Alternative fencing materials for blackwood swamp coupes

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Abstract

Fencing is routinely carried out to protect blackwood regeneration from mammal browsing in north-western Tasmania. The most expensive component of the fence is the wire netting (heavy duty) at about $1.85/m. A trial was carried out on a blackwood swamp coupe harvested in 1999 to determine the suitability of alternative materials. Five plastic meshes were tested for ease of use and durability. Only the most expensive mesh at $3.70/m remained undamaged and intact after two years. One of the cheaper meshes (a UV-stabilised windbreak material), although difficult to use, performed satisfactorily and could be considered as an option on sites where wire netting is likely to be stolen. Of the materials tested, the best value for money is still wire netting, which is easy to use and remained intact and undamaged at the end of the two-year monitoring period.

Introduction

Blackwood (*Acacia melanoxylon*) seedlings germinate prolifically from ground-stored seed after logging disturbance or fire (Forestry Tasmania 1991). However, blackwood seedlings are very palatable to native mammals. If regeneration areas are not fenced, most of the seedlings are eaten, predominantly by red-bellied pademelons (*Thylogale billardierii*) (Statham 1983). Poisoning with 1080 is not effective against this browsing pressure. Blackwood seedlings stay vulnerable to browsing for many years and when browsing animals recolonise after poisoning, the blackwood seedlings are preferentially sought. Trial areas using poisoning alone for browsing control remain understocked for blackwood (Jennings *et al.* 2000).

Fortunately, pademelons are small animals and are not high jumpers by nature. They can be excluded quite easily by low fencing. The bottom of the fence must be buried or pegged down onto the ground to stop them burrowing under, but standard 900 mm high wire netting is sufficient. The fence must remain intact for about three years for blackwood establishment to be successful.

Fencing is carried out routinely in north-western Tasmania as a blackwood regeneration system, both in blackwood-rich eucalypt areas and in the blackwood swamps. The size and shape of the fenced areas vary, but Jennings and Dawson (1998) recommend a ratio of 15 ha fenced for each kilometre of fencing to achieve fencing at costs of less than $250/ha. This area/perimeter ratio can generally be reached with coupes over 40 ha that have regular boundaries. The cost of fencing small or unevenly shaped areas can be prohibitive.

The wire netting is the most expensive component of the fence. Indicative costs of fence components are shown in Table 1. Where fencing is carried out on well-drained sites, light-gauge wire netting is adequate for the job. The wire netting costs up to $1/m. However, where fencing takes place in blackwood swamp areas, the ground is often inundated for several months during winter. The swamp water is so acid that it rusts through the light duty

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Table 1. Indicative cost of fence materials components per 100 m.

Material component	Description	Cost / 100 m
Posts	75 mm treated pine every 10 m	$20
Plain wire	1500 m rolls 'Flexabel' galvanised (3 wires)	$21
Staples	2 kg box of 30 mm staples (~ 500 / box)	$1
Wire netting	Heavy duty galvanised netting (40 mm mesh)	$185

Table 2. Alternative mesh fencing materials shown and prices per metre.

Material	Description	Price / m	Fasteners	Price / m
Wire netting	Heavy duty 40 mm mesh	$1.85	Ring fasteners	$0.02 / m
Wallaby wire	Hinge-joint wire fencing	$1.60	Nil	-
Windguard	Light black plastic mesh	$1.00	Poly clips	$0.25 / m
Barrier mesh	Large orange mesh	$1.50	Ring fasteners	$0.02 / m
Site mesh	Fine mesh / yellow stripe	$1.80	Poly clips	$0.25 / m
Onion bag mesh	Red with white stripe	$0.88	Ring fasteners	$0.02 / m
Oyster mesh	Heavy duty black plastic	$3.70	Ring fasteners	$0.02 / m

wire netting within the first 12 months, and heavy duty wire netting is required for durability. The cost of heavy duty wire netting can be up to $2 / m depending on supplier and quantity.

This paper reports on a trial carried out to test alternative fencing materials for swamp blackwood coupes. The aim was to find a range of materials that were cheaper than or competitive with wire netting but which did not rust away.

Methods

Choice of materials

A range of manufacturers, wholesalers and retailers were contacted. Any material that seemed to hold possibilities for wallaby fencing was considered. It became apparent that different kinds of plastic mesh had potential. A number of mesh types designed for a variety of uses were investigated—from site hazard mesh to onion bag material, windguard to oyster mesh. Information on all these materials is shown in Appendix 1.

After receiving samples and prices of these materials, five plastic meshes, which looked as though they would perform satisfactorily, were chosen (Table 2). A section of hinge-joint wallaby wire was also included to test whether the mesh size was small enough to exclude pademelons.

Most of the plastic meshes were priced between the light duty wire netting and heavy duty wire netting. Exceptions were the oyster mesh, a hard, durable plastic mesh double the price of heavy duty wire netting, and onion bag mesh which was cheaper than light duty wire netting. The prices of windguard and site mesh were increased by approximately $0.25 / m as their materials were unsuitable for attachment with ring clips and required the use of special plastic clip fasteners (Table 2). The price of wallaby wire is reduced by approximately $0.07 / m, as it does not require one of the plain wires supporting the fence.

Photo 1. A section of onion bag mesh attached to top and bottom wires.

Testing of materials

The fencing trial was carried out at SR107B, a blackwood swamp coupe that was harvested during late summer 1999 in north–western Tasmania (331200E, 5450100N). The fence line was cleared immediately after harvesting, using a 20-t excavator, and 50–75 mm diameter treated *Pinus radiata* posts were driven into the ground at approximately 10 m spacing, using the bucket of the same machine.

Most of the fencing materials trialled were sold in 50 m rolls. Two sections of trial fence were erected in early April 1999, one where 50 m of each of the materials were attached to top and bottom plain wires (Photo 1), and the second where 50 m of each of the materials were attached to a thick poly-propylene bale twine (designed for big square bales). The baling twine was doubled to increase its strength. These sections were exposed to similar environmental conditions. Where the materials were of sufficient height, a 10–15 cm section of the material was laid out along the ground to prevent animals from burrowing under the fence.

The bottom of the materials was either pegged down to the ground (Photo 2) or covered with harvesting debris to make the fence secure. The remainder of the coupe was fenced using heavy duty wire netting (40 mm mesh), with the exception of an 80 m section which was fenced with 'hinge-joint' wallaby wire. The bottom square of the wallaby wire was folded out along the ground to prevent breaches.

Measurement of performance

The materials tested were ranked as easy, fair or difficult to use during fence erection. This ranking was based on a combination of the weight of the rolls of material, ease of stretching the material along the fence line, the amount that it snagged on nearby vegetation during construction and its flexibility on an uneven surface. After two years, the possibility of dismantling the fence and re-using the materials was assessed.

The fence line was walked almost every month for two years, and the performance of each section of fence monitored. Breaches

Photo 2. Pegging down the bottom of the barrier mesh.

or damage to the fence were recorded in three categories:

- Pushing under—where wallabies managed to breach the fence by pushing a hole under the bottom wire;
- Falling down—where the fence structure failed; and
- Material failure—where breaks, tears or holes appeared within the fence panels.

If a section of fence disintegrated to the stage that it could no longer protect the blackwood crop, then that section was replaced and was no longer assessed as part of the trial.

Results

Ease of use

The ease of use of the five materials tested was variable. A summary of the results is shown in Table 3.

The easiest material to use was the orange barrier mesh. The rolls were lightweight and easily carried for long distances, the material was rigid enough to stand up while being used, it resisted snagging on nearby vegetation, and it contained enough stretch to be easily tensioned by hand.

Only oyster mesh (the most expensive material) and wallaby wire (an agricultural grade fencing material) showed promise for recycling.

The baling twine tangled easily, snagged on nearby vegetation and was difficult to use over long distances. It was not strong enough to be tensioned using wire strainers and was only pulled tight by hand. It sagged over time and was most successfully used in conjunction with the more rigid materials that required less support.

Performance and durability

A total of 144 fence failures of all types and for all materials occurred over the two-year monitoring period. The fence failures were almost entirely attributed to failures of the different fencing materials. Only two occurrences of burrowing under the fence were noted, one under wire netting and one under oyster mesh. There were five cases of the fence structure falling down, but on each

Table 3. Ease of use and possibility of recycling of the materials tested.

Material	Ease of use	Potential for recycling
Heavy duty wire netting	**Easy**—stiff enough to stand up without much support but flexible on uneven ground. Heavy to use; sold in 100 m rolls.	Bottom rusty
Barrier mesh	**Easy**—very light and easy to manoeuvre but with enough rigidity to make attachment and tensioning easy.	Nil
Site mesh	**Easy**—but pulled out of ring clip attachments, damaging the material. Structure of the mesh much stronger vertically than horizontally.	Nil
Onion bag	**Fair**—a soft, lightweight material that snagged on sticks, roots and posts. Easily attached using the 'drawstring' threaded at top and bottom but barely tall enough.	Nil
Wallaby wire	**Fair—**heavy rolls that are difficult to strain tight. A rigid wire which stands up on its own but is difficult to contour along uneven ground.	Possible
Oyster mesh	**Difficult**—very stiff mesh that stood up on its own but had no flexibility on uneven ground. No stretch in material resulted in billowing of the top of the fence.	Possible
Windguard	**Difficult—**a soft, lightweight material that snagged on sticks, roots and posts. No strength in the edge of the material. This necessitated the use of plastic clips for attaching the top of the material to the plain wire, and folding more of the material down onto the ground to be secured by harvesting debris at the bottom. This resulted in a fence of minimal height.	Nil

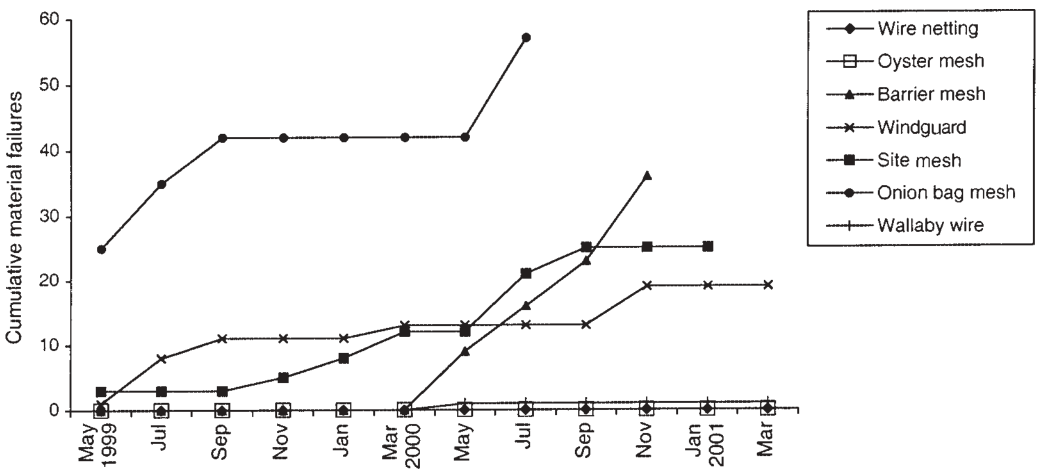
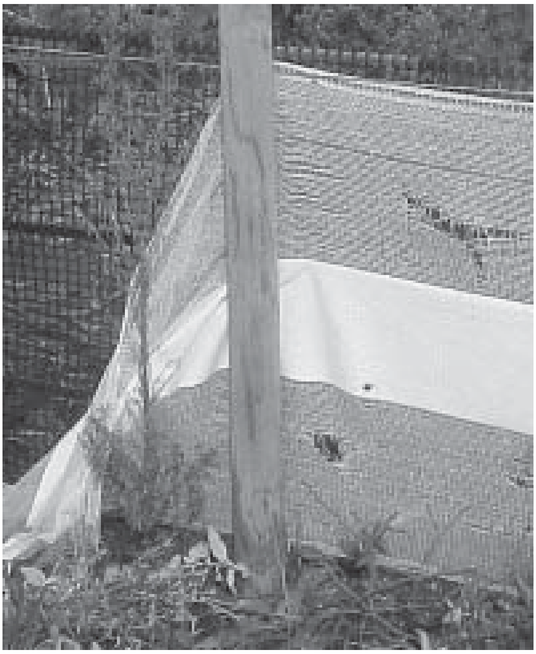
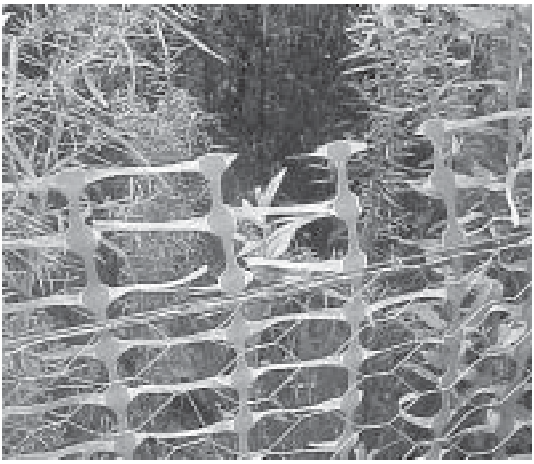


Figure 1. Cumulative material failures over 100 m of each material tested.

occasion they were associated with a fallen tree or limb over the fence line. Where the fence was attached to baling twine the damage was far greater and much more difficult to repair.

There were 137 cases of material failure noted. The failures by material type over two years are presented in Figure 1. However, if the effectiveness of any of the materials became severely compromised





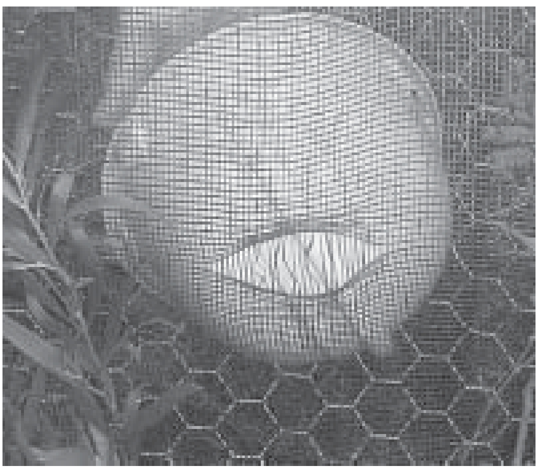


Photo 3 (top). Onion bag mesh soon lost its colour and disintegrated.

Photo 4 (centre). Barrier mesh became brittle with exposure to sunlight.

Photo 5 (bottom). Animal damage to 'windguard' material.

by damage, they were replaced with more durable netting.

The colour of the red and white onion bag mesh faded very quickly and was followed by rapid disintegration of the material itself (Photo 3). The first section of onion bag mesh was replaced within six months, with complete replacement required after 15 months.

The orange barrier mesh showed great promise with no failures during the first year. However, it was not UV-stabilised and became very brittle (Photo 4). The incidence of failure increased rapidly after the first summer, leading to complete disintegration of the material within 19 months.

The orange and yellow site mesh showed very early damage as it failed to withstand animals running into it shortly after erection. It was much weaker horizontally than vertically and split along the horizontal lines of the material. This material also became brittle with prolonged exposure and was replaced during the second summer.

The black windguard material was severely tested within the first few months and sustained small areas of damage as animals tried to claw their way through this softer fabric. However, the weave of the material did not allow large holes to develop and the integrity of the fence was retained (Photo 5). This material was UV-stabilised and did not show any greater levels of damage with time. The windguard material did not require replacing during the two-year monitoring period. Infrequent visits since have shown that it is still intact after two-and-a-half years.

Photo 6. A wallaby run developed through the larger squares of the tree-damaged wallaby wire fence.

Table 4. Comparison of fence materials. (Materials that failed to exclude pademelons for a two-year period are shaded in the durability/performance column.)

Material	Ease of use	Durability and performance	Cost	Overall ranking
Wire netting	2	1	5	1
Barrier mesh	1	5	3	
Onion bag mesh	5	6	1	
Wallaby wire	4	2	4	2
Windguard	7	3	2	3
Site mesh	3	4	6	
Oyster mesh	6	1	7	4

The section of hinge-joint wallaby wire was damaged by a falling sapling, which pushed the top of the fence closer to the ground. The smaller sized mesh at the bottom of the fence appeared to be small enough to exclude pademelons with no breaches identified, but a wallaby run developed through the fence where the larger top squares were closer to the ground (Photo 6).

Neither the oyster mesh nor the wire netting showed signs of deterioration. The baling twine was UV-stabilised and showed no deterioration over time. However, it was not strong enough to withstand damage from fallen tree limbs.

Overall performance

The materials were ranked for ease of use, durability / performance and cost. This ranking is shown in Table 4.

To calculate the overall ranking, the different criteria were given equal weighting. However, the fence materials that failed to

Photo 7. Successful blackwood establishment within the fence, after two-and-a-half years.

exclude pademelons for a two-year period (those with a durability and performance ranking above 3 – shown shaded in Table 4) were excluded as they are not a viable option for wallaby control on blackwood coupes.

Discussion

There was a wide range of materials available that showed promise as alternative wallaby fencing but in this trial the choice was confined to materials that came ready to use in conveniently sized rolls. The range could be expanded if negotiation with manufacturers was undertaken to make materials to order.

The fence failures were almost entirely due to material failure, confirming that the fence design and erection were to an adequate standard. Failure in the fence structure was always associated with fallen branches or saplings over the fence, confirming the need to monitor fences regularly. The tallest of the vigorously growing young blackwoods were over 2 m tall after two-and-a-half years, well above browsing height (Photo 7). After three years, most of the seedlings should not require further protection; therefore a three-year lifespan for materials remains the target.

The prices of some of the plastic products were high, with the oyster mesh at $3.70 / m topping the list. However, this was the only plastic mesh that did not show any damage or deterioration over the length of the trial.

In general, the plastic meshes have not proved durable. With the exception of the oyster mesh and the UV-stabilised windbreak material, all the plastics disintegrated within two years. The hazard plastics and site meshes chosen (designed for construction sites and road works) were not UV-stabilised and had a short life when exposed to sunlight. They were at the low end of the price range for such materials, costing about half as much as the UV-stabilised products.

The only material tested that gave a cost advantage and has survived more than two years was the black windguard material. This was difficult to use as it was finely woven and snagged on nearby vegetation, did not have a strong edge for attachment to the supporting wires (requiring additional fasteners) and was barely tall enough. Some of the gain from using a cheaper material is likely to be offset by higher erection costs. Despite these difficulties, it is still worth considering in areas where wire netting is likely to be stolen, as it is a much less attractive recycling option.

The hinge-joint wallaby wire was the only material with variable sized holes. The smallest mesh size at the bottom of the fence was effectively ‘wasted’ by being folded flat onto the ground. However, it is designed for agricultural sites prepared to a better standard than could be achieved using an excavator in a swamp. The larger mesh size at the top of the wallaby wire was not small enough to exclude pademelons. A material that had a smaller mesh size could be made of a lighter gauge wire, which may reduce the cost.

In general, of the materials tested, heavy duty wire netting was still the best value for money. It was relatively easy to erect and secure, with no deterioration of the material during the period of this trial.

Heavy duty wire netting has been used successfully to protect blackwood regeneration for several years and its only major drawback is cost. However, most of the cheaper materials failed to deliver the protection required and are therefore not a viable option. Any material that regularly fails leaves the blackwood crop at risk for the interval between repairs. If pademelons manage to breach the fence in sufficient numbers, a resident population will establish within the fenced area.

Bulk buying and choice of supplier can reduce the cost of wire netting, as prices were negotiable depending on quantity. The fencing cost per hectare can also be reduced by careful planning and coupe-boundary preparation. Jennings and Dawson (1998) determined during a sensitivity analysis on the economics of blackwood fencing that 80% of the total variance was due to the area / perimeter ratio of the coupe, indicating that reduction in the cost of fencing components does have an influence but is not as important as coupe size and shape.

The baling twine used to suspend the materials was not cost effective. Although much cheaper than plain wire, it was difficult to use, produced a less sturdy fence and sustained far more damage from falling limbs, increasing repair time and cost.

Research into alternative materials should continue, with an investigation into custom-made materials that are cost competitive. Ideally, a wire mesh could be designed which fits between wire netting and wallaby wire in both mesh size and gauge. Polycoating is now being used on some of the agricultural grade fencing materials to reduce rusting, and may increase material longevity in the swamps. In addition, there are still possibilities for cheaper UV-stabilised materials with a three-year lifespan.

Acknowledgements

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Appendix 1. Specifications and prices of alternative materials investigated for wallaby fencing[1].

Category	Height (mm)	Length (m)	Product name	Cost (/100m)	Description
Wire netting	**900**	**100**	**90 x 4 x 1.4**	**$185**	**heavy duty galvanised wire netting**
	900	50	90 x 5 x 1	$96	light duty galvanised wire netting
	1050	100	105 x 4 x 1.4	$240	heavy duty wire netting - tall
Farm fencing	**800**	**100**	**8-80-15 hinge-joint**	**$160**	**heavy agricultural wire mesh**
Plastic mesh	**900**	**50**	**Windguard**	**$100**	**black woven plastic fabric**
	1800	50	Shadecloth	$400	green knitted plastic fabric
	910	50	Multimesh or Windguard	$116	black woven plastic fabric
	1800	52	Supermesh	$1265	green knitted plastic fabric
Safety fencing	**1000**	**50**	**Barrier mesh**	**$150**	**medium weight plastic barrier**
	900	50	Economy mesh	$180	thick flat road barrier
	900	**50**	**Budget site mesh**	**$180**	**fine plastic barrier**
	1100	50	AusMar BFMM50	$180	flat road barrier
	850	**50**	**Barrier mesh**	**$88**	**onion bag mesh with edge tapes**
	900	50	Budget barrier	$80	onion bag mesh
	1000	30	M-net	$300	heavy plastic barrier
	1000	50	Budget fence (740200)	$212	onion bag mesh
	1000	50	Standard barricade	$280	flat road barrier
	930	30	Barrier mesh (740100)	$210	flat road barrier
Vege packaging	500	500	Hand netting (roll)	$10	fine stretchy woven netting
Fish net	100 mesh (12’)	46	2” green 9-ply	$390	string fishing net
Oyster mesh	**920**	**30**	**20 x 20 Oyster mesh** 16 x 16 Oyster mesh	**$370**	**heavy rigid black plastic mesh**

[1] The products **highlighted** were chosen for testing.

Tasforests