Koller Foresttechnik Mechanical Wedge Trial

March 2015

Zane Boyle & Cam Olsen

Background

The Koller Mechanical Wedge is a forestry product designed by engineers in Switzerland. The purpose of the product is to assist fallers by providing an efficient means of wedging over trees with unfavourable lean. Traditionally fallers use wedge shaped blocks of hardened plastic which must be driven in manually with a falling hammer.

The product

Koller have designed a mechanical wedge (as shown below) which uses a ratchet to force the wedge into the cut opening between the stump and stem.

Figure 1 - The wedge driven by ratchet turns the main pin behind the wedge block which in turn pushes the block forward between the two slider plates (left); the wedge and ratchet handle (right).

The wedge block is driven between two greased steel spreader plates by a threaded pin which is rotated by the ratchet. Grease is applied generously to the threaded pin and steel plates by a grease nipple on the side of the block. The grease is important to decrease wear and tear of the pins and increase ease and efficiency of the sliding wedge block. Cost: $485 Euro, approx. $722NZD.

Table 1 - Technical notes as provided by the Koller website.

Weight	3.45kg
Length	350mm
Width	95mm
Height	85mm
Turn	25mm
Max. full load	25Nm
Max. turn	35mm
Max. compressive force	20t

The trial

Setting

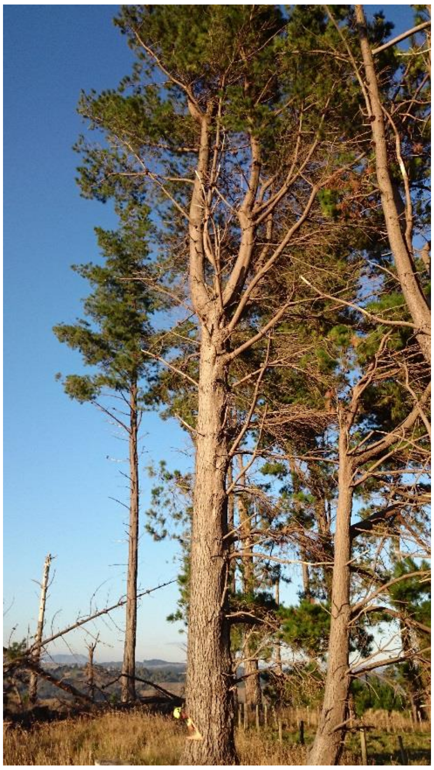

Figure 2 - Examples of the trees used during the trial.

Standing trees along a fence line boundary in Pouturu forest were used for the trial of the wedge. The trees ranged in size and shape from approximately 3t with heavy lean and high branching to 2t with broken and split heads. These trees ranged in lean from favourable (away from the fence) to unfavourable and side-unfavourable. Wind was approximately 5-10knot variables so had little-no effect on lean.

Method

Before starting in the morning careful consideration was paid to a set of instructions and potential hazards that was provided by Koller. The predominant hazard and its control method was the use of a traditional wedge in tandem with the mechanical wedge in case of mechanical wedge failure.

After these new hazards had been considered, trees were then assessed for suitability of wedging. As this type of device was unfamiliar to Cam it was important to not overload the device or fall any trees which he believed could not be lifted without the assistance of a machine.

Figure 3 - The insertion of both wedges after the bark had been trimmed and an opening been made for the wedges.

As outlined in the instructional notes, after completing the scarf cut in the desired fall direction and the back-cut was opened, bark was trimmed off of the trunk to provide better visibility of the 5cm wedge that was to be cut as the entry point for the mechanical wedge. After this was done, and before the mechanical wedge was inserted, a conventional wedge was driven in to provide back up in case of failure. The mechanical wedge was then inserted and cranked until a sufficient amount of the wedge block was driven into the back-cut to take pressure and secure its position within the cut. From here Cam was able to complete the back-cut with a cycle of cutting and cranking to increase the lift on the tree in the direction of fall. Once the cut was completely finished (i.e. to the hinge wood) he removed his saw from the stump and the wedge was driven via cranking the ratchet until enough lift was added to the tree to the point where it fell in the desired direction.

Limitations and observations

As Cam was unfamiliar with the device and there was no machine available to assist with some of the heavier leaning trees, it is possible that we have not fully tested the wedge for fear of damaging the tool and not being able to provide enough lift on the tree to complete the fall. With back up of a small machine we may be able to push further and find the limits of the wedge.

An interesting observation made of the mechanical wedge during the trial was the effectiveness of the grip within the cut from the spreader plates. On initial inspection it was not expected that the wedge would hold within the cut with grip neps which feel so un-abrasive. However these proved very effective and showed no signs of slipping throughout use. The grip neps left a distinctive 'cheese-grater' type pattern in the wood which proved the effectiveness of them.

Figure 4 – Right; the mechanical wedge spreader plates with specialised grip neps.

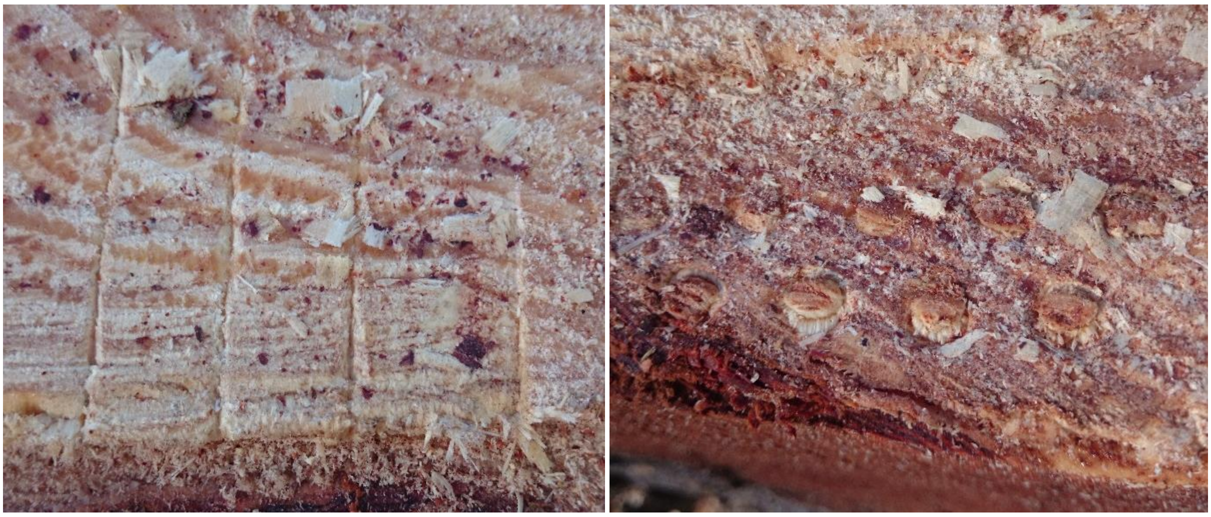

Figure 5 - Differences in grip patterns left by a conventional wedge (left) and the mechanical wedge (right).

Potential improvements

Handle length

Cam noted that the length of the ratchet handle (approximately 350mm) could be a few inches longer to increase efficiency and ease cranking strain on the operator. This could be done in one of a few ways such as lengthening the handle, a handle extension or a retractable handle with a means of determining desired length. Consideration of handle length while carrying the tool must be present when designing a new handle.

Carrying clip

Currently there is no given way of carrying the wedge other than in the hands or in a wedge bag of some type. An improvement here could be made by attaching a clip to the handle which then allows the handle to clip to the tip of the spreader plates to stop it from swinging around freely. Then a

lanyard could be attached to the back of the spreader plates by the ratchet fulcrum to connect to a falling belt.

Gearing ratios

Cam noted that the wedge could be driven in fasted with a different gearing ratio of the ratchet. An option to change the gearing ratio to the preference of the faller could assist with lift speed on lighter trees or retraction speed after the fall has been completed. A lower ratio would be harder to crank although this could be counteracted with an extendable handle.

Quick release retraction

Before moving on to the next tree the wedge must be wound back which is effectively dead time. A quick release or method of sliding back the wedge block along the threaded centre pin would reduce this time to a few seconds rather than the 20-30seconds which it currently takes.

Relevant competing products

A quick search online has revealed a number of tree falling assistance machines and tools. These range from cant hooks and levers to small and large hydraulic tree jacks. To keep comparisons relevant only simple to use tools and small hydraulic jacks will be considered.

Bahco Cant Hook/Falling Lever

Constructed of heavy gauge rectangular steel, this tool is recommended for releasing pinched saw bars, assisting with tree falling, and rolling logs with the sliding cant hook.

Table 2 - Details of the Bahco lever as provided by their website.

Weight	2.4kg
Length	800mm
Thickness	25mm x 5mm
Price	NZ$152.24

Figure 6- The Bahco lever, picture sourced from their website.

Although price and carrying weight is low, this tool appears to be limited to trees of smaller size than tested by the mechanical wedge. It is likely that the lever would be applicable for trees <1t in size only.

See for more detail: http://www.logger.co.nz/accessories/tools/bahco-cant-felling-lever-1-detail.

Silvey Hydraulic Tree Jacks

Coming in three different sizes, the Silvey Hi Jacker Single Unit jack is the smallest at a weight of 12.2kg and a lift capacity of 45t.

Table 3 - Details of the Silvey jack as provided by their website.

Lift Capacity	45t
Lift height	101mm
Cylinder Diameter	76mm
Oil Capacity	354ml
Pack Weight	12.2kg
Price	N/A

Figure 7 - Silvey tree jack, picture sourced from their website.

With the given weight and lift provided by the tree jack, this equated to approximately 3,688kg of lift per kg of tool.
Although this is a significant amount of lift per weight, the Koller Mechanical Wedge has a much greater ratio of 5,797kg of lift per kg of tool.

Although no longer in production, for more information of the product see: http://www.silveychaingrinder.com/hydraulic-tree-jacks.

After seeing the Silvey Tree Jack being used in the link posted below, we can make a few observations to compare with the Koller Wedge. The first is the extended preparation time required by the tree jack; a large section must be cut from the back of the tree before any other cuts are made. This is where the jack will be positioned during falling of the tree. The next is the same principle of using a lever to generate lift at the base of the tree; the difference with the tree jack is the up and down plane of leverage rather than circular as with the wedge.

To see the Silvey Tree Jack being use follow the URL: https://www.youtube.com/watch?v=PJt4md2J7KE

Conclusion

The Koller Mechanical Wedge was more effective than originally thought. The efficiency and ease of wedging the trees over without having to manually drive wedges in with a heavy hammer was greatly appreciated by the faller and reduced his fatigue significantly. The reduction in fatigue of not having to use the hammer as much must be weighed up against the cost of carrying an extra 3.5kg throughout the day which adds to an already significant amount to be carried by fallers.

In research of felling assisting tools the Bahco Felling Lever does not seem to be a good tool to use in a commercial situation. The Silvey Tree Jack does seem like a good option to use in a commercial situation and does not seem to have any logistical issues. However when compared with the mechanical wedge, the wedge's superior lift-to-weight ratio, smaller weight and object size, and availability as a still in production tool makes it the preferred choice between the two.

At a price tag of $722NZD these mechanical wedges are a significant investment. It is likely that there will be more time and resources required to be invested into testing and trialling this tool in a commercial setting. However these costs are likely to be covered by the benefits of less fatigue for the faller, more control over the direction of leaning trees, and an overall safer method of falling.

Appendix: