Low cost fencing

Department of Agriculture, Western Australia

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Fences with more wire and posts are not necessarily stronger. Designs using high tensile wire can save on material and reduce costs.

The first stock fences commonly used in Australia were the post and rail and other types of timber fence; timber was abundant, and more importantly, there was plenty of farm labour. Such fences were heavy, and the posts had to be sturdy and closely spaced to bear the weight of the timber rails.

Wire was a later development, being first used for fencing during the 1880's. Because the wire was soft, it had to be very thick, about 1 cm or more, to achieve strength, and the thickness made it expensive.

Fencing design took little advantage of the introduction of wire, and heavy posts closely spaced were still used. To some extent the closely spaced posts were still necessary because the wire was soft and easily stretched out of shape.

Dramatic improvements came in the late 1950's based on improved high tensile wire, leading to new concepts in fence design. These designs have now been proven, and fencing is possible at about half the price.

Low cost fencing thus allows farmers to make the best use of land by sub-division, which can take account of factors such as soil type, slope, and age of the paddock, as well as ensuring that paddock size suits cropping requirements and flock or herd size. Construction methods also apply to electric fencing.

High tensile wire

There are two types of wire, soft and high tensile. High tensile does not mean high tension wire, but refers to the higher carbon content of the steel which strengthens the wire. A thinner high tensile wire therefore can have the same strength (breaking strain) as a soft wire of heavier gauge. Because the high tensile wire can be thinner, it is also cheaper, as shown in Table 1.

High tensile wire is more elastic than soft wire of equivalent breaking strain, retaining its tension after a load has been applied. This property allows for longer strains and wider post spacings—both cost savings.

To use high tensile wire to best advantage requires a fence design that takes the load on the wire and transfers it to strainer assemblies rather than on to posts, as often occurred with older fence designs.

The basic characteristics of a high tensile fence therefore are:

- Greater attention to design and construction of strainer assemblies.
- Long strains.
- Few posts.
- High tensile wire.
- Wires loosely attached to posts and droppers rather than threaded through bored holes.
• Measured tension on wire.
Certainly high tension wire has some disadvantages. It is more difficult to handle, and more care is needed in straining. It is also more susceptible to bushfires because it is thinner.
However, when the disadvantages are compared to the cost savings, both in materials, and erection costs, high tensile fencing is certainly the best proposition in most cases.

Strainer assemblies
Because the high tensile fence takes the load on the wire and the strainer assemblies rather than the posts, the strainer assemblies must be immovable. If the strainer assemblies fail, the fence will fail, particularly a high tensile fence.
The special attention demanded for strainer assemblies for high tensile fencing may however, not mean extra work overall because long strains are used, requiring fewer strainer assemblies.
Choice of materials depends on the availability and cost. Costs include cartage to the fence line and labour, so that although timber may be available on the property, cutting and carting costs may make it more expensive.
Other materials suitable for strainer assemblies include treated timber, concrete and the more recently available prefabricated steel. Local conditions such as the likelihood of bushfires, floods or ants may influence the choice of materials.
The most important factor in the performance of strainer assemblies is the depth of the post in the ground. Horizontal stays (Fig. 1) are about 25 per cent more effective than the diagonal stay, but can be a lot more expensive in both labour and materials.
With a horizontal stay assembly, the tension member must be secure, and 2.80 mm wire is effective although knots do slip due to damage by stock.
Mechanical wire joiners which are now available, or steel rods that can be tensioned should therefore be considered because of the importance of the tension member in the strainer design.
A driven strainer assembly is more effective in holding than a backfilled and rammed assembly. However equipment is not always available to drive wooden end assemblies. The size of the strainer is of minor importance, a 10 cm diameter post being almost as effective as a 50 cm diameter post and a lot cheaper.

Length of strain
In any fence, the longer the strain, the better the chance of maintaining a constant tension. After a fence has been built, the movement of strainer assemblies, knots and ties around posts can be several centimetres. A longer strain of wire can absorb this movement better. Wire is to a certain extent elastic when tensioned—like a rubber band.
The movement in the new fence will have less effect in a longer tensioned wire.
High tensile wire can also absorb movement without a drastic loss in tension. This is because it is thinner than a soft wire of equal breaking strain.
Thus, the longer the strain and the thinner the wire, the better the fence, as far as tension is concerned. To put it differently, long strains and thin wire make tight fences.
For ease of working, strains of about 2 km seem best, although up to 7 km strains are satisfactory using plain wire. A strain of 600 metres is feasible with fabricated fence and 500 metres using barbed wire. Of course these distances also depend on conditions such as the terrain.

Posts and droppers
Fence posts perform basically two functions—holding the wires in position, and supporting the fence. Fence posts are not the barrier; this is the function of the wire components.
High tensile wire which retains its tension allows wider fence post spacings, and it is now practical with the use of droppers, to space posts 20 to 30 metres apart in good conditions.
Selection of posts depends on availability and cost. The star steel post is an integral part of most fences because of ease of construction, availability and cost. However, where steel posts are not practical, for example on saline soils, treated timber posts are recommended. Again, a driven post will be most effective.

Table 1. Comparative costs of soft and high tensile wire

<table>
<thead>
<tr>
<th>Wire Type</th>
<th>Approx. Cost ($ per km)</th>
<th>Breaking Load (kiloNewtons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.15 mm (10 gauge) soft</td>
<td>28</td>
<td>4.30</td>
</tr>
<tr>
<td>4.00 mm (8 gauge) soft</td>
<td>42</td>
<td>7.00</td>
</tr>
<tr>
<td>2.50 mm (12.5 gauge) Tyeasy high tension</td>
<td>20</td>
<td>5.50</td>
</tr>
<tr>
<td>2.8 mm (11 gauge) high tension</td>
<td>30</td>
<td>8.00</td>
</tr>
</tbody>
</table>

Fig. 1—Horizontal stays are about 25 per cent more effective than diagonal stays but can be more expensive. The most important factor in strainer assemblies is depth of posts in the ground.
A practice that has developed is to include some stronger, more expensive posts in the fence, such as a mixture of steel and concrete, or steel and wooden posts. However, the performance of a fence post under a load is little affected by support from its neighbour, so this practice is not justified.

It is important to understand that wider post spacings require only light posts because stock pressure is taken by the wire and not the posts, except if stock hit the post directly. In any case, depth of the post in the ground is of far more consequence than the strength of the post—75 cm being the minimum acceptable. Posts of this depth are about 50 per cent more resistant to overturning than posts only 60 cm deep.

Wire should not be run through holes in the posts, as this is time-consuming and therefore expensive. Also, particularly with steel posts, it reduces the amount of zinc on the wire and consequently the life of the wire.

Importantly with high tensile fencing, the wire should be tied loosely so that impact load is transferred by the wire to the strainer assemblies, and not to the posts. If wire is tied tightly on the posts, the load is taken only by a small section of wire and not on the full length of strain.

Fence droppers perform three functions. They act as a wire spacer, distribute shock load to the total fence from individual wires, and act as a visible barrier. With droppers quarter of the cost of posts, considerable savings are possible where they can be substituted.

The droppers should alternate on either side of the fence to reduce pressure on the clips, and they should remain clear of the ground so that pressure is not taken by the dropper, but is transferred by the wire to the strainer assemblies.

**Barbed wire**

Two main types of barbed wire are available:
- 2.5 mm continuous twist, soft. Commonly called Iowa barb.
- 1.6 mm reverse twist, high tensile.

The high tensile barb has a similar breaking strain to Iowa, and cost therefore again favours the high tensile barb.

Every time a barbed wire receives an impact, it loses some of its tension due to an unravelling effect. Similarly, if too much tension is applied to high tensile barbed wire, the wire unravels.

Because of the smaller diameter of the high tensile wire (1.6 mm) the high tensile barb is more susceptible to both bushfire and corrosion. To overcome the corrosion problem, it is supplied with an extra heavy galvanised coating, three times the standard thickness. The Iowa barb is supplied with either a standard or heavy galvanised coating.

**Fabricated fence**

There are two basic types of fabricated fence—hinged joint and ringlock. Hinged joint wire has individual picket wires attached to each line wire with a twist, whilst the ringlock picket wire is one piece attached to the line wires with a wire ring. Various sizes are available, distinguished by the height of the fence, number of line wires, and spacings of the picket wires. The recommended maximum tension to be applied to hinged joint is 1 kN per line of wire, for example a 6 line could be tensioned to a maximum of 6 kN.

With labour constituting about half the total cost of a fence, fabricated fencing is becoming increasingly popular, at present being used for about half the fencing in Western Australia. It is easy to run out, and can be strained in a single operation.

Prefabricated fencing is made from 2.5 mm (4 kN) high tensile wire, and makes a very secure fence, particularly suitable for cross-bred sheep where other types of fencing have not been successful. Both hinged joint and ringlock perform similar functions, and the main difference affecting farm use is the price—hinged joint being about 10 per cent cheaper.
Checking tension on a high tensile wire. This is essential because of the large degree of stretch making it difficult to estimate tensions.

Running out wire
One of the principal advantages of high tensile fencing is the saving of time in running out wires. Since wires are not threaded through posts, they can be run out quickly with a single or multiwire spinner. The use of a spinner, with brake lightly applied, ensures a minimum of breaks due to kinks in high tensile wire.

Tension
Because of the large degree of 'stretch' in high tensile wires, it is virtually impossible to estimate the tension of a high tensile wire in straining it up. A tension gauge is therefore essential. Tension handles incorporated in the wire strainers are often inaccurate particularly after they have been in use for some time. Models with a compression spring are more satisfactory.

Further information
Details of construction methods are available through the Department of Agriculture or directly from Australian Wire Industries.

Table 2. Recommended tensions for plain wire

<table>
<thead>
<tr>
<th>Wire Diameter</th>
<th>Tension 1</th>
<th>Tension 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.00 mm</td>
<td>1.8 kN</td>
<td>2.8 mm high tensile 3.0 kN</td>
</tr>
<tr>
<td>3.55 mm</td>
<td>1.4 kN</td>
<td>2.5 mm Flexabel 1.4 kN</td>
</tr>
<tr>
<td>3.15 mm</td>
<td>1.1 kN</td>
<td>2.5 mm Tyeasy 2.0 kN</td>
</tr>
</tbody>
</table>

Fastening a dropper. Considerable savings are possible if droppers can be substituted for posts.