



## Foothills Growth and Yield Association *Quicknote # 7* **Fertilization and Thinning Trials**

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May 2005

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. Five trials that examined response to fertilization in early to late rotation were established between 1965 and 1984 (Table 1) by the Canadian Forest Service (CFS) and Alberta Forest Service (now Alberta Sustainable Resource Development (ASRD)). Results from these long-term field trials allow us to assess the potential for increases in productivity resulting from fertilization in combination with thinning, and provide invaluable input to and validation of models forecasting stand development, growth and yield, and timber supply.

**Table 1. Long-term lodgepole pine fertilization and thinning trials**

<b>Trial name</b>	<b>Year established</b>	<b>Age (years) at treatment</b>	<b>Treatments</b>
Ricinus (CFS)	1965	15	(stand previously thinned from 12,970 sph to 2,268 sph) unfertilized control, N39+P20, N79+P41 (kg/ha)
Clearwater <sup>2</sup> (CFS)	1968	72	(stand previously thinned from 2,500 sph to 850 sph) unfertilized control, N112, N112+S28+P168, N673, N673+S28+P168 (kg/ha)
Takyi 7008 (ASRD)	1980	24	3-way factorial unthinned (15,000-25,000 sph) vs. thinned (1,600 sph) urea vs. ammonium nitrate N0, N0+P+K, N200+P+K, N400+P+K (kg/ha)
Takyi 7009 (ASRD)	1980	24	2-way (4 reps of each combination) unthinned (15,000-25,000 sph) vs. thinned (1,600 sph) N0, N250+P150+K200, N500+P300+K400 (kg/ha)
McCardell <sup>3</sup> (CFS)	1984	40	2-way factorial unthinned (5,270 sph) vs. thinned (2,130 sph) N0, N180+P+S, N360+P+S, N540+P+S (kg/ha)

Since 2002 the trials have been maintained and measured cooperatively by the CFS, ASRD, 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<sup>3</sup>/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 authors or the FGYA.

Total and merchantable volume MAI increased with fertilization compared with unfertilized controls in the Clearwater, McCardell, and three of the Takyi trials (Table 2). The lack of significant change observed in the Ricinus trial may be due to the low rate of application. The optimal application rate for nitrogen fertilization appears to be in the range of 250 to 400 kg/ha. In the Takyi trials, 250 kg/ha was better than

500 kg/ha in the poor site (7009), but 400 kg/ha was better than 200 kg/ha in the medium site (7008). The source of nitrogen made no significant difference to volume production. In the McCardell trial, the intermediate level (360 kg/ha) proved better than 540 kg/ha. However, the strong response to the high level of fertilization used in the Clearwater trial suggests that higher levels may work well in some cases.

**Table 2. The effect of fertilization and thinning of lodgepole pine on total and merchantable volume MAI (m<sup>3</sup>/ha/year)**

Trial / site	Total volume MAI (m <sup>3</sup> /ha/year)			Merchantable (13/7) volume (m <sup>3</sup> /ha/year)			Best fertilization prescription	Years since treatment
	Unfertilized	Best fertilized treatment	Difference	Unfertilized	Best fertilized treatment	Difference		
Clearwater	1.80	3.39	1.58 * (88%)	1.61	3.14	1.53 * (95%)	N673	28
Takyi 7008 unthinned	4.86	5.74	0.87 * (18%)	1.19	2.57	1.38 * (115%)	N400	19
Takyi 7008 thinned	3.56	4.31	0.74 * (21%)	2.90	3.73	0.83 * (29%)	N400	19
Takyi 7009 unthinned	2.25	2.78	0.53 * (24%)	0.29	0.50	0.21 * (74%)	N250	19
Takyi 7009 thinned	2.34	2.68	0.33 (14%)	1.70	2.16	0.47 (27%)	N250	19
McCardell unthinned	6.51	7.41	0.90 * (14%)	4.90	5.81	0.91 * (19%)	N360	15
McCardell thinned	5.61	5.79	0.18 * (3%)	4.86	5.13	0.27 * (6%)	N360	15
Ricinus	4.54	4.23	-0.31 (-7%)	3.61	3.35	-0.25 (-7%)	N79P41	30

Note: MAIs are based on standing volumes calculated at age of culmination or of last measurement. An asterisk (\*) denotes a statistically significant difference between unfertilized and fertilized treatments. 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).

Is thinning required to get the best response to fertilization? In the three paired trials where this could be tested, differences in total volume MAI due to fertilization were greater in the unthinned than in thinned plots. The same trend is seen for merchantable volume MAI differences in the McCardell and Takyi 7008 trials, but not in the Takyi 7009 trial. These results suggest that thinning may not always be necessary for effective fertilization treatments.

The results from these trials indicate that N fertilization can improve lodgepole pine productivity in west-central Alberta, with or without thinning. These results also suggest an optimal range of application rate of 250 to 400 kg/ha. A more detailed assessment of trial results, and their implications for timber and other management objectives, is in preparation.

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<sup>2</sup> Bella, I.E. 1978. Fertilization after thinning 70-year-old Lodgepole Pine (*Pinus contorta* Dougl. var. *latifolia* Engelm.) in Alberta. Fish. Environ. Can., For. Serv., Bi-mon. Res. Not. 34:22-23.

<sup>3</sup> Yang, R.C. 1985a. Ten-year growth response of 70-year-old lodgepole pine to fertilization in Alberta. Can. For. Serv., North. For. Res. Cent., Inf. Rep. NOR-X-266.

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