

Suitability of bamboo as a renewable energy resource

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Bamboo species are perennial grasses with a rapid sprout growth. While this growth takes usually 40 to 50 days, but never longer than one year, the maturation time ranges from two to five years (LI et al., 2005). During this period chemical characteristics are changing.

The aim of this study was to determine characteristics of thermal combustion of bamboo in dependency on the culms age as well as against the position along the culms height. Therefore *Phyllostachys pubescens* and *Bambusa emeiensis* had been analysed on the calorific value and moisture content.

METHODOLOGY

The study was conducted into two parts: Initially DIETENBERGER (2009) analysed 96 samples of *B. emeiensis* taken of different aged culms in three different heights at 1.5 m (bottom), 5.0 m (middle) and 10.0 m (top) along the culm. The samples were obtained from Shaoping village, Guangxi province, PR China in 2009. Additionally 27 samples of *Ph. pubescens* were taken also in 2009 in Nanjing village, Zhejiang province, PR China.

SCHOENHERR (2010) examined 162 samples of *Ph. pubescens*, taken from 27 culms. Again the samples were obtained from the bottom, middle and top of the culms.

Table 1: number of samples for laboratory analyses

age [year]	<i>Phyllostachys pubescens</i>		<i>Bambusa emeiensis</i>	
	number of samples	number of culms	number of samples	number of culms
0.5	54	9		
1.0	9	1	15	2
1.5			9	1
2.0	9	1		
2.5	54	9	27	3
3.0	9	1		
4.5	54	9		
5.0			9	1
5.5			18	2
9.0			9	1
10.0			9	1
total	189	30	96	11

For both parts of the study, analyses of calorific value were accomplished according to the standard DIN 51 900-2 and moisture content according to the standard DIN 52 183.

RESULTS

Compared to wood, the moisture content of bamboo is much higher at an average of 136.9 % and high standard deviation. Both species show a strong decrease in moisture content within maturation time, *Ph. pubescens* seems to have lower values in young ages. When the moisture content reached about 60 %, there seems to be no further decrease for both species. Along the culms height there is a strong decrease of moisture content from the bottom (in average 121.4 %) to the top (in average 41.3 %). This is true for *Ph. pubescens* and *B. emeiensis*.

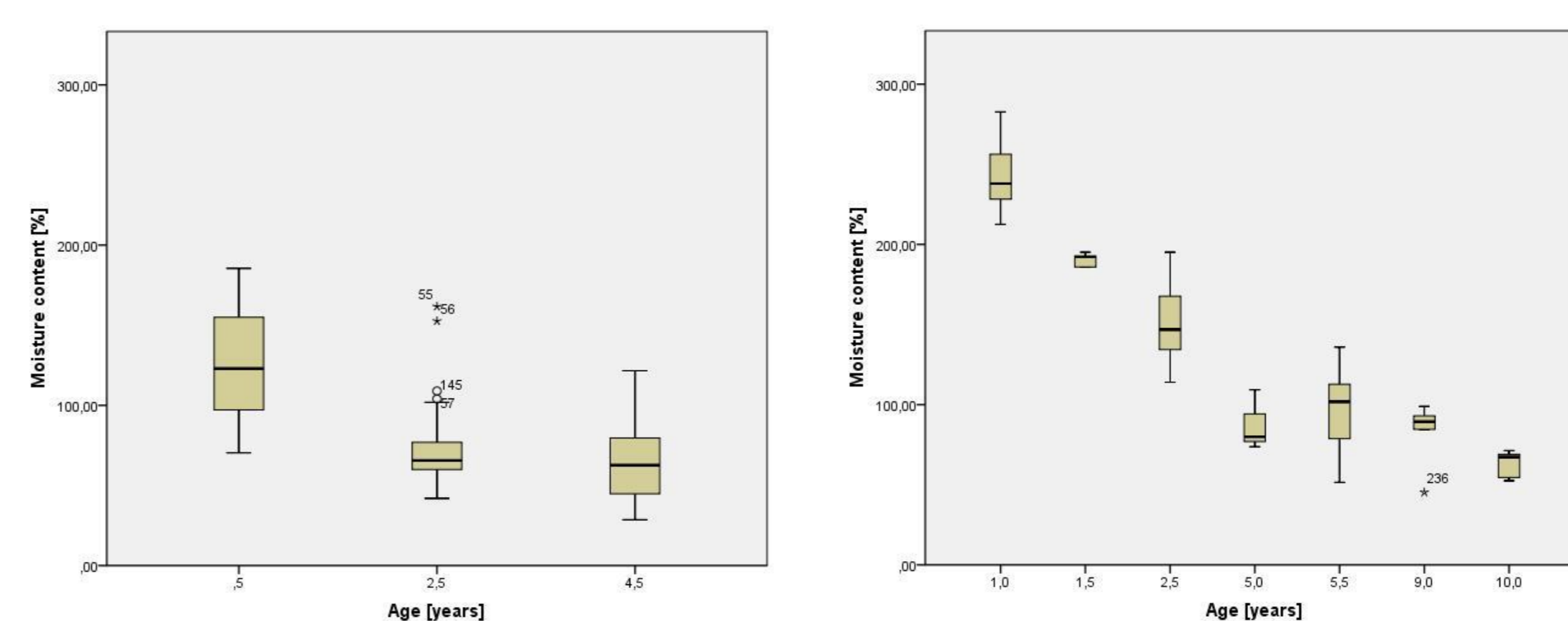


Figure 1: Moisture content of *Phyllostachys pubescens* (left) and *Bambusa emeiensis* (right) against the culms age

The calorific value of both bamboo species is not changing significantly with the culms age. In average *Ph. pubescens* shows a calorific value of 19,443.9 J g⁻¹ and the value of *B. emeiensis* was 18,323.6 J g⁻¹ in average. This is comparable to Norway spruce or poplar.

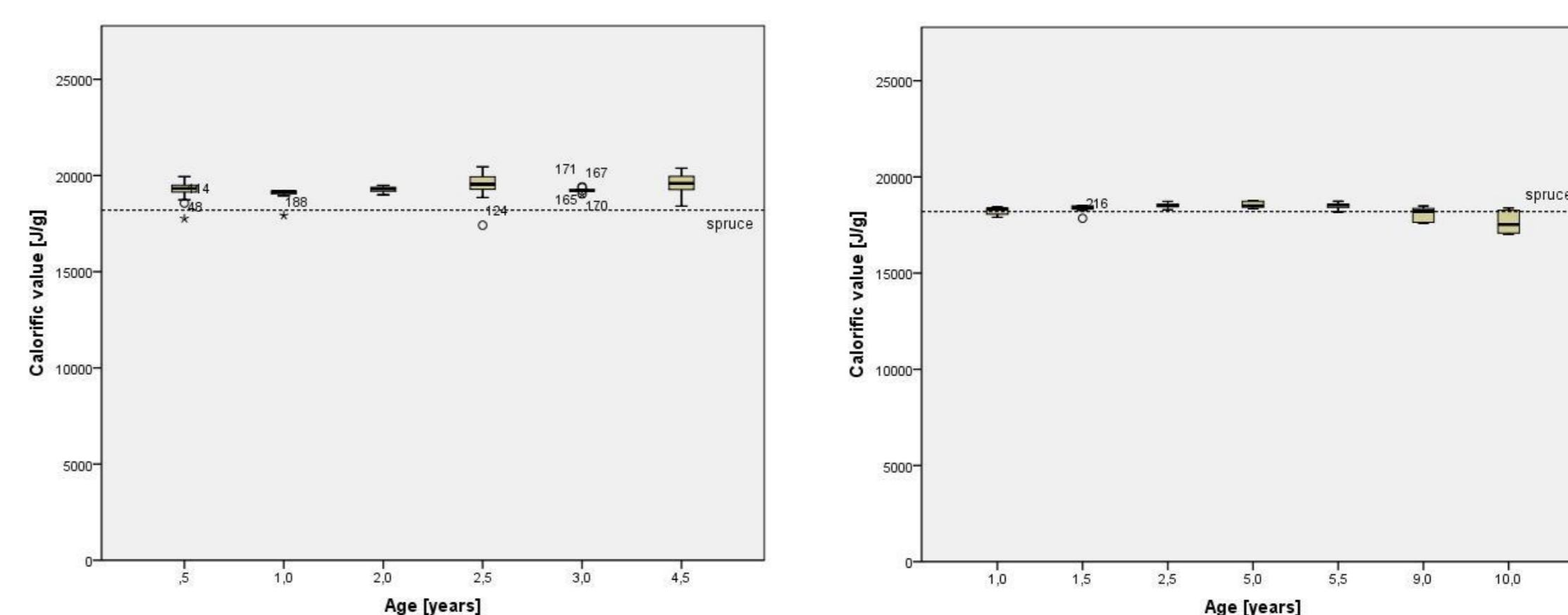


Figure 2: Combustion value of *Phyllostachys pubescens* (left) and *Bambusa emeiensis* (right) against the culms age

CONCLUSIONS

Results show that from the energetic point of view, even young bamboo at an age of one year are suitable for thermal combustion. But taking energy efficiency into account, lower moisture content is favoured, so the recommended harvesting time would be around 2 to 3 years, as moisture content does not continue to decrease with time anymore.

Due to the high value of material uses of bamboo in general and a comparatively low moisture content of the upper part of the culms, it is furthermore recommended, to use only the top of the culms for energy recovery, while using the bottom of the culms for other material purposes.

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