Technical Report

Title: Feasibility trials –peeling posts from durable eucalypt logs

Author/s: Daniel Boczniewicz, Paul Millen and Clemens Altaner

Date: 1/6/2021

Report: SWP-T123

TABLE OF CONTENTS

supported by forestgrowers commodity levy

BACKGROUND

The NZDFI aims to establish a ground-durable eucalypt resource under a short rotation regime to produce pole wood for use as agricultural posts (Millen et al., 2020; Millen et al., 2019). While manufacturing of round wooden posts is a mature technology for which machinery of various capacity and different technical solutions exist, their suitability to process the NZDFI species is unknown.
More details on wooden post manufacturing (Altaner, 2020) and experience of durable eucalypts used as agricultural posts (Lambert and Severino, 2018; Millen and Altaner, 2017; Millen et al., 2018) can be found elsewhere.

OBJECTIVE

The objective of this work was to test the feasibility of manufacturing posts from NZDFI species with existing post manufacturing machinery. The work focused on the question of whether the thick and fibrous bark of the durable eucalypt poses a challenge for the post manufacturing machinery. It was not intended to produce an elaborate data set enabling robust statistical analysis but rather observe the post production process with the NZDFI species to a) give confidence that round posts can be produced from NZDFI species and b) identify potential problems guiding the development of technical solutions. A by-product of the trial were the availability of a small number of posts for further study and demonstration purposes.

MATERIAL

Posch (Schälprofi 500) trial

One subdominant/suppressed tree of each, *E. bosistoana, E. quadrangulata* and *E. globoidea*, planted in 2003 in Marlborough NZ, were felled on the 30th of October 2020 and cut into 1.2 m long logs. Half of the logs from each tree were debarked in the forest (Figure 1). The logs were shipped to Invercargill (Figure 2). Information on the average diameter of the logs before peeling can be found in the appendix (Figure 18).

Morbark trial

Three subdominant/suppressed *E. bosistoana* (age 17 years), one dominant *E. quadrangulata* (approx. age 14 years), one supressed *E. globoidea* (age 17 years) and one dominant *Cuppresocyparis ovensii* (approx. age 14 years) trees were felled on the 19th of May 2021 in Marlborough, NZ. Stems were cut into 2.4 m long logs, of which a subset was debarked, and delivered to Dashwood timber (Renwick) (Figure 3). Information on the average diameter of the logs before peeling can be found in the appendix (Table 1).

Figure 1: Debarking E. globoidea log shortly after felling by first bruising with a sledge hammer and then stripping the bark with a spade.

Figure 2: 1.2 m long logs from one tree of each, E. bosistoana, E. quadrangulata and E. globoidea, were used for post peeling with the Schälprofi 500 (Posch). Every second log along the stem was manually debarked in the forest (see Figure 1).

Figure 3: 2.4 m long debarked and undebarked logs used for post peeling with the Morbark equipment.

Post production equipment

Schälprofi 500 – Posch

Access to a mobile post peeler (Schälprofi 500 – Posch, Austria) (Figure 4) was offered by Peak Equipment (Invercargill). The machine manual states that it can handle logs ranging from 3 cm to 25 cm in diameter and a having minimum length of 1.2 m. The machine was operated by Steve Winsloe (Peak Equipment) and posts were processed on the 6th of November, 1 week after felling. The RPMs were set to the middle of the recommended range and the peeling ‘strength’ was set to medium except for the second pass the *E. globoidea* logs with bark, which were peeled at the maximum setting.

Morbark

The trial was conducted with a Morbark post peeler, similar to the current PS8 model, at Dashwood Timber, Renwick on the 26th of May, one week after felling (Figure 4). According to the manufacturer the PS8 is able to peel posts from 7.6 cm to 30.5 cm diameter and 1.8 m to 3.6 m in length using a split peeling head with carbide-tipped cutterhead teeth to remove bark and knots and planer knives to provide a smooth surface after one pass through the machine. The productivity is up to 2,000 2.4 m posts during an eight-hour shift.

Figure 4: Posch Schälprofi 500 (left) and Morbark (right) post peeler used for durable eucalypts trials.

DATA COLLECTION

The small and large end diameter of logs was measured with a diameter tape before and after peeling and subsequently averaged. The peeling trial was documented by video and photographs were taken from the logs, posts, shavings and equipment. Commented videos of the trials are available from the corresponding author and on https://www.youtube.com/watch?v=mh6uhHJpxkE and https://youtu.be/nd1qDHo881w.

The operator was interviewed to comment on the performance of the machine when used on the durable eucalypts. Finally the posts were collected and stored for potential future use.

RESULTS

Posch Schälprofi 500

Debarked logs

The high density of the three durable eucalypt species (Bootle, 2005) appeared to be unproblematic for the Schälprofi 500 (Posch). The finish of the posts obtained from the debarked logs was similar for all three species (Figure 5) with branch stubs smoothly cut and comparable to what would be expected from experience with other species (i.e. chestnut, spruce).

Figure 5: Debarked logs after one pass through the Schälprofi 500 (Posch). E. quadrangulata, E. bosistoana and E. globoidea (from top to bottom).

The sapwood shavings resembled planer shavings (Figure 6) and cleared without difficulty from the machine and might be usable as animal bedding or mulch.

Figure 6: Sapwood shavings produced by the Schälprofi 500 (Posch) from debarked durable eucalypt logs.

Logs with bark

The performance of the Schälprofi 500 (Posch) differed for the undebarked logs (Figure 7). Most (but not all) of the bark could be removed from the *E. bosistoan*a and *E. quadrangulata* logs after 2 passes through the machine (Figure 8). The performance might be improved by optimising machine settings (i.e. RPMs and peeling intensity).
The bark shavings of those 2 species (Figure 7) appeared to clear from the machine and were of similar shape to the wood savings (Figure 6).

Figure 7: E. quadrangulata and E. bosistoana logs with bark after one pass through the Schälprofi 500 (Posch) (top) and a representative sample of the bark shavings (bottom).

Figure 8: E. globoidea (left), E. quadrangulata (middle) and E. bosistoana (right) logs with bark after two passes through the Schälprofi 500 (Posch).

The thicker and more fibrous bark of *E. globoidea* proved challenging. While the *E. globoidea* logs with bark passed through machine, most of the surface was still covered by bark after the first (Figure 9) and second pass (Figure 8).
The *E. globoidea* bark 'shavings' were fibrous (Figure 9) and appeared not to clear easily from the Schälprofi 500 (Posch) (Figure 10), potentially blocking the machine and requiring frequent maintenance/cleaning. The Schälprofi 500 also produced a significant amount of dust from the *E. globoidea* bark, potentially requiring dust extraction systems (refer to video).

Figure 9: E. globoidea logs with bark after the first pass through the Schälprofi 500 (Posch) (top) and a representative sample of the bark shavings (bottom).

Figure 10: Fibrous E. globoidea bark accumulating in the knife disk (left) and under the operating table (right) after the 1^{st} pass of the not debarked E. globoidea logs.

Removing the sapwood to produce heartwood posts (Figure 11) would require numerous passes though the machine, depending on the depth of the sapwood band. Removing all sapwood might not be necessary for all post products, however, only the heartwood cross section can be expected to last in the soil and provide strength for an extended period of time.

Figure 11: After passing an E. globoidea log (G7) five times through the Schälprofi 500 (Posch) most sapwood was removed.

General comments

On average, the Schälprofi 500 (Posch) reduced the diameter of the posts by ~1 cm, removing ~0.5 cm from the surface, independent of being bark or sapwood (Figure 12). However, the depth of peeling was not homogeneous over the surface of the log as can be seen by the patches of exposed wood after logs with bark were passed once though the machine (Figure 7). Therefore debarking or removing sapwood from the durable eucalypts will likely require several passes, depending on bark thickness and/or sapwood depth.

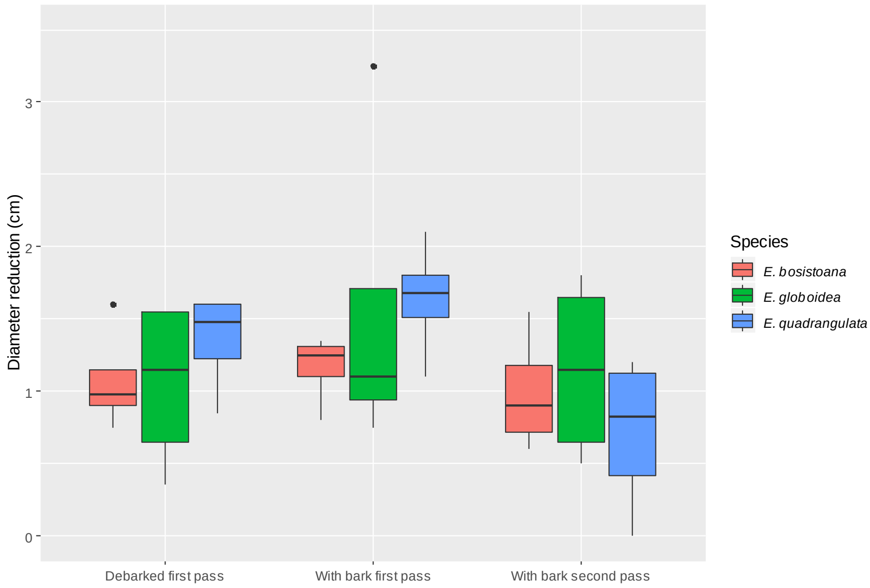

Figure 12: Reduction of log diameter for E. bosistoana, E. globoidea and E. quadrangulata with and without bark when passed through a Schälprofi 500 (Posch).

Operating the Schälprofi 500 (Posch) machine manually without an infeed system was physically demanding, especially for the larger diameter logs. This was due to the weight of the logs, despite using the minimum length (1.2 m) suitable for the machine and typical agricultural posts being longer (starting from 1.8 m). Mechanical infeed systems are available and were shown to reduce operator fatigue (Spinelli et al., 2018a; Spinelli et al., 2018b). Aligning the short (1.2 m) logs parallel to knifes/disc needs practise if tapering of the ends is to be avoided. However, by angling the log ends towards the knifes/disc, the Schälprofi 500 (Posch) can be used to point the posts.

Morbark

Debarked logs

The Morbark post peeler easily processed the debarked high density eucalypt logs. Eccentricity of logs was unproblematic (see video). The surface quality was good for all three tested species (Figure 13), comparable what is typically achieved with this type of machine from *P. radiata*. The sapwood shavings resembled splinters, being shorter and more symmetrical in cross-section (Figure 13) then the softer planer-shaving-like by-product of the Schälprofi 500 (Posch) (Figure 6). The hard, splintery nature of the shavings might not be ideal for utilisation as animal bedding but should be usable as mulch.

Figure 13: Left: Debarked logs after one pass through the Morbark post peeler. E. quadrangulata (Q1), E. bosistoana (2B1) and E. globoidea (G1 and G3). Right: Sapwood shavings produced from debarked durable eucalypt logs.

Logs with bark

The bark of the eucalypts posed a significant challenge to the Morbark post peeler. The infeed rollers stripped the bark in long strips from the log before the debarker head (Figure 15). The long and tough bark strips of all three species entangled the infeed section causing a jam and displacing the log. It is worth noting that the thin layer of inner bark of a not cleanly debarked *E. bosistoana* log, already accumulated in the log infeed (appendix Figure 19). Three undebarked cypress logs were easily processed by the machine, demonstrating that the machine worked in principle.

Three small diameter logs with the thinnest bark were pushed through the post peeler by removing bark jams. This was not possible with larger diameter logs with thicker bark as the tangled bark displaced the logs from the infeed (refer to video). After one pass the Morbark post peeler had removed the bark from the small diameter logs, but not cut into the wood (Figure 16). As expected a second pass of these logs proceed without difficulties and removed sapwood.

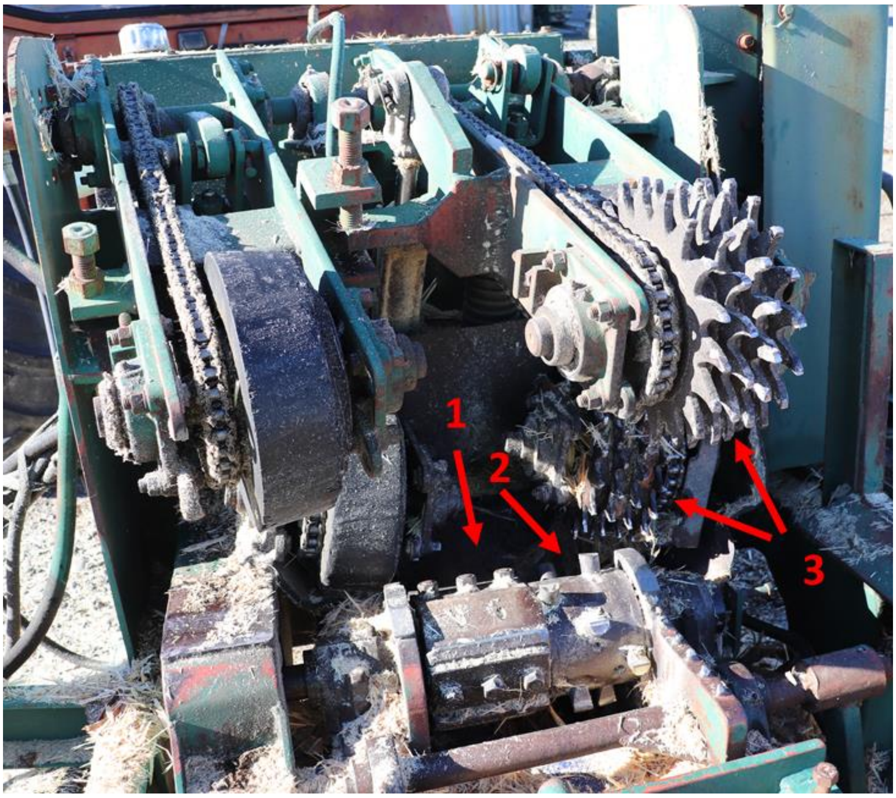

Figure 14: Cutter head (1 and 2) and infeed rolls (3) of the Morbark post peeler. The cutter head is divided into a debarking (2) and post peeling section (1).

Figure 15: E. bosistoana bark strips jamming the log infeed of the Morbark post peeler.

Figure 16: Undebarked E. bosistoana logs: after 1 pass through the Morbark post peeler (3B5 – short post on the left). Note sapwood has not been peeled. After 2 passes through the Morbark post peeler (3B3 and post to the right (2B2)) sapwood was removed.

General comments

On average the Morbark post peeler removed 1.25 cm of sapwood from the surface (i.e. 2.5 cm in diameter) of the durable eucalypt posts. That was 2.5-times as deep as the Posch Schälprofi 500. According to the operator deeper peeling is possible. As a consequence it was possible to produce pure heartwood posts with one pass through the machine (refer to video). The post ends often get tapered (Figure 17) as the machine infeed presses the log end onto the cutting head. This is not unique to eucalypts and less pronounced for larger/longer logs. End tapering could be avoided by the operator pushing onto the front end of the log.

Figure 17: Posts produced with the Morbark post peeler. Note the tapered log ends.

ACKNOWLEDGMENTS

We would like to acknowledge Gert Hendiks, who located mobile post peelers in New Zealand and Ash Millen who managed the log supply. Linda and Steve Winsloe from Peak equipment (Invercargill) peeled the logs on their Schälprofi 500 (Posch). Randal Grey from Dashwood Timber (Renwick) machined the posts with the Morbark post peeler.

REFERENCES

Altaner, C. (2020). "Wooden posts – A review." Speciality Wood Products Partnership, New Zealand.

Bootle, K. R. (2005). "Wood in Australia. Types, properties, and uses," 2nd/Ed. McGraw-Hill Australia.

Lambert, J., and Severino, D. (2018). "“Boxed-Heart” Posts From Small-Diameter Durable-Eucalypt Plantation Thinnings," Rep. No. ISBN: 978-1-925213-84-3. Forest & Wood Products Australia, Melbourne, Australia.

Millen, P., and Altaner, C. (2017). "Performance of naturally durable eucalypt posts in Marlborough vineyards." Speciality Wood Products Partnership, New Zealand.

Millen, P., Altaner, C., and Palmer, H. (2018). Naturally durable timber posts performing well. *New Zealand Tree Grower* **39**, 24-26.

Millen, P., Altaner, C., and Palmer, H. (2020). Durable hardwood peeler pole plantations. A new growing regime for eucalypts. *New Zealand Tree Grower* **41**, 8-13.

Millen, P., Altaner, C. A., Buck, K., and Palmer, H. (2019). "REGIONAL STRATEGY 2020 to 2030 - Durable Eucalypts. A Multi-Regional Opportunity for New Zealand’s drylands." New Zealand Dryland Forests Initiative.

Spinelli, R., Aminti, G., Magagnotti, N., and De Francesco, F. (2018a). Postural Risk Assessment of Small-Scale Debarkers for Wooden Post Production. *Forests* **9**, 111.

Spinelli, R., Lombardini, C., Aminti, G., and Magagnotti, N. (2018b). Efficient Debarking to Increase Value Recovery in Small-Scale Forestry Operations. *Small-scale Forestry* **17**, 377-392.

APPENDIX

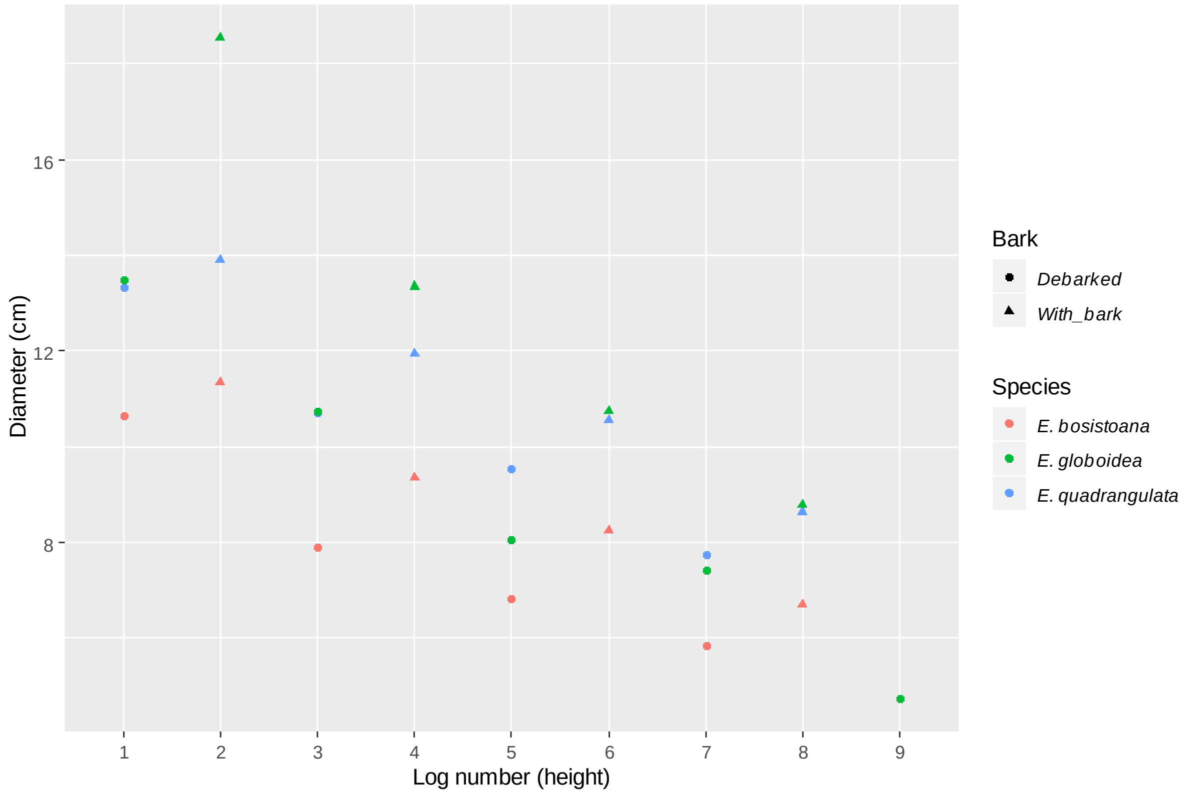

Figure 18: Diameter of logs before post peeling (Posch trial).

Table 1: Mean log diameters [(SED+ LED)/2] before and after post peeling with the Morbark equipment.

Species	Tree	Log	Bark	Mean Ø (cm)	After 1 pass Ø (cm)	After 2 passes Ø (cm)	Ø reduction per pass (cm)
E. bosistoana	1	1	yes	11.7			
		2	yes	8.4			
	2	1	no	10.6	6.9		3.7
		2	yes	10.6			
		3	yes	6.8			
	3	1	no	11.6	8.3		3.3
		2	yes				
		3	yes	9.4		5.1	2.1
		4	yes	8.0			
		5	yes	7.1	5.1		2.0
E. quadrangulata	1	1	no	12.6	11.1		1.4
		2	yes	13.4			
		3	yes	11.5			
E. globoidea	1	1	no	11.3	8.4		2.9
		2	yes	15.4			
		3	no	7.7	5.6		2.1
C. ovensii	1	1	yes	11.3	8.7		2.6
		2	yes	12.8	10.3		2.5
		3	yes	14.1	11.9		2.1
Average							2.5

Figure 19: Left - Not cleanly debarked E. bosistoana (3B1) log with a thin layer of inner bark attached (left). Right - inner bark caught up in the log infeed of the Morbark post peeler.