Foothills Growth and Yield Association

Quicknote # 6

Commercial Thinning Trials

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A network of long-term lodgepole pine silvicultural trials in Alberta, developed over the past 6 decades, is providing important information on lodgepole pine response to thinning and fertilization treatments. Three trials that examined response to thinning in mid to late rotation were established between 1941 and 1954 (Table 1) by the Canadian Forest Service (CFS). Results from these long-term field trials allow us to assess the potential for increases in productivity resulting from commercial thinning (CT). Trials such as these are invaluable as input to and validation of models forecasting stand development, growth and yield, and timber supply.

Table 1. Long-term lodgepole pine commercial thinning trials

Trial Name	Year Established	Age (years) at Thinning	Treatments
MacKay[2]	1954 1969	22 (first) 37 (second)	Unthinned control (11,308 sph); precommercially thinned to 2986 sph, some plots later re-thinned to 70% basal area, and others left
K57[3,4,5]	1941	77	Unthinned control (5700 sph; estimated from 1949 measurement); thinned to 1720 sph (70% volume removal from above and below)
Strachan[6]	1951	85	Unthinned control (1647 sph); heavy low thin (to 815 sph); heavy crown thin (to 840 sph); sanitation cut (to 1020 sph). All thinnings removed approx. 40% of BA.

Beginning in 2002, the trials have been maintained and measured cooperatively by CFS, Alberta Sustainable Resource Development, and Foothills Growth and Yield Association. Previous data were compiled from government and company (Hinton Wood Products, formerly Weldwood of Canada) archives. Recent re-measurements were combined with older data to create a standardized database. In the following table, mean annual increment (MAI) of stem volume (m^3/ha/year) is used as an indicator of growth response. For more details on experimental designs, treatments, analyses and results, consult the publications referenced below and / or contact the author or the FGYA.

Total standing volume MAI in all three trials was lower in the thinned treatments than in the controls (Table 2). However, including the thinnings in the MAI calculation increased the volumes from nil to 15% more than in the controls. This amounted to an absolute increase of 0.03 m^3/ha/year at age 71 for MacKay, 0.28 m^3/ha/year at age 130 for Strachan low thin, and 0.53 m^3/ha/year at age 135 for K57. In the MacKay trial, the only one of the three to also include pre-commercial thinning, total standing volume MAI is almost the same in the 2986 stems/ha treatment as in the 2986+CT treatment (3.92 vs. 3.99 m^3/ha/year, respectively); however, including thinnings raises MAI of the latter to 4.36 m^3/ha/year. It should be noted that MAI is still increasing in the thinned treatments in the K57 and MacKay trials, although it has reached culmination in the unthinned controls.

Table 2. The effect of commercial thinning of lodgepole pine on total and merchantable volume MAI (m^3/ha/year)

Trial	Maximum Unthinned MAI	Maximum Thinned MAI (remaining + removed)	Thinning Prescription	Percent Change
		Total volume		
K57	†3.51 *	2.65 + 1.39 = 4.04*	70% vol. removed	15
Strachan	2.94 *	2.52 + 0.70 = 3.22*	sanitation cut	9
		2.37 + 0.84 = 3.21*	low thin	9
		2.00 + 0.91 = 2.90	crown thin	-1
MacKay	†4.33 *	3.99 + 0.37 = 4.36	2986 sph PCT+CT	1
		Merchantable volume		
MacKay	2.46 *	3.66 + 0.07 = 3.74*	2986 sph PCT+CT	52
K57	2.96	2.48 + 0.63 = 3.11	70% vol. removed	5
Strachan	2.78	2.24 + 0.53 = 2.77	low thin	0
		2.36 + 0.31 = 2.67	sanitation cut	-4
		1.87 + 0.75 = 2.62	crown thin	-6

Note: For thinned treatments, MAIs are based on standing volumes plus volume of thinnings calculated at age of culmination or of last measurement. The cross (†) indicates that the treatment has reached MAI culmination. Within each row, values followed by an asterisk (*) are significantly different from each other. Merchantable volumes are based on a 13/7 utilization standard (i.e. 13 cm minimum stump diameter outside bark and a 7 cm minimum top diameter inside bark).

Merchantable volume MAI was significantly increased by 52% or 1.28 m^3/ha/year in the re-thinned treatment compared to the unthinned control in the MacKay trial. Also compare the MAI of 3.44 m^3/ha/year in the 2986 sph PCT only treatment to the 3.74 m^3/ha/year (including thinnings) in the 2986+CT treatment. Commercial thinning did not result in a significant increase in merchantable volume MAI in either the K57 or Strachan trials. For these two sites, we estimated merchantable volumes of the thinnings from total volumes, BA, stand age and stand density, based on multiple regression on similar data from other trials (adjusted $R^2 = 0.99$). Note that in none of these trials has culmination been reached.

The results of the 3 trials indicate that commercial thinning can increase the total yield of merchantable volume, particularly when used in conjunction with pre-commercial thinning. A more detailed assessment of trial results, and their implications for timber and other management objectives, is in preparation.

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[2] Johnstone, W.D. 1981b. Pre-commercial thinning speeds growth and development of lodgepole pine: 25-year results, Inf. Rep. NOR-X-237. Environ. Can., Can. For. Serv., Edmonton, Alberta, 36 p.

[3] Quaite, J. 1950. Severe thinning in an overstocked Lodgepole Pine stand. Silvicultural Leaflet no. 47. Dep. Resour. Dev., For. Br., Calgary, AB, 2 p.

[4] Johnstone, W.D. 1982. Heavy thinning accelerates growth of 77-year-old lodgepole pine. For. Manag. Note No. 16. Can. For. Serv., North. For. Cent., Edmonton, Alberta, 3 p.

[5] Navratil, S. 2002. A lodgepole pine commercial thinning trial in Kananaskis, Alberta: 58-year results, Special Report. Nat. Resour. Can., Can. For. Serv., North. For. Cent., and Weldwood Can. Ltd., Hinton Div., Edmonton, 14 p.

[6] Crossley, D.I. 1955. Foliage and stand growth responses of semi-mature lodgepole to thinning and fertilization. Can. J. For. Res. 28:1794-1804.