1-1-1963

Oxalate poisoning. 1. The effect of oxalate-containing plants on ruminants

M R. Gardiner

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

Recommended Citation


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.
IMPORTANT DISCLAIMER

This document has been obtained from DAFWA's research library website (researchlibrary.agric.wa.gov.au) which hosts DAFWA's archival research publications. Although reasonable care was taken to make the information in the document accurate at the time it was first published, DAFWA does not make any representations or warranties about its accuracy, reliability, currency, completeness or suitability for any particular purpose. It may be out of date, inaccurate or misleading or conflict with current laws, polices or practices. DAFWA has not reviewed or revised the information before making the document available from its research library website. Before using the information, you should carefully evaluate its accuracy, currency, completeness and relevance for your purposes. We recommend you also search for more recent information on DAFWA's research library website, DAFWA's main website (https://www.agric.wa.gov.au) and other appropriate websites and sources.

Information in, or referred to in, documents on DAFWA's research library website is not tailored to the circumstances of individual farms, people or businesses, and does not constitute legal, business, scientific, agricultural or farm management advice. We recommend before making any significant decisions, you obtain advice from appropriate professionals who have taken into account your individual circumstances and objectives.

The Chief Executive Officer of the Department of Agriculture and Food and the State of Western Australia and their employees and agents (collectively and individually referred to below as DAFWA) accept no liability whatsoever, by reason of negligence or otherwise, arising from any use or release of information in, or referred to in, this document, or any error, inaccuracy or omission in the information.
POISONING by plants which contain salts of oxalic acid may be a more common cause of stock losses in Western Australia than was previously thought. This article describes the effects of these plants on ruminants and outlines an experiment in which the toxicity of soursob was examined.

An article in next month's Journal of Agriculture will describe the most important oxalate-containing plants found in Western Australia.

POISONING by oxalate-containing plants has been known to occur for many years but outbreaks have been thought to be infrequent and of no special consequence as a cause of sheep loss in Western Australia.

Routine studies of sheep tissues submitted to the Animal Health Laboratory during the past four years have suggested, however, that damage resulting from ingestion of these plants may be far more widespread than previously realised, even though mortalities are not often associated with their consumption. It is likely that oxalate poisoning may be one of the causes of the so-called non-specific losses with which every grazier is well-acquainted and which are seldom diagnosed accurately.

In most accounts of oxalate poisoning a lowering of blood calcium (hypocalcaemia) is considered to be the principal ill effect, causing the external symptoms. However, accumulated evidence indicates that hypocalcaemia may occur only as an uncommon but dramatic expression of oxalate plant poisoning. Insidious damage is far more widespread and important in loss of life and production in the sheep industry.

Kidney damage is undoubtedly the main harmful effect of these plants. As mentioned previously, routine studies have uncovered this fact and it may be conservatively estimated that as many as 25 per cent. of sheep in many flocks may suffer some degree of kidney damage during the autumn and early winter. A few of these sheep may die, while the great majority show no definite signs of poisoning, although they continue to carry the scars.

These sheep would be particularly vulnerable to further bouts of poisoning. Because of cumulative effects, they may suffer further and irreparable damage, or even death, in the following years.

There are other kinds of tissue damage associated with ingestion of these plants.
These may be briefly summarised as follows:—

1. Induced Calcium Deficiency

Soluble oxalate salts have a strong affinity for calcium, forming insoluble calcium oxalate. This prevents its assimilation. There may, therefore, be interference with calcium metabolism in the intestine and in bone, leading to skeletal abnormalities and subnormal growth. These effects of chronic oxalate poisoning naturally vary with physiological conditions and with availability of calcium in pastures.

Pregnant and lactating sheep and cattle require considerable amounts of calcium, and oxalate intake during these periods of calcium stress may not only cause acute hypocalcaemia in some animals, but may also interfere with milk production and bone growth.

2. Kidney Damage Causing Urinary Calculi

Oxalates causing kidney damage may be involved in some forms of urinary calculi. This possibility has been studied in Queensland and is now being investigated in Western Australia.

3. Brain Damage

Oxalates may, in certain circumstances, crystallise out in other tissues, especially the brain. Paralytic symptoms and other disorders of the central nervous system may then be seen in some affected animals.

4. Breakdown of Red Blood Cells

Oxalates appear to have a toxic action on red blood cells, causing their breakdown.

**METABOLISM OF OXALATES**

Oxalates are normally metabolised to harmless products in the rumen of sheep and cattle. This undoubtedly protects many animals from its toxic effects.

However, rumen inactivation of oxalic acid depends obviously on normal function of this organ, a function which may be seriously upset in cobalt deficiency. We have definite evidence that oxalates may be more toxic where cobalt is deficient.

If oxalic acid is given to sheep directly into the blood stream or bypasses the rumen by injection into the fourth stomach (abomasum), very small quantities are sufficient to cause signs of poisoning, as Dodson showed in South Australia. He further demonstrated that most sheep grazing soursob (one of the plants containing high amounts of oxalates) eat the equivalent of 75 grams (2½ ounces) of oxalic acid each day without ill-effects during the winter, after they have become accustomed to the plant.

After a summer of dry feed, ingestion of small amounts of this plant will cause severe kidney damage and even death. The work of Dodson and others leaves little room for doubt that sheep can metabolise and destroy the oxalates of plants when they have become accustomed to it (that is, when specific bacteria essential for this process have developed in the rumen.)

The existing evidence strongly suggests that this rumen adjustment takes as long as 10 days and that during the initial period of oxalate plant ingestion, there is considerable susceptibility to its toxic effects.

The plane of nutrition of sheep before the intake of these plants, is important. This was shown by Dr. P. S. Watts, in South Australia. Thus, on a low level intake of wheat-chaff, amounts of oxalate-containing plant equivalent to 6 grams of oxalic acid per day, could be fatal, while on a high plane of nutrition (provided by wheat-chaff plus lucerne) much greater amounts of oxalic acid could be tolerated.

**LOCAL INVESTIGATIONS**

Some practical aspects of this problem were studied in the Department of Agriculture's Animal Health Laboratory in 1962. The basis of this investigation was the widely accepted belief that oxalates are broken down in the rumen to harmless by-products and that, in theory, ruminants should be able to metabolise the acid completely.

The sheep used were obtained from a property free from oxalate plants.

In the trial, some sheep were put on a low intake of oaten chaff for a week before the oxalate plant intake, while others were left on oxalate free intake.

One group of these sheep was allowed to change over gradually to soursob (containing an average of 5.9 per cent. oxalates
dry basis), over seven days and then continued on a complete sourso diet. This might be one pattern in the field with one of the oxalate plants assuming rapid dominance following opening autumn rains.

A second group was changed abruptly from chaff to sourso, another possibility under some farm conditions, when a flock of sheep is moved, or otherwise gains access, to a heavy stand of the plants.

A third group was alternated abruptly from chaff to sourso at weekly intervals. This might happen in some pasture rotations.

These treatments were continued for four to five weeks, although in some cases death occurred earlier.

A summary of results is given in the table.

**Results**

There were marked differences in the ability of the sheep in the different groups to tolerate oxalates. All the sheep showed severe kidney damage but those which were transferred gradually onto sourso were able to eat from 1,300 to 1,600 grams of total oxalates over a period of 27 days with no more damage than sheep taking in 150 to 270 grams oxalate abruptly over a five or six day period. In each group one sheep died.

Another conclusion was that sheep put abruptly onto sourso on alternate weeks learned to tolerate the plants and to metabolise oxalates so that a second period of sourso feeding was better tolerated.

Kidney damage was more severe in sheep on restricted normal feed before starting sourso than in those on a prior optimum diet. However part of this greater severity was certainly due to a much greater consumption of sourso by the previously restricted and presumably hungrier sheep.

**Kidney Damage Severe**

It is remarkable how much kidney damage sheep can sustain without signs of ill-health. This damage occurs regardless of the method of administration of oxalate containing plants, although the length of time sheep can eat a pasture dominated by these plants, before sudden decline and death, does vary considerably with the way ingestion of these plants is related to normal feed intake.

Dr. L. B. Bull, working with oxalate plants in South Australia many years ago, considered that sheep could graze dominant sourso pastures for three to four weeks without injury. Our results showed that, at least under extreme conditions, death may occur in a few days.

**No Hypocalcaemia**

None of our experimental sheep developed hypocalcaemia, widely considered to be one of the main effects attributed to ingestion of oxalate plants. Although hypocalcaemia may occur after abrupt unrestricted access to the plants, it is probably rare compared with insidious chronic kidney damage.

In Western Australia, oxalate-containing plants are most important and dangerous following opening autumn rains which may occur as early as February or March. The appearance of a green pick of immature oxalate plants coincides with the end of a long period of poor quality feed intake, setting the stage for increased susceptibility to their toxic effects.

Furthermore, this appearance may also coincide with the end of pregnancy, or with lambing, both of which may be adversely affected by oxalate intake.

**EFFECTS OF SOURSOB ON EXPERIMENTAL SHEEP**

<table>
<thead>
<tr>
<th>Group</th>
<th>Sheep</th>
<th>Pre-trail feeding</th>
<th>Number of days on sourso</th>
<th>Total Sourso</th>
<th>Approx. Oxalate acid intake</th>
<th>Degree of Kidney Damage</th>
<th>Consumption sourso first week</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.—Gradual change to sourso—7 days</td>
<td>1</td>
<td>Ad lib oaten chaff</td>
<td>Dead on day 27</td>
<td>150</td>
<td>1,600</td>
<td>Tremendous</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Ad lib oaten chaff</td>
<td>Killed on day 28</td>
<td>120</td>
<td>1,300</td>
<td>Severe</td>
<td>12.5</td>
</tr>
<tr>
<td>II.—Abrupt change to sourso</td>
<td>3</td>
<td>Ad lib oaten chaff</td>
<td>Killed on day 8</td>
<td>13.5</td>
<td>150</td>
<td>Very severe</td>
<td>13.5</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>200 grams/day oaten chaff</td>
<td>Dead on day 8</td>
<td>25</td>
<td>270</td>
<td>Extremely severe</td>
<td>25.0</td>
</tr>
<tr>
<td>III.—Alternatively abruptly from sourso to chaff 7 day intervals</td>
<td>6</td>
<td>Ad lib oaten chaff</td>
<td>Killed on day 34</td>
<td>35</td>
<td>380</td>
<td>Very severe</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>200 grams/day oaten chaff</td>
<td>Killed on day 34</td>
<td>75</td>
<td>810</td>
<td>Extremely severe</td>
<td>25.0</td>
</tr>
</tbody>
</table>
RECOMMENDATIONS

The following precautions should be taken in the autumn and winter, when oxalate plants may be prevalent in pastures:

- Avoid grazing pregnant or lambing ewes on such pastures. Only wethers should be allowed access to them for short periods.
- If sheep are placed on pastures containing many oxalate plants, supplementary feed, such as palatable hay, should be provided for a couple of weeks. If possible, rotation onto non-oxalate plant pastures should be practiced.
- Never run valuable rams or breeding ewes on pastures containing oxalate plants. It is probable that long-term adverse effects on fertility of both sexes may result both from chronic kidney damage and from interference with calcium metabolism.
- Do not graze sheep of any class on pastures carrying a dominant stand of these plants.
- Avoid the use of autumn paddocks containing oxalate plants for hoggets, especially ewe hoggets, as serious effects on growth and fertility may occur.

ACKNOWLEDGMENTS

It is a pleasure to record the able assistance of Mr. Pieter Visser, of the Animal Health Laboratory, in the conduct of feeding trials.

REFERENCES


FOR LYSAGHT Silos

Get in touch with DALGETY-N.Z.L.

LYSAGHT DISTRIBUTORS

Journal of Agriculture Vol 4 No 3, 1963
Now! Handle bulk storage faster...easier...than ever before!

With full-size, walk-in doors and many other modern improvements, Lysaght All-purpose Silos streamline bulk storage...save time and money for wheat farmers, big and small. Essential at harvest time, they continue to earn money for you all the year round. When not being used for bulk grain, they become ideal all-purpose storage units simply by opening the doors and slipping out the bulkheads.

Above: A typical battery of Lysaght 3,100 bushel Silos at Condobolin, N.S.W., installed for the bulk handling of wheat. With the new flat floor, these silos work 365 days of the year as general storage for seed wheat and many other purposes.

At left: Close-up of a mobile Auger emptying one of the above silos. With a sweep attachment, and the flat floor the silo can be emptied to less than a single bag of grain.

LYSAGHT
ALL PURPOSE SILOS

AMERICAN TYPE
FLAT FLOOR SYSTEM

* Patent Pending No. 55007/59

- Full-size "walk-in" door (silos from 1,200 bushels upwards) enables silos to be emptied and cleaned with a minimum of time, effort and discomfort.
- Easier, faster, cheaper erection.
- Vertically rigidised walls and 6-ply horizontal ribs for added strength.
- Robust positive-action bagging outlets, complete with quick release bag holder and steel hood.
- Auger Chute in bottom bulkhead behind the door.
- Improved centre and side-filling hole assemblies, complete with hinged lids and positive fastenings.
- Wide turned-down eaves on roof panels
- Fully rodent-proof construction.

PRICES
(Ex Fremantle Store)

<table>
<thead>
<tr>
<th>Nominal Capacity</th>
<th>Steel Bushels</th>
<th>Earth Ring Floor</th>
<th>Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>500</td>
<td>£93</td>
<td>£11.10.0</td>
<td>£31.10.0</td>
</tr>
<tr>
<td>1,200</td>
<td>£172</td>
<td>£22</td>
<td>£31.10.0</td>
</tr>
<tr>
<td>2,000</td>
<td>£240</td>
<td>£22</td>
<td>£31.10.0</td>
</tr>
<tr>
<td>3,100</td>
<td>£318</td>
<td>£31.10.0</td>
<td>£47</td>
</tr>
<tr>
<td>3,700</td>
<td>£349</td>
<td>£31.10.0</td>
<td>£47</td>
</tr>
</tbody>
</table>

* The 500 Bushel Silo is not equipped with a door. Price includes steel floor.

Optional extras: Easy to install, heavy gauge Steel Floor • Steel Earth Ring.

Post coupon now for complete details to: John Lysaght (Australia) Limited.

Please send me full details of the complete range of Lysaght Grain Silos.

NAME
NAME OF PROPERTY
ROUTE OR RMB NO.
DISTRICT STATE

JOHN LYSAHGHT (AUSTRALIA) LIMITED
8 Pakenham Street, Fremantle, W.A. 6160
Manufactured by: John Lysaght (Australia) Limited, Special Products Division, Newcastle Works, Newcastle, N.S.W.

SBCW

Please mention the "Journal of Agriculture of W.A.," when writing to advertisers.