

A Performance Comparison of Chainsaw Bar Lubricants

By Levi J. Suryan

Candidate for Master of Science in Mechanical Engineering

Major Professor: Dr. John Parmigiani

Abstract

Chainsaws, an indispensable tool for modern forestry operations, rely on bar lubricant to prevent rapid wear of the chain and bar. Choice of bar lubricant must balance performance, cost, and biological impact. Many bar lubricants are available, but little published work exists that conclusively ranks the performance of these choices. This study used a series of laboratory-based cutting and free running chainsaw experiments to compare the lubrication performance of 6 petroleum-base lubricants and 2 vegetable-base lubricants. The cutting experiments mimicked normal operating conditions and used bar temperature distribution to show how lubricant choice, lubricant flowrate and chain tension effected frictional power dissipation in the chain and bar assembly. Cutting results indicated that chain tension was the strongest predictor of frictional power dissipation. Boundary lubrication conditions occurred at 1 mL/min of lubricant flowrate, mixed lubrication occurred at 3-5 mL/min flowrate, and film lubrication occurred at 10 mL/min flowrate. In the 3-5 mL/min flowrate range, high viscosity index appeared to reduce lubricant film breakthrough. The free running experiments used measurements of chain length increase to test the ability of each lubricant to protect chain components from rapid wear under abusive operating conditions sometimes encountered in the field. Length increase is caused by material loss at the rivets of the chain. Results showed that under these operating conditions, lubricant viscous properties had no effect on wear rates. Lubricant additive composition dictated chain wear rates, which was independent of whether the lubricant was petroleum or vegetable-based. The combined results show that a reliable means of evaluating chainsaw bar lubricants was developed and that both high and low quality examples of petroleum and vegetable-base lubricants exist.

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