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Tarping of Pulp Log Decks to Maintain Low Moisture Content: Interim Report

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By:

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ABSTRACT

FPInnovations, in cooperation with BC Timber Sales and Coast Tsimshian Resources, is in the process of performing a tarping trial in an attempt to maintain low moisture content of pulp logs in the Terrace region.

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INTRODUCTION

Interest in feedstocks for pellet production has been increasing in the Terrace, B.C. area for a number of years. However, Terrace has one of the highest annual precipitation rates in Canada, and western hemlock, which has high green moisture content, is the predominant tree species. One of the critical factors affecting the financial viability of a pellet production plant is the moisture content of the feedstock utilized because it must be dried to approximately10% moisture content before use. Drying of pellet feedstock is accomplished in large dryers that use hog fuel, pellet residuals, or natural gas as fuels. The higher the moisture content of the feedstock, the more biomass is necessary to fuel the dryer and the longer the feedstock remains in the dryer. Feedstock drying costs can be 20–50% of the total pellet production cost, depending on the initial moisture content of the feedstock and the fuels utilized to dry it.

Several storage methods and technologies have been considered to reduce moisture content, including seasoning logs in carefully configured pile shapes and in covered storage buildings. One of the most promising technologies consists of covering piles (pulp decks or residue piles) with “breathable tarps” that allow the moisture to evaporate from the deck or pile, yet prevent it from gaining moisture during rain or snow.

FPInnovations, in cooperation with BC Timber Sales and Coast Tsimshian Resources, is in the process of performing a tarping trial in an attempt to maintain low moisture content of pulp logs in the Terrace region. This report is an interim summary of the activities performed in the 2014–2015 fiscal year ending on March 31, 2015. The second half of the trial will be completed in the 2015–2016 fiscal year.

METHODOLOGY

Summary

Two large decks of roundwood were assembled in the Coast Tsimshian Resources log sortyard in late January 2015 (Figure 1) and will be tarped in late summer 2015, when moisture content is typically lowest. Moisture content samples were collected immediately after the decks were built and will be collected throughout the year to determine the effectiveness of the tarping methods and material. A short paper exercise was completed and described using FPJoule™, FPInnovations’ tool for calculating the amount of usable energy in biomass, to evaluate the costs and benefits of the tarping application.

Figure 1. Front-end loader arranging logs for sample decks.

Piles

Two large decks made from pulpwood located at the Coast Tsimshian Resources log yard were piled approximately 3.5 m in height and 25 m in length (Figure 2). The piles were created with a flat top to facilitate the application of the tarping material.

Figure 2. Finished sample deck.

Tarping material

The tarping material to be used in this trial is BioBlanket™—a paper-based laminate reinforced with scrim (a very light textile made from cotton, or sometimes flax). BioBlanket™ is produced by InterWrap and is widely sold by many companies throughout Europe. More information about the product can be found on the InterWrap website.[1]

Moisture content

"Cookie" samples were randomly cut from pulp logs located throughout the two decks. Moisture content analysis (wet basis) of the cookies was completed at FPInnovations' Vancouver laboratory. The moisture content will continue to be re-assessed every two months until the end of March 2016.

Figure 3. Sample deck.

Scenarios

FPJouleTM

FPInnovations recently completed a tarping module for the FPJoule™ program. FPJoule™ allows the user to do the following:

- Determine the amount of energy obtained when burning a given mass of residues of a certain species, type, and moisture content. A conversion tool calculates monetary equivalents (per weight, volume, or energy content).

[1] http://www.interwrap.com/Coating-Lamination/BioBlanket.html

- Calculate annual potential savings by modifying the traditional energy supply to biomass.
- See an overview of the analysis and print a copy.

More information on FPJoule™ is available on FPInnovations' website.[2]

FPJouleTM – tarping module

The new tarping module was designed to help users calculate the savings associated with utilizing drier, tarped feedstocks.

Three scenarios were developed with three log pile heights: 2 m, 3.5 m, and 5 m. The species, material cost, machine cost, labour cost, and price of delivered biomass are presented in Table 1. The scenarios will prove the benefit of protecting more volume of biomass with the same amount of tarping material.

Table 1. Inputs for FPJoule

Inputs	Values used
Fixed	
Basic density of species	Hemlock–balsam mix (420 kg/m^3)
Tarp cost ($/m^2)	1.00
Time to place tarp into position (h)	0.5
Machine cost ($/SMH)	180.00
Labour cost ($/h)	20–30
Price of delivered biomass ($/m^3 or $/odt)	50.00
Month of primary harvest	January
Storage period (months)	12
Pile length (m)	22.5
Pile width (m)	6
Variable	
Pile height (m)	2, 3.5, 5

INTERIM RESULTS AND DISCUSSION

Moisture content

The moisture content averaged 46.5% and ranged from 24.2 to 61.5% (Table 2). The variance in moisture content was likely due to the location of the logs within the original pile they came from in the

[2] http://fpjoule.fpinnovations.ca/Views/Welcome.aspx

sortyard or the length of time the logs had spent in the sortyard. Logs may have been sheltered in the centre of the pile or sunk into the mud below the pile.

Table 2. Results of moisture content analysis of logs in sample decks

Species	No. samples	Moisture content (%)		
		Average	High	Low
Western hemlock	31	46.9	55.9	24.2
Balsam	9	45.2	61.5	28.9
Total	40	46.5	61.5	24.2

The moisture content will likely decrease somewhat in the spring and then decrease faster in the warm weather in the summer. As the decks were already very wet at the set-up time in January, it was decided that waiting to tarp until September, when the moisture content is likely at its lowest, would be a more effective use of the tarps to maintain a low moisture content in the subsequent winter months.

Scenarios

A table was created for each scenario using the FPJoule^{TM} tarping module. These tables show the cost savings of lowering moisture content with a tarping treatment. They also show the moisture content that the tarped feedstock must reach in order for the treatment to be profitable (Tables 3 to 5).

For example, in Table 3, a feedstock that starts at 45% moisture content (y-axis) and achieves 25% (x-axis) by the end of the tarping treatment will save the end user $0.63 per cubic metres after the cost of tarping is considered. These savings are important for end-users such as pellet producers that require low moisture content (~10%) in feedstocks. Most pellet producers utilize dryers to achieve this goal, so by lowering or maintaining low moisture content, the feedstock requires less time in the dryer and thus a lower cost to produce pellets.

As the height of the pile increases, the volume under the effect of the tarp also increases, decreasing the cost per unit involved in the treatment.

In Tables 3 to 5, red values indicate a financial loss for the treatment, while black values indicate a financial gain.

Scenario 1 – 2 m height

Table 3. Cost/benefit for deck 2 metres in height

Pile Height - 2.0m	Finish Moisture Content (%)											
Starting Moisture Content (%)	10	15	20	25	30	35	40	45	50	55	60	Break even MC
10	-$1.88											None
15	-$1.65	-$1.88										None
20	-$1.34	-$1.57	-$1.88									None
25	-$0.94	-$1.17	-$1.49	-$1.88								None
30	-$0.47	-$0.70	-$1.01	-$1.41	-$1.88							None
35	$0.09	-$0.14	-$0.45	-$0.85	-$1.32	-$1.88						12.2%
40	$0.76	$0.52	$0.22	-$0.18	-$0.65	-$1.22	-$1.88					22.8%
45	$1.57	$1.33	$1.02	$0.63	$0.15	-$0.41	-$1.07	-$1.88				31.5%
50	$2.59	$2.36	$2.05	$1.65	$1.18	$0.62	-$0.05	-$0.86	-$1.88			39.7%
55	$3.98	$3.74	$3.43	$3.04	$2.56	$2.00	$1.33	$0.52	-$0.50	-$1.88		47.7%
60	$5.96	$5.73	$5.42	$5.02	$4.55	$3.99	$3.32	$2.51	$1.49	$0.10	-$1.88	

Scenario 2 – 3.5 m height

Table 4. Cost/benefit for deck 3.5 metres in height

Pile Height - 3.5m	Finish Moisture Content (%)											
Starting Moisture Content (%)	10	15	20	25	30	35	40	45	50	55	60	Break even MC
10	-$1.08											None
15	-$0.84	-$1.08										None
20	-$0.53	-$0.76	-$1.08									None
25	-$0.14	-$0.37	-$0.68	-$1.08								None
30	$0.34	$0.11	-$0.20	-$0.60	-$1.08							16.9%
35	$0.90	$0.67	$0.36	-$0.04	-$0.51	-$1.08						24.5%
40	$1.57	$1.33	$1.02	$0.63	$0.15	-$0.41	-$1.08					31.4%
45	$2.37	$2.14	$1.83	$1.43	$0.96	$0.40	-$0.27	-$1.08				38.1%
50	$3.40	$3.17	$2.85	$2.46	$1.98	$1.42	$0.76	-$0.05	-$1.08			44.7%
55	$4.78	$4.55	$4.24	$3.84	$3.37	$2.80	$2.14	$1.33	$0.31	-$1.08		51.3%
60	$6.77	$6.54	$6.23	$5.83	$5.35	$4.79	$4.13	$3.32	$2.30	$0.91	-$1.08	

Scenario 3 – 5 m height

Table 5. Cost/benefit for deck 5 metres in height

Pile Height - 5.0m	Finish Moisture Content (%)											
Starting Moisture Content (%)	10	15	20	25	30	35	40	45	50	55	60	Break even MC
10	-$0.75											None
15	-$0.52	-$0.75										None
20	-$0.21	-$0.44	-$0.75									None
25	$0.19	-$0.05	-$0.36	-$0.75								14.1%
30	$0.66	$0.43	$0.12	-$0.28	-$0.75							21.6%
35	$1.22	$0.99	$0.68	$0.28	-$0.19	-$0.75						28.1%
40	$1.89	$1.66	$1.34	$0.95	$0.47	-$0.09	-$0.75					34.3%
45	$2.69	$2.46	$2.15	$1.76	$1.28	$0.72	$0.05	-$0.75				40.4%
50	$3.72	$3.49	$3.18	$2.78	$2.31	$1.75	$1.08	$0.27	-$0.75			46.5%
55	$5.10	$4.87	$4.56	$4.17	$3.69	$3.13	$2.46	$1.65	$0.63	-$0.75		52.5%
60	$7.09	$6.86	$6.55	$6.15	$5.68	$5.12	$4.45	$3.64	$2.62	$1.23	-$0.75	

GOING FORWARD

Moisture content analysis will be done for samples taken from the pulp logs every two months, in order to create a moisture profile that will compare pre- and post-tarping treatments. Tarping of the piles will occur in late summer 2015. Moisture content analysis of samples will continue to be performed until March 2016.

The FPJoule™ tarping module will be able to track the financial gains or losses of the tarping treatment throughout the duration of the trial.

A final report will be produced after the completion of the trial in late March 2016.

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