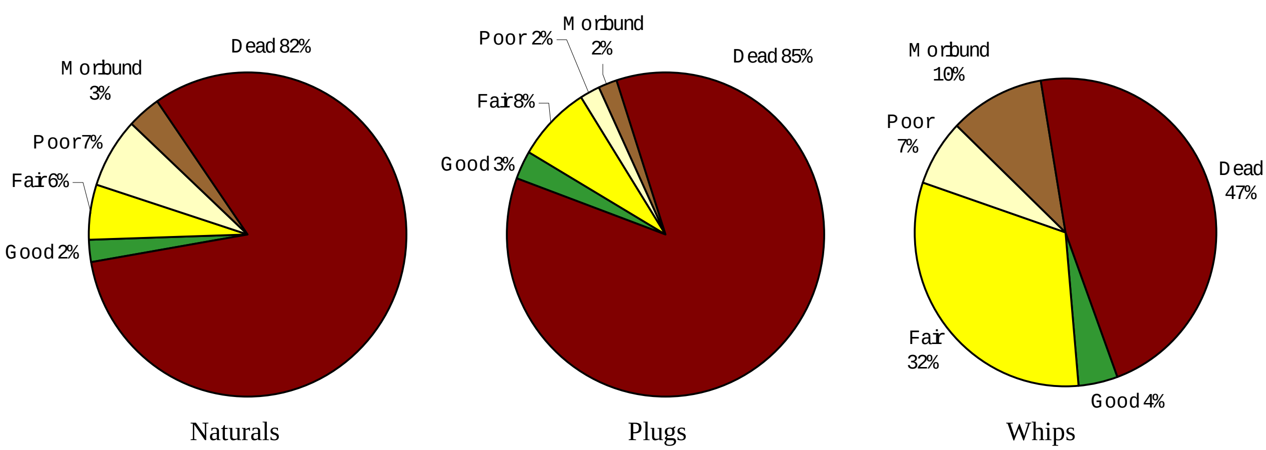

Figure 1) Condition of each cottonwood establishment method after 2 growing seasons.

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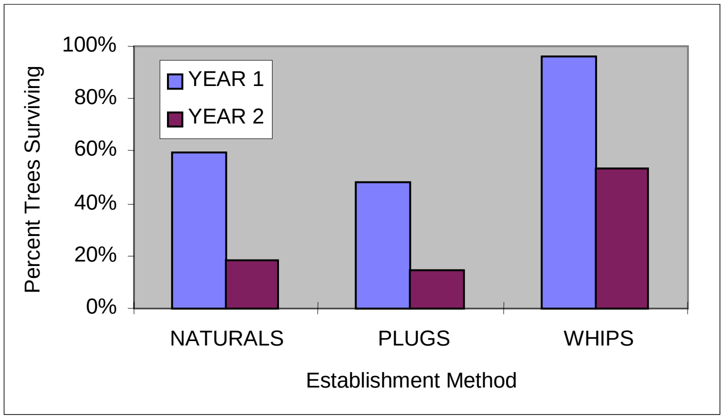

Figure 2) Percent seedling survival after two growing seasons

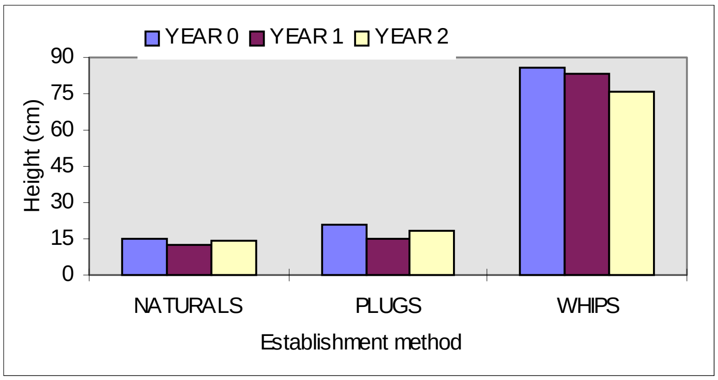

Figure 3) Mean height of three establishment methods in first two growing seasons

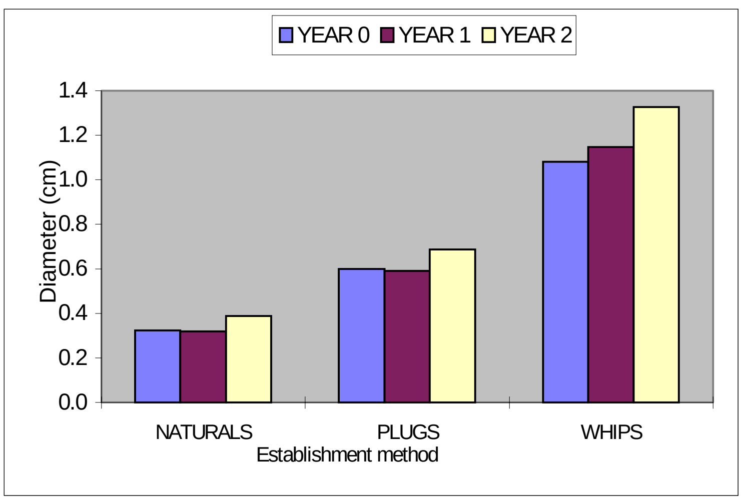

Figure 4) Mean tree basal diameter of three establishment methods in first two growing seasons

Whips had the best survival on this site after two growing seasons (Figure 2). Heavy wildlife browse in year two accounted for most of the seedling damage - 10% of natural, 16% of plug and 19% of whip stock. The major causes of mortality were noted as flooding and vegetation competition. Missing sample trees were assumed dead due to competition.

Height

The whips were much taller than the plugs and naturals at establishment (85 cm vs. 20 cm and 15 cm, respectively). The mean height of all surviving trees declined after two growing seasons (Figure 3). For those seedlings undamaged by browsing, there was a small mean height increase in naturals (3 cm) and plugs (6 cm) and a decline in the mean height of undamaged whips due to top die back. There was not, however, enough undamaged sample trees to make conclusive remarks about the potential height growth of each establishment type.

Diameter

There were considerable differences between the mean tree basal diameters of the different establishment types at the time of planting and after two growing seasons (Figure 4). The whips had the greatest initial mean diameter (11 mm) and growth after two growing seasons (3 mm). The initial mean diameters of the plugs and naturals was 6 mm and 3 mm, respectively, and the mean two-year

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diameter growth for both of these establishment types was less than 1 mm.

Discussion

We did not find any of the three establishment methods we tried in this trial to be successful in artificially regenerating cottonwood. The whips had the best survival over two growing seasons (53%), growth and performance. The whips had the best initial height and diameter at the time of establishment and therefore suffered less damage and mortality due to competing vegetation. Whips may be able to withstand growing season flooding better than naturals or plugs but, like any method, can be heavily browsed.

Both the plug and natural stock types had lower initial height and diameters and very poor survival (<20%). The plug stock did not produce sufficient root growth to fill plug cavities and the rooted whips easily separated from the plugs during handling. It was difficult to avoid this damage during planting which may explain some of the poor performance of this establishment method.

The natural transplant stock had the lowest height and diameter at time of planting. This disadvantage seemed to outweigh the advantages of a better-developed root system and balanced root/shoot ratio. The natural transplants were very labour intensive to establish and the most susceptible stock type to vegetation competition and flooding.

All establishment methods were damaged considerably by wildlife browse and cattle trampling which made it difficult to examine the potential growth of each.

Conclusions

The whip stock had the best performance of the three cottonwood establishment methods that we tested in this trial, although we still were not able to achieve sufficient regeneration to re-stock the site with this establishment method. The site we planted for this trial was very wet and prone to flooding during the growing season. We may have better success with whip stock on moist sites with lower water tables.

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Funding

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Reference Cited

McLennan, D.S. and Aube-Marie Mamias. 1992. Cottonwoods in British Columbia, Problem Analysis. FRDA report 195, ISSN 0835-0752.

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