THE EFFECT OF WHOLE COTTONSEED FEEDING ON RAM SEMEN QUALITY

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SUMMARY
The effects of whole cottonseed on semen quality were evaluated when fed as a supplement to rams eating grassy hay. Mature Merino x Wiltshire Horn rams were placed in pens for 90 days and were fed 1000 g/ram.day Rhodes grass hay with no supplement (Group 1, control) or plus a supplement of either 200 g (Group 2), 400 g (Group 3), or 800 g/ram.day whole cottonseed (Group 4).

The rams offered 200 g and 400 g whole cottonseed consumed nearly all their ration from the beginning of the trial. The 800 g/ram.day whole cottonseed group only consumed 400 g for the first 42 days but had total acceptance for the remainder of the trial. Group 1 consumed all the Rhodes grass hay that was offered but Rhodes grass hay consumption in groups 2 and 3 was less than was offered. Intakes of Rhodes grass hay in the fourth group reduced proportionally to the increased intakes of whole cottonseed and the molasses that was used to improve palatability.

Semen quality in the 4 groups remained the same throughout the duration of the trial. No significant correlations were found between whole cottonseed intakes of the 4 groups and the semen quality of the rams in those groups.

Keywords: whole cottonseed, supplement, gossypol, semen quality, rams.

INTRODUCTION
As a result of the harsh Queensland environment and poor levels of nutrition it has become a common management practice in the wool industry to supplement rams prior to joining with a high protein and high energy diet. The rapid rise in cotton production in recent years has resulted in the increased use of a waste product referred to as whole cottonseed for supplementary feeding of sheep and cattle (Knights and Pritchard 1990; Thompson and Dixon 1988). Tests show whole cottonseed to be high in both protein (20%) and energy (14 MJ/kg) (Leng 1986) and therefore very suitable for the preparation of rams prior to joining. However, whole cottonseed could have contraceptive effects due to its gossypol content. Such effects have been reported in humans (Maugh 1981) and rats (Sotelo et al. 1982). The latter became infertile after consuming 50 mg of free gossypol daily for 4 weeks. These effects on male infertility are considered to result from the inhibition by gossypol of the enzyme lactate dehydrogenase (LDH-X) which has a crucial role in the metabolism of spermatozoa and spermatogenic cells.

Unsubstantiated reports from the cattle industry suggest that bulls could be infertile after being fed whole cottonseed prior to joining. However, Reiser and Fu (1962) considered gossypol to be safe for ruminants because of partial detoxification in the rumen.

The aim of this trial was to determine if whole cottonseed fed as a supplement to rams caused a change in semen quality.

MATERIALS AND METHODS
The experiment was conducted at Yeerongpilly, Queensland between June and October, 1986. Eight mature Merino x Wiltshire Horn rams were fed 1000 g/ram.day of Rhodes grass hay in individual pens. Semen was collected by electroejaculation twice weekly for 12 weeks. At the end of the first 2 weeks rams were allocated to 4 treatment groups (n = 2) on the basis of volume, colour and wave motion of semen. Treatment was supplementation with different levels of whole cottonseed (WCS): Group 1, control no WCS; Group 2, 200 g/ram.day WCS; Group 3, 400 g/ram.day WCS; Group 4, 800 g/ram.day WCS. The above semen characteristics were examined at each semen collection. To improve palatability and consumption of WCS molasses was fed to 3 rams (Table 1).

Total lactate dehydrogenase (LDH) activity in semen was measured using a standard kit method (Boehringer Mannheim) and an automated analyser (Guilford 3500). LDH isoenzymes in semen extracts were separated by cellulose acetate electrophoresis and subject to visualisation and/or densitometry after staining. Correlations between semen volume, colour and wave motion and whole cottonseed intakes were calculated and LDH was subjected to a regression analysis.
RESULTS

Rams offered 800 g/ram.day whole cottonseed took 5 weeks to accept 600 g/ram.day with total acceptance being achieved soon after (Table 1).

Table 1. Mean intake (g) of Rhodes grass hay, whole cottonseed and molasses for individual rams given daily amounts of 1 kg of hay and 0, 200, 400 or 800 g whole cottonseed (WCS) over the 90-day trial period

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>Control No WCS</th>
<th>200 g/ram.day WCS</th>
<th>400 g/ram.day WCS</th>
<th>800 g/ram.day WCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhodes grass hay</td>
<td>983</td>
<td>696</td>
<td>763</td>
<td>521</td>
</tr>
<tr>
<td>Whole cottonseed</td>
<td>184</td>
<td>200</td>
<td>396</td>
<td>657</td>
</tr>
<tr>
<td>Molasses</td>
<td>83</td>
<td>179</td>
<td>192</td>
<td>242</td>
</tr>
</tbody>
</table>

Semen quality on the basis of measurements conducted remained high in all treatment groups during the 12 weeks duration of the observation. However, no attempt was made to impregnate ewes with semen from rams in the trial group. There was no detectable change in the level of staining of the LDH-X isoenzyme due to the feeding of whole cottonseed to the rams. Furthermore, the correlation between total LDH activity in semen and whole cottonseed intake was not significant (r = 0.561).

No significant correlations were found between whole cottonseed intake and the semen quality of rams (Table 2).

Table 2. Mean values for semen volume, colour (5, thick creamy; 4, creamy; 3, milky; 2, cloudy; 1, clear) and wave motion (0, no currents; 1, few slow currents or waves; 3, many sweeping waves; 4, numerous vigorous waves; 5, numerous rapid and vigorous waves, pattern tumultuous) and their correlation with whole cottonseed intake of individual rams offered 1 kg Rhodes grass hay and 0, 200, 400, or 800 g of whole cottonseed (WCS)

<table>
<thead>
<tr>
<th>Treatment group</th>
<th>Control No WCS</th>
<th>200 g/ram.day WCS</th>
<th>400 g/ram.day WCS</th>
<th>800 g/ram.day WCS</th>
<th>Correlation coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume (mL)</td>
<td>1.7</td>
<td>1.5</td>
<td>1.3</td>
<td>1.2</td>
<td>0.128</td>
</tr>
<tr>
<td>Colour</td>
<td>3.9</td>
<td>3.4</td>
<td>3.3</td>
<td>3.2</td>
<td>0.013</td>
</tr>
<tr>
<td>Wave motion</td>
<td>4.3</td>
<td>4.6</td>
<td>3.6</td>
<td>4.1</td>
<td>0.123</td>
</tr>
</tbody>
</table>

DISCUSSION

The results from this trial have reduced concern about feeding whole cottonseed to rams. Intakes of free gossypol by the rams in this trial were as high as 700 mg/ram.day without any measured changes in semen quality. Daily oral doses as low as 20 mg over a 2-month period was adequate to reduce sperm counts in humans while a maintenance dose of 75–100 mg taken twice monthly thereafter was 99.89% effective as a contraceptive (Maugh 1981). The lack of change in semen quality in this trial could be related to detoxification of the gossypol in the rumen (Reiser and Fu 1962). Unsubstantiated reports that whole cottonseed caused infertility in bulls could have been confused with overheating problems resulting from the high intakes of cereal grains.

REFERENCES