

Reducing skidder fuel consumption

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Introduction

Fuel is a major expense component of operating off-road machines, so finding ways to reduce machine fuel consumption can affect overall machine operating cost. FPIinnovations measured the effect that a 5% change in grade had on the fuel consumption of a skidder, and also compared the fuel consumption of the skidder when its grapple carried the loads at various heights. Analysis of the test results allowed FPIinnovations to recommend several fuel-saving practices that machine owners can utilize to optimize machine performance.

Methodology and site conditions

The test was performed in one day to limit variation in the condition of the test track, which was compacted native soil and was conducted in northern British Columbia in late August 2016. Only one trial was performed with the initial test condition repeated once to confirm that the drag from the log stems remained consistent and that the test track conditions had not degraded and thus altered previous test results. A diagnostic data logging tool compatible with the skidder's J1939 CAN bus port was used to access data from the electronic control module to determine the fuel consumption rate of the engine. The test machine was a model year 2011 John Deere 848H skidder that was equipped with a 149 kW Tier 3 engine. This model and size of the skidder are typical of most skidders used in boreal forest operations. The skidder was equipped with relatively new tires and chains, so the fuel consumption was not affected by issues related to traction loss. The test track for the skidder was a finished road grade made of native material with good bearing capacity (Figure 1). The test load was carried at three different positions from the ground and was high, middle, and low position, as measured from ground to the grapple pin; this would be 2.85, 2.33, and 1.67 meters respectively, as shown in (Figure 2).



Figure 1. Skidder on test track.



Figure 2. Measuring grapple height from ground to grapple pin, in this case the high position is being measured.

Results

Table 1 shows the fuel consumption rate of the skidder operating on a 5% adverse grade, with the grapple of the skidder at different heights.

Table 1. Fuel consumption of skidder operating on 5% favourable and adverse grades with the grapple at different heights

Grapple position	Fuel consumption on 5% favourable grade (L/h)	Fuel consumption on 5% adverse grade (L/h)	Difference in fuel consumption (%)
High	20.0	31.0	55
Middle	21.5	31.5	47
Low	25.0	32.0	28

The results show that the grapple position can have a dramatic effect on log drag forces and, thus, fuel consumption. Dragging the logs in the highest position decreases drag from the logs and yields the lowest possible fuel consumption. The lower the load, the greater the fuel consumption and the higher chance there is for the load to hit a stump or snag logging debris, which could further increase drag on the load.

The table also shows that an adverse grade of only 5% can increase fuel consumption significantly. When skidding on an adverse slope, the position of the grapple has less of an impact (3% difference high to low) than skidding on a favorable slope (25% difference high to low). Skidding on favourable slopes is preferred, and can decrease fuel consumption by 47% when the grapple is at the middle position, which is the most common position. For a skidder that consumes 200 L in a shift, poor planning could increase the fuel consumption by 30 L per shift, or 7 500 L per year.

Therefore, what may appear to be an insignificant change in grade or grapple position can have a significant impact on the fuel consumption, and thus on the machine operating cost.

Implementation

Whenever possible, skid logs with the grapple position at its highest position. However, machine stability and the safety of the operator and others at the site must be taken into consideration first. Skidding on adverse slopes can greatly increase fuel consumption and increase the cost of operations on a unit basis considerably. Forest planners and logging supervisors are encouraged to revisit their plan of operation prior to commencing road construction or locating skid trails in order to realize possible efficiency gains. Meeting with the logging crew on a daily basis would help ensure that the plan is working and being followed.

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