NOTE

VARIATION IN AVAILABILITY OF BARK FROM *PINUS RADIATA* LOGS, IN THE CENTRAL NORTH ISLAND OF NEW ZEALAND

R. C. WOOLLONS and J. H. POWELL*

ABSTRACT

An equation is derived to model the weight of green bark obtained from debarking Pinus radiata *sawlogs at a processing site. The tonnes of bark available during a year can change by 50%, and some fall-off in realised weight can occur in later winter months.*

INTRODUCTION

In 1981 N.Z. Forest Products Ltd commenced processing bark extracts (commercially called Tannaphen) at its Kinleith Mills, near Tokoroa. From a production viewpoint, a major question was the amount of bark that could be obtained from radiata pine logs arriving at the Kinleith and other outlying sawmills, throughout a year.

The volume of bark associated with *Pinus radiata* trees in the forest has been estimated by C. J. Goulding (pers. comm.) to be approximately 18%, that is, volume of bark is 18% of volume of wood, inside bark. For predicting likely amounts of bark available for consumption in the Tannaphen plant, this estimate is plainly inappropriate. When felling, hauling and subsequently transporting a stem from forest to mill, a proportion of the bark is knocked or dragged from the bole, and this loss rises sharply when cambial activity becomes pronounced.

Throughout 1979, nine studies of bark reaching the Kinleith site were carried out. In each case, a load of logs was intensively scaled for wood volume, and all the bark scraped from the logs was weighed. From these trials it was estimated that from April to September one tonne of wood was likely to realise 50 kg of green bark, but in the remaining months only 30 kg could be expected.

*N.Z. Forest Products Ltd.

FURTHER STUDIES

One of the sources of bark for the Tannaphen plant is the Kinleith sawlog intake, and from May 1981 to April 1983 the total monthly tonnes of bark extracted were measured and recorded.

Table 1 gives the average tonnes per day of green bark for a year, together with the average tonnes per day wood intake.

TABLE 1: AVERAGE INTAKE OF TONNES OF WOOD, AND ACQUIRED TONNES OF GREEN BARK DURING THE YEAR

	Average Tonnes Bark per day	*Average Tonnes Wood per day*
January	68.5	1443
February	68.0	1514
March	88.0	1772
April	86.2	1927
May	100.7	1920
June	101.0	2239
July	95.0	1847
August	95.5	1942
September	83.8	2243
October	77.5	1938
November	70.5	1930
December	73.0	1868

RESULTS AND DISCUSSION

It is evident that the first assumption of two constant conversions for a year was incorrect. Table 1 clearly shows a sinusoidal relationship, reaching a maximum during May-June.

To develop a general equation to predict green weight tonnes of bark as a function of tonnes of wood and time of year, the data were augmented by the actual tonnes of wood delivered to the sawlog intake, for the relevant months .

A model

$$E(B—x) = aTM^{b}e^{-cM} \qquad (1)$$

where E = statistical expectation
B = green weight tonnes per day of bark
T = thousands of tonnes per day of wood
M = months of the year (Jan.=1, Feb.=2, etc.)
x = an arbitrary constant
a,b,c = parameters estimated by non-linear ordinary least squares

was developed, which gave an excellent fit of the data. The approximate coefficient of determination was 0.807, and plots of residuals against predicted values, months, and wood tonnes gave no sign of systematic bias (Draper and Smith, 1966). All parameter estimates were significantly different from zero according to the asymptotic confidence intervals calculated by the non-linear procedure, at the 95% level.

The data shown in Table 1 are compromised in that the bark yields are partly determined by the wood flow of any month. Figure 1 shows the bark yield for a year, calculated by equation (1) above, using the overall average daily wood intake over the two years spanning the data.

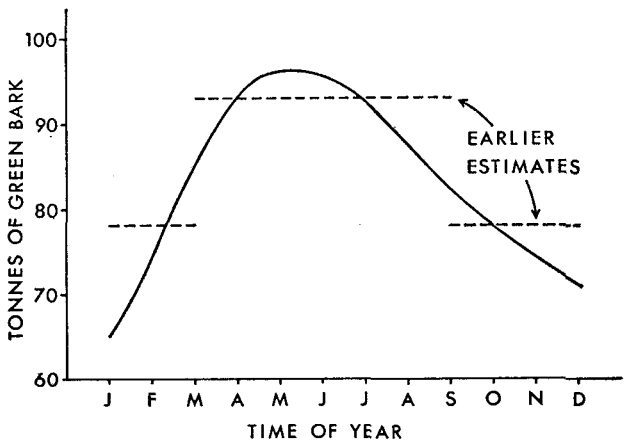

FIG. 1: *Tonnes of bark obtained during a year.*

After adjustment for wood inflow, it is clear that available green weight of bark is strongly related to time of year, and can vary by 50%. The failure of the early samples (the estimates are depicted in Fig. 1) to reflect this variation is reasonably attributed to an inadequate sample size.

The shape of the weight equation logically follows seasonal *Pinus radiata* green density (Ellis, 1978; Woollons, unpubl. data), as log weight is usually measured with the bark attached. The extent of the amplitude of the weight equation may be slightly confounded with bark moisture content, dirt, and extraneous debarked wood.

The derived equation is mainly useful for estimating potential bark tonnes, but it does provide some implicit evidence that

cambian activity can be significant as early as August, which is perhaps surprising considering the rigour of the central North Island winter.

ACKNOWLEDGEMENTS

The authors are grateful to N.Z. Forest Products Ltd for permission to publish the data, and to Mrs S. Ross for typing the manuscript. Dr J. M. Harris and J. C. Ellis of the Forest Research Institute, Rotorua, provided helpful comment.

REFERENCES

Draper, N. R.; Smith, H., 1966. *Applied Regression Analysis*, 1st ed. Wiley, New York.

Ellis, J. C., 1978. Weight scaling of radiata pine logs from Riverhead forest in Auckland Conservancy. *In* D. A. Elliot (comp.), Mensuration for management planning of exotic forest plantations. *FRI Symp. No. 20*: 477-84.