Cereal straw and stubble for sheep feed

E M. Aitchison

Follow this and additional works at: https://researchlibrary.agric.wa.gov.au/journal_agriculture4

Part of the Sheep and Goat Science Commons

Recommended Citation
Available at: https://researchlibrary.agric.wa.gov.au/journal_agriculture4/vol29/iss3/7

This article is brought to you for free and open access by Research Library. It has been accepted for inclusion in Journal of the Department of Agriculture, Western Australia, Series 4 by an authorized administrator of Research Library. For more information, please contact jennifer.heathcote@agric.wa.gov.au, sandra.papenfus@agric.wa.gov.au, paul.orange@dpird.wa.gov.au.
Cereal straw and stubble for sheep feed

By Elisabeth Aitchison, Research Officer, Sheep and Wool Branch

Many farmers in Western Australia run sheep in addition to their cropping programmes. The resulting cereal straws and stubbles are therefore important as sheep feed during summer and autumn. During this period the diet must provide sufficient energy to maintain liveweight, but additional energy and protein may be required for young stock and pregnant or lactating ewes, and to reduce problems from tender wool.

The nutritional quality of cereal straw is generally very poor, mainly because of its low digestibility and low nitrogen content, and straw alone is seldom able to provide a maintenance diet for sheep. Its main advantage is that it is a readily available, cheap roughage that can be used together with other feeds to provide a source of roughage for feeding sheep during summer and autumn.

This article considers some of the factors which can affect straw quality, and suggests strategies to make best use of straw for sheep feed.
Straws grown in low rainfall areas have a higher digestibility than those grown in higher rainfall areas.

Straw quality

Two essential components of a diet are the amounts of energy and protein it provides to the animal. During summer and autumn, different classes of stock grazing stubbles have varying requirements for energy. The amount required increases with the nutritional demands of the animal. To provide sufficient energy for growth and development of both the ewe and her unborn lamb, for example, ewes in late pregnancy and early lactation require up to three times the energy needed to maintain a non-pregnant animal.

The digestibility of a feed is the main factor which determines the amount of energy provided by that feed. Concentrates such as barley or lupins are 80 to 90 per cent digestible, and provide a high energy diet, whereas roughages such as straw or hay are generally of lower digestibility (35 to 55 per cent), and provide less energy.

Protein is also an essential component of any diet, and different classes of stock have varying nutritional demands for protein. Demands for protein are high during late pregnancy and during lactation, and high wool growth rates can only be achieved with a high protein diet.

Lupin seeds are about 30 per cent protein, and are therefore a particularly important source of supplementary protein. Straw, however, contains less than 4 to 5 per cent protein, and an additional source of protein is generally needed with straw diets.

Plant breeders seldom consider the nutritive value of stubbles when selecting cereal varieties for development, so there is little information available for the farmer to choose a cereal variety on the basis of either the protein content or its digestibility.
Nevertheless, the quality of cereal straws can vary widely. Soil fertility, rainfall, time of sowing and time of harvest can all modify straw quality. Few of these factors have been investigated in any detail for their effect on straw quality. Those that will be discussed here are: the variety and species of the crop grown; the growing location; and the time after harvest.

**Effect of variety and location**

In 1977-79, CSIRO research workers collected a wide range of cereal straws from throughout Western Australia’s South-West to assess the effect of growing location on the quality of the straw. They found the digestibility of the straws could be directly related to the rainfall of the growing location, such that straws grown in high rainfall areas had a lower digestibility than straws grown in low rainfall areas (Purser, 1983).

The Department of Agriculture used this information to set up an experiment in 1986 to measure the digestibility of straws for sheep. Samples of straw from three or four varieties each of wheat, oats and barley, each grown at Badgingarra, Wongan Hills, Popanyinning and Mt Barker, were collected from the Department’s cereal variety trial sites, after the grain had been harvested. The digestibilities of these straws were measured by incubation of samples in nylon bags suspended in the rumen of sheep. Measurement of the disappearance of dry material from these bags after 48 hours gave an estimation of the digestibility of the sample.

Table 1. Ranges in digestibility (%) of cereal straws from different locations collected after the grain had been harvested

<table>
<thead>
<tr>
<th>Location</th>
<th>Wheat</th>
<th>Oats</th>
<th>Barley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Badgingarra</td>
<td>38-46</td>
<td>45-47</td>
<td>NA</td>
</tr>
<tr>
<td>Wongan Hills</td>
<td>30-36</td>
<td>37-44</td>
<td>42-43</td>
</tr>
<tr>
<td>Popanyinning</td>
<td>41-47</td>
<td>37-49</td>
<td>45-51</td>
</tr>
<tr>
<td>Mt Barker</td>
<td>28-35</td>
<td>26-32</td>
<td>30-37</td>
</tr>
</tbody>
</table>

Straws collected from Mt Barker were consistently of lower digestibility than those from any of the other three locations (Figure 1). In addition, at each location, the digestibilities of the wheat and oat straws were lower than those of the barley straws.

Although the values given are the means for each of the locations, there was considerable variation in digestibility within each of the varieties, even when these were grown at the same location. Table 1 shows these ranges in digestibility. Grain yield also varied with growing location: as the mean grain yield at each location increased, the digestibility of straw decreased.

**Time after harvest**

Grazing sheep are able to select the more nutritious parts of the stubble crop: spilt grain remaining after harvest is eaten rapidly, so that even though it forms only a small proportion of the dry matter available in the stubble, grain is a high proportion of the diet selected. Once most of the grain has been eaten, sheep select the more digestible parts of the plant straw.

In a study carried out by G.R. Pearce (1983), the variations in digestibility between different parts of wheat straw were measured. He found that the leaf blade and sheath in the stubble had a digestibility of about 59 per cent, whereas the stem material was only 29 per cent digestible. The proportion of leaf material compared with stem is low, and sheep preferentially graze the leaf material.

Rain during summer and autumn can significantly reduce the digestibility of the stubble, mainly through leaching out the soluble or digestible components of the straw.

The nitrogen content of grazed stubbles is also too low to sustain adequate microbial growth in the rumen. This may restrict digestion of dietary fibre, and with it the sheep’s ability to digest the roughage diet efficiently.
Stubbles grown in wet areas will be of lower quality than those from drier areas, particularly late in the season when rain may have reduced digestibility further. Farmers should monitor the performance of sheep throughout summer and autumn, either by weighing them or by condition scoring, to provide feeding strategies that will prevent unwanted losses of bodyweight or condition.

Supplementary feeding is therefore essential during late summer and autumn to provide additional energy and protein for maintaining sheep liveweight, particularly of young animals or pregnant ewes.

Cereal grains or lupin seed are commonly used as supplements. Their use has been discussed in a previous *Journal of Agriculture* article by sheep and wool research officer J.B. Rowe (see further reading).

An alternative to leaving stubbles in the paddock is to conserve the straw in bales for use later in summer or autumn, when grazing feed supplies are low in quality and quantity.

**Conservation of straw**

Baled straw can:
- minimize wastage of stubbles over summer;
- provide roughage in autumn and early winter when paddock feed is limited;
- be used to feed stock in confined areas to prevent soil erosion.

These advantages also provide farmers more flexibility in their paddock management options for pasture establishment in autumn or for their cropping programmes.

However, the nutritional value of baled straw is low. Conserved straw seldom includes any of the spilt grain which is so beneficial to animals grazing stubbles, so some form of supplementation with either lupin seed or cereal grains is essential for it to provide a maintenance diet.

**Feedlotting sheep**

Baled straw can be fed to sheep in enclosed paddocks as the basis of a feedlot ration or in drought conditions.

Chaffing the straw before feeding out may be advantageous where the sheep can be fed in troughs, since this reduces wastage. However, sheep fed chaffed straw have less opportunity to select out the more digestible fractions of the straw compared with those grazing stubbles. Lupin or oats supplements are therefore essential to prevent excessive weight losses. Levels of supplementation under this feeding system are generally higher than those recommended for paddock feeding because of this reduced selection ability.
In a pen feeding experiment at Wongan Hills Research Station, 55 kg wethers were fed chaffed wheat straw (49 per cent digestible) either with or without lupin seed at 200 g per head per day. Over an eight-week period all sheep lost weight, but the lupin supplementation reduced liveweight losses by 100 g per head per day compared with those receiving no lupins (Figure 2).

**Chemical treatment of straw**

Chemical treatment of straw or low-quality hay by applying alkalis has been used successfully in many countries to increase the digestibility of the roughage by breaking down some of the more indigestible fibrous parts of the plant. Increased digestibility may result in improved intake and animal performance compared with that from untreated straw.

The Department of Agriculture has investigated the use of a solution of urea to increase the nutritional quality of straw. When urea is dissolved in water and exposed to bacterial enzymes the ammonia combines with the water to form an alkaline solution. The alkali acts on the fibrous part of the straw to increase its digestibility. The urea also provides extra nitrogen, which can boost the low nitrogen content of the straw.

Several experiments have investigated the potential use of urea as a method of increasing the digestibility of straw for sheep. In early work a Kojonup farmer, Mr P. Harrison, sprayed a solution of 2 per cent urea, soluble carbohydrate and minerals onto large round bales. This level of urea was found to be too low to achieve maximum increases to the digestibility of the straw. Subsequent experiments showed that levels of urea of up to 6 to 8 per cent were necessary.

Despite measured increases in straw digestibility, the performance of sheep eating urea treated straw has been disappointing, compared with some of the results obtained elsewhere when treated straw is fed to cattle. In particular, the responses were always considerably lower when compared with those from untreated straw supplemented with lupin seed.

In an earlier Department experiment, mature ewes were fed either urea-treated oaten straw or the untreated straw plus 250 g per head per day lupins. Although all animals lost weight, the lupin-supplemented ewes lost only 50 g per head per day compared with the animals eating urea-treated straw which lost 200 g per head per day.

The initial quality of the straw is also important in determining its response to urea treatment. In our experiments, the percentage improvement in digestibility is higher with lower quality straws. However, even though straws of low digestibilities show the greatest percentage increases in digestibilities after urea treatment, the resulting urea-treated straws are still low in digestibility.

In other words, urea treatment of very poor quality (about 35 per cent digestible) straw may increase its digestibility by 30 per cent, but it will still result in only a poor quality treated straw of 45 per cent digestibility. Treating a straw initially 45 per cent digestible may improve the straw by only 20 per cent, but this will yield a treated straw of 54 per cent digestibility.

Where straw is treated with urea, the urea should be included in solution at 5 to 7 per cent (by weight of straw), together with ammonium sulphate (in the ratio 10:1 urea:sulphate). Bales should be thoroughly soaked with the urea solution. For best results 120 to 140 litres of urea solution should be applied to each large (300 kg) round bale. Bales should be wrapped tightly in plastic, to prevent losses of nitrogen as ammonia, and kept for at least three weeks before use to allow for maximum reaction of the urea solution on the fibre.

**Wool growth**

Wool growth of sheep grazing stubbles can decline to as low as five to six grams clean wool per head per day during late summer and autumn. This growth rate is less than 40 per cent of the maximum wool growth rates which are achieved during spring. Wool production during late summer and early autumn can also be reduced further as a result of the additional energy and protein demands of pregnancy.

Figure 2. The effect of feeding lupins to sheep eating chaffed straw.
Wool growth requires an adequate supply of energy and protein to the animal. Both of these nutrients are in low supply for animals on stubble pastures or straw diets, and supplementation with additional protein and energy is important to maintain wool growth.

In a supplementary feeding trial carried out at Wongan Hills Research Station by J.B. Rowe, G.A. Brown and J. Ferguson in 1986, lupins, oats or barley, at levels between nil and 750 g per head per day, were fed to weaner sheep from February to May. Supplementation, even at only 150 g per head per day, increased wool staple strength from 18 to 25 Newtons per kilotex, and 12-month fleece weights increased with the level of supplementation (Figure 3). Sheep eating lupins grew more wool during the experimental period than those eating similar amounts of the other grains, but the difference between feeds was not significant for 12-months wool growth.

[The staple strength is derived by a measure of the maximum pulling force (in Newtons) required to break the staple divided by the staple size or thickness (in kilotex, which is a measure of the weight of staple per unit length). Staple strength can range from zero to 90 Newtons per kilotex.]

These results indicate that, with current wool prices, farmers may recover the costs incurred for low levels of supplementary feeding during summer and autumn from the value of the additional wool grown.

Conclusions
Cereal straws are a valuable source of roughage for sheep on mixed cereal/sheep farms, if they are managed correctly.

Not all cereal stubbles are of the same quality: different varieties and growing conditions can produce straws of widely varying nutritional value. We need further research to establish what influences the digestibility of straw and its nutritive value.

Baled straw can provide a versatile source of low-cost roughage during late summer or autumn when the quality and quantity of paddock feed is low. Feeding urea-treated straw in a paddock feedlot is not an economical method of providing a maintenance diet for sheep; however, lupin supplementation of untreated cereal straw bales may be an easy and cost-effective method of lot-feeding sheep.

Acknowledgement
The author thanks the Wheat Research Committee of Western Australia for its financial support of this project.

Further reading

Figure 3. Effect of grain supplementation on clean wool weight of weaners grazing wheat stubble at Wongan Hills Research Station over summer, 1986.