CANADA

Timber Talks

Department of Fisheries and Forestry

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Measurement of Moisture in Forest Fuels No. 62

Extent of damage from fire within a forested area and success in its control is dependent on the nature of the fuel complex. The quantity, size, arrangement and species of the component parts influence the behavior and rate of spread of the fire. Flammability of the fuel is closely related to its percentage moisture content, the weight of absorbed and adsorbed water as a percent oven-dry weight of the fuel. The development of reliable fire danger rating systems and acceptable prediction of fire behavior require that moisture be evaluated to $\pm$ 5 percent of its true value, although, for practical application, less accuracy may suffice.

Oven drying has been a favored method for determining the moisture content of cellulose. This method is simple, inexpensive, does not require standardization of fuel particle size, and a large number of samples can be processed simultaneously. Unfortunately, the drying period is lengthy (24 hr at 105°) and the continuous operation of a generator in field laboratories is costly and impractical. Freeze-drying, distillation processes and titration are alternative methods, all having one or more of the disadvantages of high initial cost, limited sampling capacity, and long periods of power consumption.

The Karl Fisher titrimetry method of determining moisture content was selected as being suitable for use in a mobile field laboratory as it is quick, required only short periods of power consumption, and is adaptable to a variable number of samples. This technique involves the extraction of water from a known weight of a finely ground sample by a known volume of methyl hydrate. As reduction of fuel particle size is commonly accomplished with a Wiley mill, its limitations were investigated and moisture lost during the grinding process was determined.

Simulated natural fuel components were tested. White pine match-splints and 2-year-old ponderosa pine needles represented twig and foliar components of the litter, respectively, and one-half-inch Douglas-fir dowels represented the large sized natural fuels. After preliminary conditioning, milled and unmilled samples of each type of material was oven-dried for 24 hours; samples were then weighed and the moisture content calculated.

The moisture content of milled samples was less than that of the unmilled. Moisture loss was greatest in samples with the highest initial moisture content and increased as the particle size was reduced. Differences in moisture loss attributable to type of fuel were not evident. Some difficulty was experienced with grinding because compacting of the material occurred. However, it is possible to grind to 40 mesh fuels having an initial moisture content of approximately 20, 25 and 40% for needles, match-splints and dowels, respectively. Fuels having a moisture content less than 20% are more easily processed and if milled to only 10 mesh, moisture content up to 120 percent can be tolerated.

Determination of moisture content by a process that includes grinding fuel particles in a Wiley mill is unsatisfactory. Errors as high as 40 percent of the true value were obtained when particles were reduced to 40 mesh, and up to 5 percent when grinding was to 10 mesh.

REPORT: Errors in Fuel-Moisture Measurement Resulting from Grinding in a Wiley Mill. S.J. Muraro and W.L. Cave, Forest Research Laboratory, Victoria, B.C.