Implications of Processing Green Versus Dry Residues for Aviation Fuel

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Introduction

Forest harvest residues are produced as a byproduct of commercial timber harvest and represent a source of readily available material for energy production. However, these forest harvest residues, when green, contain high moisture content that can increase the costs of processing and transportation and may reduce the yield of potential extractable polysaccharides for biofuel production. Different moisture management strategies can be implemented to reduce the moisture content prior to processing but the most important question is what are the trade-offs between collecting green versus dry residue, moreover what is the opportunity cost of letting the material sit while drying. This analysis could help to quantify the opportunity cost of implementing moisture management strategies by estimating the processing, transportation and pretreatment cost of green versus dry residues.

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FIGURE 1.– a) Dry forest harvest residue, 15% MC; b) Green forest harvest residue, 60% MC

Objectives

Our main objective is to estimate the implications in processing, transport and pretreatment of using green versus dry forest harvest residues. Our analysis is focused on harvest residues comminuted in the field using grinders and loaded and transported in chip vans. Specifically, we discuss differences in bulk density, bark and needles content, and polysaccharides yield.

Methods

We processed 150 tons of green and 150 tons of dry forest harvest residues from two similar 45 year-old Douglas-fir stands. Dry residue was collected in the summer from a harvest operation completed at the end of the previous winter season. Residues were transported to a centralized yard where we spread the material in windrows to facilitate drying. Moisture content when ground was estimated at 15% (wet basis). Green residue was collected immediately after harvest and immediately ground. The green residue had an average moisture content of 60%. This allowed us to calculate the bulk density and estimate potential trailer capacity and limitations (Figure 2).

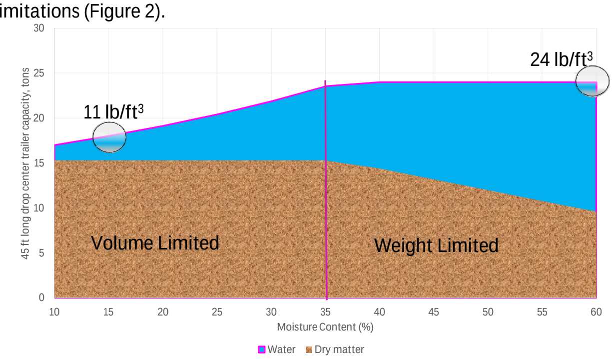

FIGURE 2. – Trailer capacity at different moisture contents using conveyor-fed loading. For values of less than 35% the truck will become volume limited. This applies to a 3500 ft³ drop center trailer 45 ft long. For moisture content greater than 35% the truck will become weight limited

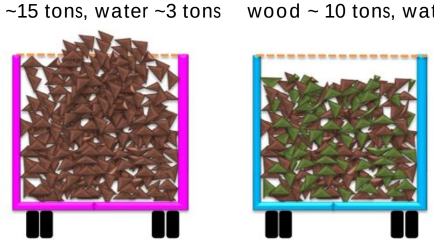

FIGURE 3.– Bulk density comparison of green versus dry residues.

Analysis and Results

Preliminary results indicate that the proportion of bark, needles and other substances in green residue is higher than in dry material (14% versus 8%) (Figure 4). When residue is green, needles are still attached to the branches and therefore the proportion of needles as a function of the total weight increases. Additionally, bark tends to fall off the branches as the material becomes drier due to the natural shrinking of the wood.

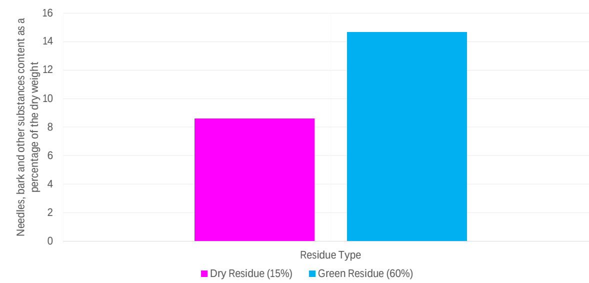

FIGURE 4.– Needles, bark and other substances in green versus dry residues.

Chemical analysis was done for screened grinding "accepts" between 3" and 1/8" particle size (Figure 5). The screened out fines removed some, but probably not all, bark, needles, and dirt. Dry residue "accepts" had higher polysaccharides and lower ash content compared to green residue "accepts".

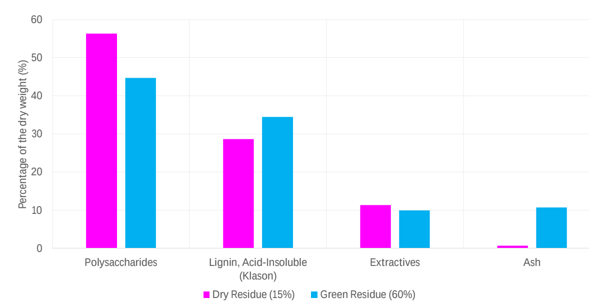

FIGURE 5.– Chemical analysis of green versus dry feedstocks

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