Matapedia roundwood tarping trials

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By:

Sylvain Volpé, Forest Feedstocks

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CONTACT

Sylvain Volpé
Scientist
Forest Feedstocks
514 782-4521
sylvain.volpe@fpinnovations.ca

Disclosure for Commercial Application: If you require assistance to implement these research findings, please contact FPInnovations at info@fpinnovations.ca.

Table of contents

List of figures

Keywords

Biomass, moisture content, drying, storage, tarps, roundwood

Abstract

The effects of natural drying in relation to the use of tarps on the moisture content of stacked softwood roundwood were examined. Biomass quality logs were stored for a period of 15 months in a mill yard in the Bas Saint-Laurent region of Quebec. The results of the study showed that the roundwood dried naturally during the summer season with moisture content at the end of the season below 30%. Tarping the roundwood piles during the fall and winter prevented an average increase in moisture content of 6%.

INTRODUCTION

Biomass is a fuel source that is gaining more popularity in Quebec, and the Matapedia region is one of the forerunners in this development. The biomass used in the region is mainly dedicated to supplying boilers used for heating commercial and institutional buildings individually or by small-scale district heating systems. Heating systems used in these applications are usually below 2 MW and heating systems of that size are generally sensitive to the quality of biomass, especially moisture content (MC).

One of the challenges to biomass suppliers is to store sufficient volumes of biomass during the spring and summer to supply boilers during the fall and winter, when increased precipitation tends to offset some of the drying that had taken place during the summer months. Experience from Europe, where biomass is stored over long periods, has indicated that summer drying gains can be preserved by tarping the biomass (Röser 2012).

The purpose of this study was to determine the effects of applying tarps on the natural drying process of logs. The trial took place in Ste-Florence in the Bas-Saint-Laurent region, Quebec, where the biomass was stored for 15 months (January 2012 to March 2013) (Figure 1).

Figure 1. Piles of roundwood stored on the site of Coopérative forestière de la Matapédia (CFM).

METHODS

The roundwood used in the study was harvested in December 2011 and piled in January 2012. Eleven truckloads of small-diameter balsam fir logs (2.5 m in length with average large-end diameter of 11 cm) were used (Figure 2). All truckloads were piled separately so that each represented a sample unit. The piles had average dimensions of 12.5 m (length) × 2.5 m (width) × 2.3 m (height), and averaged 15 oven-dry tonnes.

Figure 2. Piling operation in January 2012.

In January 2012, eight sample discs were taken from each pile prior to the piling operation. The discs were then weighed and put into a drying oven for 24 hours at 105°C to assess initial moisture content (Figure 3).

Using a 68-tonne capacity scale with an accuracy of 10 kg, the piles were loaded onto trucks and weighed to determine the initial weight and correlate to moisture content (wet basis) of each pile (Figure 3). Following the initial weighing in January 2012, the piles were weighed at different times during the trial to monitor the moisture content in May, September, and December, then in January and March 2013.

Figure 3. Disc samples (top) and pile weighing (bottom) to determine moisture content.

Tarping with paper-based tarps was carried out in January and September 2012 (Figure 4). Two piles were covered in January and six additional piles were covered in September, while three control piles were left uncovered. Two types of commercial tarps were used—Bioblanket, a Canadian product, and Walki, a Finnish product.[1] These tarps are composed mainly of water-resistant paper, and are reinforced with a layer of polyethylene to provide special waterproof properties and a mesh of polypropylene to increase tear resistance.

Figure 4. Tarping operation to cover roundwood piles in September 2012.

[1] Bioblanket: http://www.interwrap.com/coating-lamination/bioblanket.html.
Walki: http://www.walki.com/web/walki-Biomasscover.

A weather station (Davis Vantage Pro2 Plus) with solar power was installed at the storage site to accurately measure precipitation and temperature during the trial (Figure 5).

Figure 5. Davis Vantage Pro2 Plus weather station used to measure on-site precipitation.

RESULTS

In Matapedia during 2012, the average temperature was 4.5°C and the amount of precipitation was 718 mm (Figure 6). The average temperature and precipitation over the last 30 years for the region was 1.9°C and 1150 mm, respectively.

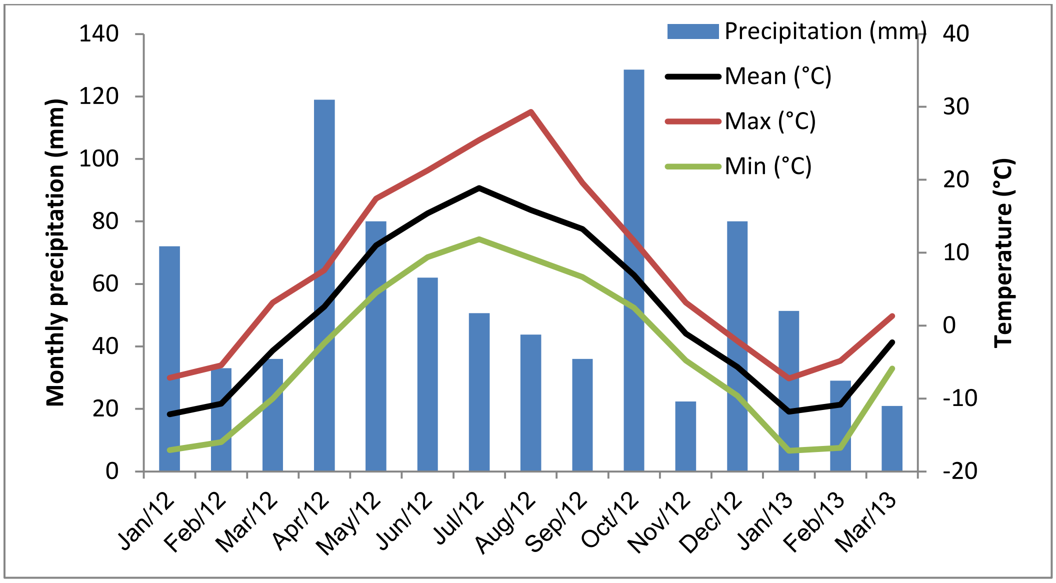

Figure 6. Weather conditions in Matapedia during the months when drying was monitored.

Evaporation of moisture from the ground surface (which we can relate to moisture loss from wood) measured by the weather station exceeded absorption from precipitation during the months of June to November, which allowed the biomass to dry naturally in the open air (Figure 7).

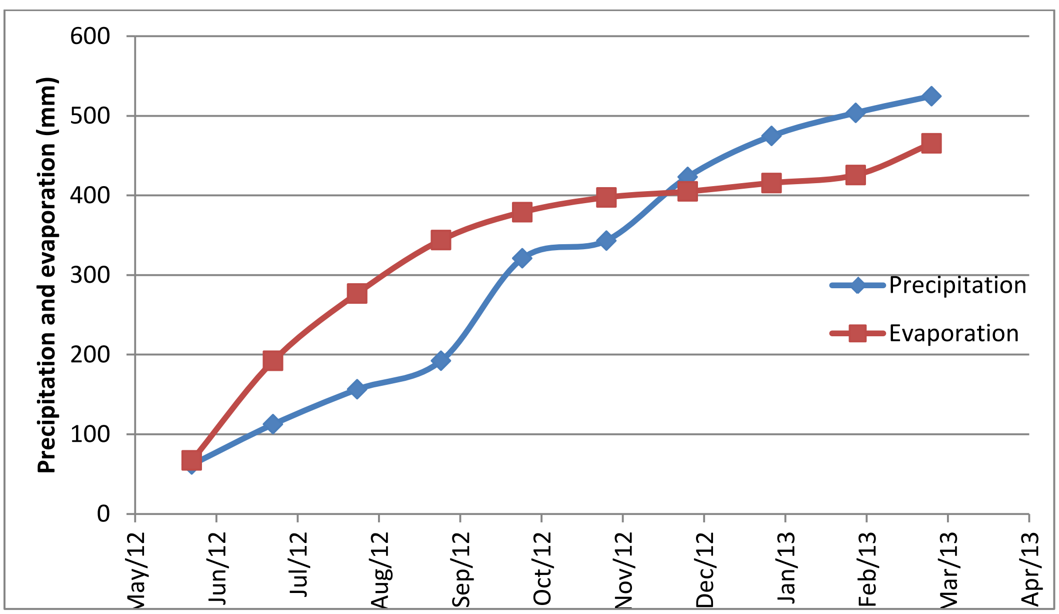

Figure 7. Precipitation and evaporation in Matapedia during the trial.

The average moisture content of the roundwood was 57% in January 2012, 48% in May 2012, and 22% in September 2012 (Figure 8). Reductions in moisture content of 20–30% were measured in similar studies by Nurmi and Hillebrand (2007), Nurmi (2014) and Röser et al. (2010).

The biomass dried slowly during the winter months from January to May 2012 during the initial storage phase. After the summer drying period, all of the piles had moisture contents below 30%. From September 2012 onwards, eight piles were covered with tarps and three were left uncovered. The average moisture contents of the covered and uncovered piles during the September tarping operation were the same at 22%. In early winter, after the fall rainy season, the moisture content of the uncovered piles was 10 percentage points higher compared to covered ones. The average difference in moisture content between December 2012 and March 2013 for the covered and uncovered stacks was 6 percentage points (Figure 8).

Based on a cost of $1/m^2 for the tarp and the assumption that it would take 15 minutes to cover a pile of 15 oven-dry tonnes (odt) using a truck's boom, a total cost of $4.75/odt was determined. Considering that drier biomass has a higher energy content, the extra cost of tarping can be justified if the moisture content is reduced by at least 5 percentage points.

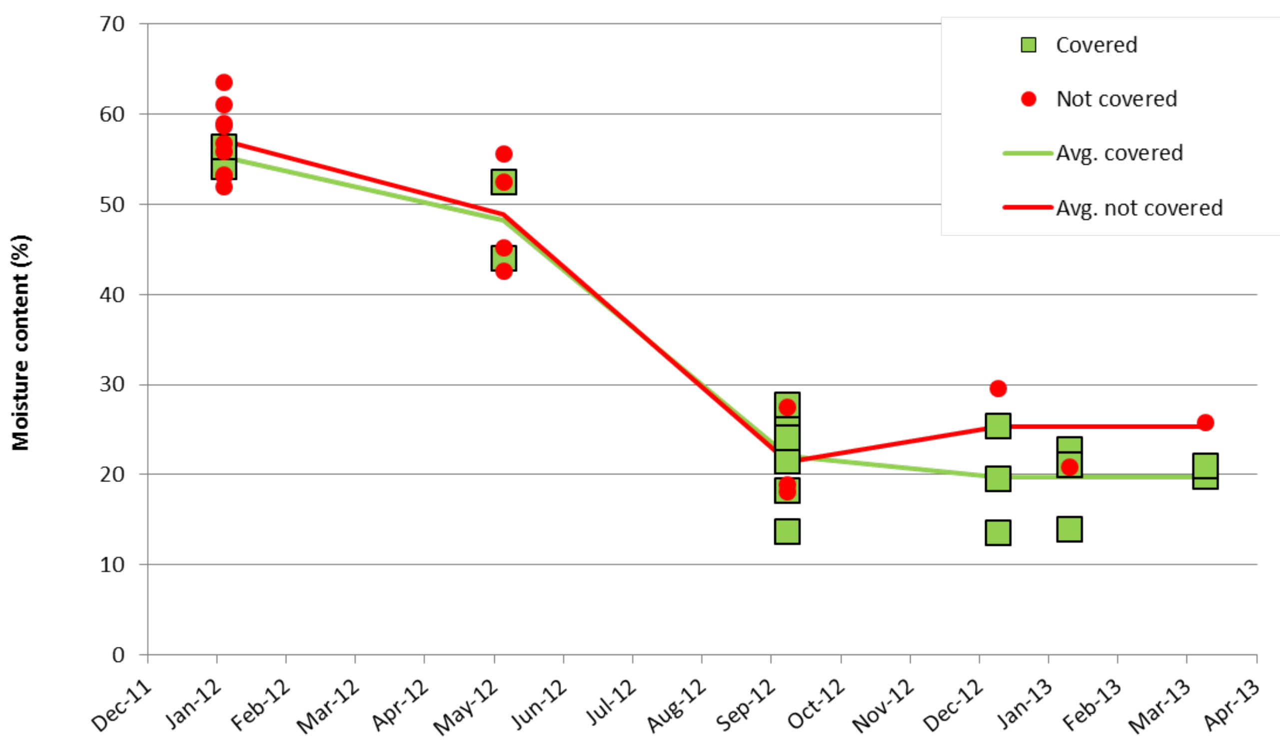

Figure 8. Natural drying curve for covered and uncovered piles.

IMPLEMENTATION

- Tarp application can be done using any mobile machine with a grapple loader that can lift a 180-kg steel roll dispenser and a 300-kg paper roll.
- During storage, tarps need to be held down by logs to prevent wind from blowing them off or ripping them apart.
- Operators (loading equipment and on the ground crew) should be careful when applying tarps over log piles, especially when conditions are windy which can make the tarps difficult to handle.
- Official suppliers of paper-based tarps should be used for this application as their products specifically designed for the purpose. There is currently only one North American producer of paper-based tarps based in Vancouver, Canada (Interwrap).
- Between May and September, there is no need for tarps as average moisture losses are similar to piles that aren't covered.
- From September to March, tarping slows the moisture content gain compared to uncovered piles.
- Tarping is economically justifiable only if the biomass is delivered to the customer before the end of winter. If the biomass is only intended to be sold after the next summer season, it will dry naturally during the summer and no tarping is required.
- Results proved to be successful with small diameter softwood logs stored in a temperate North American climate such as results obtain in similar Scandinavian climates (Nurmi 2014; Roser 2010). Other species, product size, and climate conditions should be tested to confirm if similar patterns exist under different conditions.
- A prediction model based on the time of harvest, storage period, and meteorological data would optimize the drying time and the time of use. Further studies are needed to develop such a model.

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Head Office

Pointe-Claire
570 Saint-Jean Blvd.
Pointe-Claire, QC
Canada H9R 3J9
T 514 630-4100

Vancouver
2665 East Mall
Vancouver, BC
Canada V6T 1Z4
T 604 224-3221

Québec
319 Franquet
Québec, QC
Canada G1P 4R4
T 418 659-2647

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