Seminar proceedings: Goats and the farming system. Bridgetown, August 14, 1986

L.J.E Karlsson

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SEMINAR PROCEEDINGS:
GOATS
IN THE FARMING SYSTEM
Compiled by: L.J. E. Karlsson

BRIDGETOWN, AUGUST 14, 1986
A joint programme sponsored by the Bridgetown District Office of the Western Australian Department of Agriculture and Windmill Farms, Bridgetown.
GOATS IN THE FARMING SYSTEM

Proceedings of a seminar organised by the Bridgetown District Office of the Department of Agriculture and Windmill Farm, Bridgetown

August 14, 1986

Compiled by: L.J.E. Karlsson

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CONTENTS

Introduction
* Definition of goat fibre types - John Karlsson

Management considerations
* New branding regulations for goats - Jim Maddams
* Requirements for keeping feral goats - David Rees
* Management aspects of goat farming - John Karlsson

Commodity outlook
* Sheep and goat fibre market outlook - Peter Eckersley
* Review of the Australian goat meat industry - Larry King

Economic considerations
* Goat establishment options and costs - Bruce Shields
* Economic comparison of mohair, cashmere and sheep - Gerry Parlevliet

Industry structure and organisation
* Angora mohair breeders of Australia Ltd - Graham Larke
* Australian cashmere industry - Tod Kirwan

Supplementary papers
* Worms in goats and their control - Geoff de Chaneet
* Angora flock improvement - John Karlsson

Appendix
* The importance of marketing and clip preparation - Joan Eggleston
* Selling cashmere through the A.C.M.C. - Lucinda Corrigan
DEFINITION OF GOAT FIBRE TYPES
L.J.E. Karlsson, B.V.Sc., B.Sc.
District Veterinary Officer,
Department of Agriculture, Bridgetown

Evolution of fibre types

Animals that have evolved in an environment where there are significant differences between the summer and winter seasons, have a need for a seasonal growth pattern of their coat to facilitate body temperature control. The resulting coat types are referred to as summer and winter coat corresponding to the respective seasons.

The winter coat is usually a dual fibre coat composed of an under coat and an outer coat. The under coat is made up of fine fibres derived from secondary follicles. Its main purpose is insulation. The outer coat is made up of longer and coarser fibres derived from primary follicles.

Fibre growth in the secondary follicles is under hormonal control and regulated by centres in the brain. Fibre growth begins in response to decreasing day length in preparation for the ensuing autumn and winter. At the other end of this cycle, secondary follicle activity declines in response to increasing day length. The secondary fibres are then typically shed during the ensuing spring.

Comparative aspects of fibre growth

Fibre development and growth in the goat differs little from that in sheep. Primitive or unselected sheep have a dual coat with a seasonal growth cycle. This corresponds to most of the goats in the temperate areas of the world.

The anatomical structure from which fibre is produced is the follicle. The structure and arrangements of the follicles are similar in sheep and goats. In both species, follicles are arranged in a characteristic fashion, being in groups, with each group typically consisting of three primaries and a group of associated secondary follicles. In the primitive (unselected) goat or sheep, the primary follicles are much larger than the associated secondary follicles.

The large primary follicles produce a coarse 50 to 150 micron (µm) diameter fibre. These fibres are medullated, that is, have a central tubular air space. The secondary fibres have a fine diameter with the majority found in the range of 10 to 25 micron. These fibres are non-medullated.

Selective change of fibre growth

Fibre growth and morphology is determined by an animals genetic makeup. The dual coat in animals living in a temperate environment has probably evolved gradually through natural selection following exposure to this environment. In unselected sheep and most of the goat breeds, the fibre produced by the secondary follicles is short and therefore not useable in the processing industry.

The various sheep breeds have been subjected to more deliberate selection directed at "improving" their fleece production in terms of both quantity and quality. In the Merino sheep, selection has achieved the most extreme result. In this case, selection has been directed towards production of a single coated animal. Selection has been against coarse medullated primary fibres and in favour of a longer and continously growing secondary fibre.
With this selection pressure there has been a corresponding change in the follicle structure. The primary follicles have become smaller, the secondary follicles are longer and surrounded by a better blood supply to service their greater metabolic activity.

Although goats have been domesticated for a longer period than sheep, there has been less deliberate selection in goats for various production traits. Of the two most recognised fleece producing goats, Angoras have the longest history of selection for improved fleece production.

The selection aim in Angora/mohair production has been towards a single coated animal. In the better Angoras, this aim has been almost achieved, where these animals have less than 1 per cent of medullated fibres. However, the Australian Angora industry, compared to the other major mohair producing countries, Turkey, South Africa and the U.S.A. (Texas) is recognised as having a relatively high incidence of medullated fibres. This is a reflection of a more recent history of upgrading.

During the selection for a single coated Angora/mohair fleece, changes in the follicle structure have been similar to the Merino sheep. However, there are some differences which are as follows; The secondary fibre diameter has been increased compared to the unselected goat; there has been a reduction in the size of the primary follicle and the diameter of the primary fibre. This reduction is not as great as the corresponding change in the Merino.

There is no recognised cashmere breed type; instead it is best described as a goat with a well developed, seasonally growing, winter coat.

The traditional cashmere fibre comes from goats in the mountainous regions of Central Asia. It is unlikely that man has imposed much selection for cashmere production in these areas. However, natural selection may have operated in favour of goats with a well developed winter coat favourable to the harsh winter period.

The Australian cashmere producing feral goat is a "synthetic" collection of animals with a varied background, including dairy goats, Angora goats and probably some cashmere/cashgora type goats. This difference compared to the traditional Asiatic cashmere goats is "reflected" in a higher degree of lustre in the Australian fibre compared to, for example, Chinese cashmere.

Comparison of fibre characteristics

The major parameters affecting fibre quality and quantity are listed in the following table. This table gives examples of single and double coated animals in both goats and sheep.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Cashmere</th>
<th>Angora</th>
<th>Merino</th>
<th>Scottish Blackface (carpet wool)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S/P ratio</td>
<td>7-9</td>
<td>7-9</td>
<td>15-25</td>
<td>3</td>
</tr>
<tr>
<td>Follicles (mm)</td>
<td>20</td>
<td>20</td>
<td>50-85</td>
<td>7-9</td>
</tr>
<tr>
<td>Fibre diameter (µm)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- primary</td>
<td>50-150</td>
<td>30-40</td>
<td>15-23</td>
<td>70-95</td>
</tr>
<tr>
<td>- secondary</td>
<td>10-20</td>
<td>30-40</td>
<td>15-20</td>
<td>22-35</td>
</tr>
<tr>
<td>Medullation</td>
<td>+</td>
<td>+/-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>- primary</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>?</td>
</tr>
<tr>
<td>Fibre length</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- primary</td>
<td>4-15 cm</td>
<td>2.5 cm/mo.</td>
<td>0.5-1.0 cm/mo.</td>
<td></td>
</tr>
<tr>
<td>- secondary</td>
<td>2-12 cm</td>
<td>2.5 cm/mo.</td>
<td>0.5-1.0 cm/mo.</td>
<td></td>
</tr>
<tr>
<td>Growth period</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- primary</td>
<td>about 1 yr.</td>
<td>12 mo.</td>
<td>12 mo.</td>
<td>seasonal</td>
</tr>
<tr>
<td>- secondary</td>
<td>2-12 mo.</td>
<td>12 mo.</td>
<td>12 mo.</td>
<td>seasonal</td>
</tr>
</tbody>
</table>

The above parameters apply to adults.

+ yr = year  † mo = months

**Summary of goat fibre types**

Goats produce five types of fibres that are used commercially:

(a) Guard hair

The coarse guard hair (primary fibre) is used in carpet and underfelt manufacture. In Asia it is also used for the production of rope and tents.

(b) Mohair

The total fleece produced by the Angora goat. It is a lustrous fleece with an average fibre diameter range of 30 to 40 µm (in adults).

(c) Cashmere (Pashmina)

Cashmere is the fine 8 to 28 µm (mean 15 to 18 µm) fibre produced by the secondary follicles of central Asiatic cashmere goats, as well as others such as the Australian feral goat population.
(d) Cashgora

The cashgora fibre falls between cashmere and mohair. It is produced by goats resulting from various crosses with Angora goats. Its mean fibre diameter range is between 19 and 22 μm.

Cashgora is the only new natural fibre to appear in the world market in the last century.

(e) Shah tush

This is a very fine fibre (6 to 14 μm) produced by the secondary follicles of the Asiatic ibex (*Capra ibex sibirica*). It is the fibre from which the famous "ring shawls" of Kashmir are woven.
Stock (Brands and Movement) Act

Amendments to the Stock (Brands and Movement) Act and the appropriate Regulations Act were proclaimed on January 17, 1986. This now allows for the registration of goat brands, together with the compulsory branding of goats as from May 1, 1986, and the compulsory use of waybills when moving stock between properties or from property to saleyards.

There is still some confusion amongst goat breeders or goat owners as to their exact legal responsibilities defined by these two Acts. This paper consists mainly of extracts from these two Acts which pertain principally to goat branding requirements. Where possible, to facilitate understanding, the appropriate regulation will be given immediately following the Stock (Brand and Movement) Act sections, so that the text does not become too disjointed.

It is of course absolutely useless to quote passages if the exact legal interpretation of the words used are not known. Therefore, it would be expedient now to define some of these words.

"BRAND" means the impression of any letter, sign or character branded upon any stock, including any wool brand, firebrand, freeze-brand, tattoo mark, ear tag and any other identifying device approved by the Registrar for use as a brand, but does not include a registered earmark or any age mark, cull mark, flock reference mark, private reference mark, or any mark used in connection with the control of stock diseases;

"BREED SOCIETY" means a body that carries out the registration of a particular breed or strain of stock and that is recognised as such by the Royal Agricultural Society of Western Australia Incorporated;

"GOAT" means any male or female goat and includes a sterilized goat;

"OWNER" in relation to a registered brand, means a person who is registered as being the owner, whether jointly or severally, of any brand registered under this Act, and includes an authorized agent of or manager appointed by, such an owner; and "owner", in relation to a registered earmark, has a corresponding meaning;

"REGISTERED EARMARK" means the impression of any earmark in the form of a symbol or symbols that is or are registered as an earmark for goats, cattle or sheep pursuant to this Act;

"STUD" used in reference to stock, means any breed or strain thereof which is registered in any recognised herd, stud or flock book maintained by a Breed Society whose rules require identification of individual animals, and includes any Merino sheep stud.

One brand for each run

Sect. 1. A proprietor of stock shall not be granted more than ... one registered brand and one registered earmark for goats, unless he is a proprietor of more runs than one, in which case he may be
allotted a separate brand and, if applicable, separate earmark for each kind of stock for each run.

Use of brands

Sect. 8. (1) Every proprietor of stock possessing a registered brand shall use that registered brand for all of his stock on which the use of that brand is permitted or required pursuant to this Act.

(2) Subject to subsection (2a), every proprietor of stock possessing a registered earmark shall use that registered earmark for all of his stock on which the use of that registered earmark is permitted or required pursuant to this Act.

(2a) Subsection (2) does not require a proprietor of goats possessing a registered earmark to use that registered earmark on any of his goats.

Sect. 15a. (1) Every proprietor of goats on any run situated wholly or partly in any part of the State specified in section 30 (1)

(a) shall apply for, and obtain, a registered brand for goats and may, in addition, apply for, and obtain, a registered earmark for goats.

(2) A proprietor of goats to which subsection (1) does not apply may apply for, and obtain, a registered brand, or a registered earmark, for goats or both such a brand and earmark.

(3) Every brand registered under this Act for goats shall consist of an arrangement of 2 letters and a numeral, as allocated by the Registrar, and shall be applied as-

(a) a firebrand burnt on the horns of the goat;

(b) a tattoo that is applied in the prescribed manner to an ear of the goat; or

(c) an eartag that is of such colour or colours, type and shape as the Registrar determines.

Reg. 4. (1) Where goats or sheep are branded by means of a firebrand, the letters and numeral shall not be less than 25 millimetres in height.

(2) Where goats or sheep are branded by means of a tattoo-

(a) the letters and numeral shall be placed in the left or near ear of male goats or sheep and in the right or off ear of female goats or sheep; and

(b) each tattoo letter and numeral shall not be less than 6 millimetres or greater than 25 millimetres in height.

(3) A person shall not manufacture for use in the branding of goats and sheep unless-
(a) he has first submitted a sample of these eartags to the Registrar for inspection and the Registrar has approved of the sample; and

(b) the eartags are identical in type to that sample.

(4) Where goats or sheep are branded by means of an eartag—

(a) the eartag shall be an eartag that has been manufactured in accordance with subregulation (3) of this regulation; and

(b) the eartag shall be clearly impressed with the letters and numeral of the registered brand and shall be placed in the left or near ear of a male goat or sheep and in the right or off ear of a female goat or sheep.

Sect. 16. A proprietor of goats, sheep or cattle may, in addition to marking the goats, sheep or cattle with his registered brand registered earmark—

(b) in the case of goats or sheep, place on the appropriate ear of the goat or sheep any other private reference mark, which shall not be registered; and

Sizes of certain brands and earmarks

Sect. 17. (3) Any registered earmark on a goat or sheep shall be of the prescribed size for such an earmark.

(4) Any registered earmark applied to goats, sheep or cattle shall be made by means of a punch or pliers of a type approved by the registrar.

Reg. 9. (4) The earmark for sheep shall not be less than 4 millimetres and not more than 20 millimetres in any dimension when the animal is fully grown.

Rules of brand marking goats

Sect. 33. (1) Subject to this section, every proprietor shall brand each of his goats kept on a run situated wholly or partly in any part of the State specified in section 30 (1)(a) with his registered brand before the goat—

(a) is weaned

(b) attains the age of 6 months; or

(c) is removed from the run,

whichever first occurs.

(2) Nothing in subsection (1) requires a young goat to be branded before it is removed from the run if—

(a) it has not then attained the age of 6 months nor been weaned; and
(b) it is being removed from the run accompanied by its mother.

(3) The proprietor of any stud goat may, within the time specified in subsection (1) in relation to branding-

(a) tattoo his Breed Society mark on the ear of the goat; or

(b) firebrand the goat with his Breed Society mark, and thereon no further branding of the goat is required by this Act.

Sect. 36. Notwithstanding any other provision of this Act, a proprietor of stock is not required to brand the stock with his registered brand or earmark the stock with his registered earmark, or both, as the case requires, for so long as-

(a) the stock are legibly branded with the registered brand of a previous proprietor or are legibly earmarked with the registered earmark of the previous proprietor, or are both so branded and earmarked, as the case requires; and

(b) he has in his possession or control documents establishing his right to the ownership or possession of the stock.

Movement of stock

Waybill or other prescribed document to be made out for stock being moved

Sect. 46. (1) The proprietor or any other person for the time being having the custody and control of any stock of any type prescribed for the purposes of this section which are on a run or on any other place where stock are sold or disposed of, shall not, except where otherwise prescribed, cause or permit the stock to be removed from the run or place until the drover or carrier of the stock has been furnished with a waybill which meets the requirements of this section, or with such other document as may be prescribed for the purpose of this section.

(2) Every waybill or other document prescribed for the purpose of this section shall-

(a) be made out in triplicate;

(b) clearly indicate in writing such particulars concerning the number and type of stock, registered brands or earmarks as defined by the coded earmark index or both, places from which the stock are being driven or carried and the destination thereof, as are prescribed;

(c) be signed by such person or persons as are prescribed and be delivered to and retained by such persons and for such periods as are prescribed.
Inspection of travelling stock and waybills

Sect. 47. Any Police Officer or Inspector may, at any hour of the day or night, inspect any travelling stock and the waybill which relates to the stock and may compare the number of, and the registered brands and earmarks appearing on, the travelling stock with those specified on the waybill.

Summary

- Goats have to be branded by either:
  
  Firebrand
  Tattoo mark
  Ear tag

  using two letters and a numeral allocated by the registrar.

- Goats MAY be earmarked i.e. the owner is not legally obliged to earmark his goats but may do so if he wishes.

  * earmark symbols to be allocated by the registrar.

Comment

For some time, goat owners have been trying to persuade various governing bodies and organisations to recognise that goats are a legitimate farm animal and should not be discriminated against.

The Stock (Brands and Movement) Act, has in part, recognised the legitimacy of goat farming, although I believe goat breeders should exercise their option and earmark their unregistered animals for permanent identification.
REQUIREMENTS FOR KEEPING FERAL GOATS
David Rees, Regional Officer, Agriculture Protection Board

The Agriculture Protection Board has an obligation to prevent feral goats becoming established as pests in the agricultural areas of Western Australia.

The Board revised its requirements for keeping feral goats in 1984, after consultations with its Regional Advisory Committees and the Australian Cashmere Growers Association.

The requirements for keeping feral goats acquired from pastoral areas have been framed to safeguard agriculture as a whole, while minimising restrictions on the cashmere industry.

The minimum fence height for containing feral goats in agricultural areas is 1.5 metres. However, following amendments to the Stock (Brands and Movement) Act to make all goats (domestic and feral) subject to branding, feral goats in some areas will be allowed in normal paddock conditions after a domestication period of three months (subject to inspection by the APB).

Feral goats must be retained behind the 1.5 metre fence at all times in the higher rainfall parts of the State, where there is concern that they could establish in timbered country.

Applications

Producers wanting to keep feral goats should contact their local APB officer for an application form.

Providing the district officer approves the enclosure in which the goats are to be kept, and the applicant has a registered brand, the Board's Head Office will issue a permit to keep the animals.

Another permit will be required if any of the animals are subsequently sold or moved to another property (except for export or slaughter) whether or not they have spent the required period behind a 1.5 metre fence.

Permit-conditions

Permits may be granted by the Agriculture Protection Board for feral goats to be kept in the agricultural areas of the State, under the following conditions:

* Feral goats kept under permit must be identified by a slit in the ear opposite the ear which is to be tattooed or otherwise used for identification, before being removed from the property of origin.

* All feral goats must be ear tattooed, ear marked or ear tagged, with the owner's property brand registered under the Stock (Brands and Movement) Act within seven days of arrival on the property.

* All feral goats must be transported from the property of origin in a secure vehicle from which they cannot escape.

* All feral goats must be treated for possible lice infestation before leaving the property of origin.

* Feral goats are to be held in an approved enclosure with fences of a minimum height of 1.5 metres, built to specifications approved by the APB, until they are eligible for release.
* In the Albany, Manjimup, Busselton and Harvey APB regions, feral goats must be kept within the approved enclosure at all times.

* Shires where feral goats must be kept behind a 1.5 metres fence at all times:

  Albany, Augusta, Boyup Brook, Bridgetown-Greenbushes, Bunbury, Busselton, Capel, Collie, Cranbrook, Dardanup, Denmark, Donnybrook-Balingup, Harvey, Mandurah, Manjimup, Margaret River, Murray, Nannup, Plantagenet, Serpentine-Jarrahdale, Waroona.

* Double security gates will be fitted at each entrance in such a way as to allow passage through the first gate which is to be closed before the second gate is opened.

* Elsewhere in the agricultural areas, feral goats must be kept within the approved enclosure for a domestication period of at least three months. If, after three months, an APB officer is satisfied that the goats are domesticated, they may be released from the enclosure into an adequately fenced paddock.

  If these goats escape, the APB may, at its discretion, require their return to an enclosure of the original height and specifications for a specified period.

* The approved enclosure must be maintained so that it remains effective at all times. The fence line must be kept free of vegetation to ensure there is no danger of falling timber damaging the fence.

* A written record must be kept of all feral goats obtained and of any variations in the number kept. These records are to be made available on request for sighting by an officer of the APB.

* If more than one lot is obtained within a period of three months, all the goats in each lot must be distinctly marked.

**Fence specifications**

The fencing requirements for the compound to contain feral goats are:

* Fence line to be cleared so that there is no danger of falling timber damaging the fence.

* Strainer posts of adequate size with box strainer assemblies to be placed at at intervals to permit fabricated wire fencing to be strained to the manufacturer's specifications.

* Line posts of suitable material to be placed at not more than 6 metre intervals. If a wider post spacing is used, the bottom of the fence must be securely pegged to the ground at not more than 6 metre intervals.

* Fence to be built of fabricated ringlock, hinged joint, or comparable material (minimum eight line), with the vertical wires spaced no more than 300 millimetres apart. The bottom line is to be no more than 100 millimetres above ground level.

* Two barbed wires and sufficient other wires to be placed equidistant above the fabricated fencing to bring the fence to a total height of 1.5 metres.
with spacings no greater than 200 millimetres. Droppers, at no more than 1 metre spacings, should be used to tie these wires and the top of the fabricated fencing.

* A single barbed wire to be placed midway between the bottom of the fabricated fencing and the ground.

* All fencing materials to be strained to the manufacturer's specifications.

The APB will consider any reasonable variation on the general conditions and fence specifications listed, in an effort to ensure that its requirements are met in a practical and workable manner. For example, lice treatment may be allowed on the property of destination; the fence post spacing may be widened; and forms of branding other than tattooing will be considered. Any requests for variations to be made should explain the reasons for the proposed change.

A permit is not required to keep feral goats which have satisfactorily completed the three month domestication period.

The paddock fencing of a property intending to keep feral goats after domestication must be approved by an APB officer. A permit to move goats to this property will only be issued following approval.
APPLICATION TO KEEP DECLARED ANIMALS.

Name: 

Address: 

Telephone: (Home) ___________________ (Work) ___________________

Declared Animals to be Kept (if space insufficient, attach list)

<table>
<thead>
<tr>
<th>Species</th>
<th>Number</th>
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</tbody>
</table>

Place of Keeping: ____________________________

Name of Supplier: ____________________________

Address of Supplier: ____________________________

Intended Date of Purchase: ____________________________

NOTE: A permit will not be issued until the enclosure in which the declared animals will be kept has been approved for the holding of those animals and the prescribed fee has been paid.

Date: ____________________________  Signature of Applicant

Receipt No.: ____________________________

NOTE: A MINIMUM OF SEVEN (7) DAYS NOTICE MUST BE GIVEN PRIOR TO ACQUIRING ANIMALS.

Enclosure approved for holding on ____________________________

Permit No. ____________________________  Signature of Applicant

Date: ____________________________
MANAGEMENT ASPECTS OF GOAT FARMING
L.J.E. Karlsson, B.V.Sc., B.Sc., District Veterinary Officer
Department of Agriculture, Bridgetown

Introduction

Australian farmers have considerable knowledge of sheep management requirements. Most farms developed for sheep production can run goats in most cases without any significant modifications to their infrastructure. This paper will therefore suggest that most farming enterprises can run goats without the necessity for any major changes either to infrastructure or management practices.

In order to make a successful entry into goat farming it is, however, helpful to recognise where there are differences between goats and sheep. This recognition can be of value in two main areas:

* To obtain maximum performance of any farm animal species/breed it is important to recognise their specific requirements.

* Differences between different farm animals can be exploited for maximum return from a given resource.

The management aspects of goat farming can be divided into the following categories:

* physiological and behavioural aspects.

* farm management requirements.

* legal responsibilities.

The legal responsibilities in W.A. can be subdivided into those pertaining to feral goats and those pertaining to domesticated goats. These regulatory aspects are dealt with in two separate papers of these seminar proceedings.

1. Physiological and behavioural aspects

It is essential to recognise the innate physiological and behavioural aspects of farm animals in order to obtain maximum productivity from them.

This discussion will make comparisons between goats and sheep because of the wider familiarity with sheep management requirements. It is also intended that a sheep/goat comparison may highlight some areas of the farming system where goats may result in an improvement of the net farm income.

1.1 Family groups

Goats tend to associate in family groups rather than in the more amorphous flock structure as seen in Merino sheep. The strong family bonding behaviour can be a predisposing factor in some goat health problems.

When a family group is broken up, individuals are prone to fretting, which in turn may result in voluntary starvation. This chain of events can result in a critical situation for an individual under the following circumstances:
* Does in advanced pregnancy are generally in a delicate state with regard to their energy balance. They are therefore not able to cope with any drastic reduction in feed intake. The clinical manifestation of an energy deficit is referred to as pregnancy toxaemia, which is typically fatal if left untreated. Pregnant does should therefore not be subjected to unnecessary stress during the last third of their pregnancy.

* When feral goats are captured they are subjected to a multitude of stresses, ranging from the original disruption of the family group, often prolonged periods in yards and on trucks and finally, at the place of destination, they may be placed in a crowded situation.

Some of the captured feral goats will fret and subject themselves to voluntary starvation. The body begins to mobilise tissue reserves. If this is too rapid, there is a build up of ketone bodies in the circulatory system which can reach toxic levels. The resulting syndrome is referred to as ketosis, which, if not treated, usually has a fatal outcome (see Farmnote No. 10/84). Both of these clinical syndromes can occur if there is starvation, either due to prolonged yarding or lack of feed.

1.2 Chilling

Goats do not like chilling conditions. The worst climatic conditions are prolonged periods of rain and wind. If an animal is not able to withstand chilling environmental conditions, it may suffer hypothermia. Hypothermia refers to a situation where there is an uncontrolled drop in body temperature to a point where normal physiological functions are impaired.

Goats are most susceptible to hypothermia during the following periods:

* In the first few days after birth. This period depends on the general body condition of mother and offspring. When the kids are born strong and healthy they are normally "safe" after the first 24 hours, whereas if they are born weak they could be at risk for up to two weeks post-kidding.

* Goats are susceptible to hypothermia for the first couple of weeks post-shearing. Most problems seem to occur following the autumn shearing if there is unseasonal heavy rain (this also applies to sheep). A body metabolism adapted to warm conditions appears less able to cope with a sudden chilling.

It is important to ensure that goats are run in paddocks with some shelter at least during the critical periods of kidding and post-shearing. A few rocky areas or some logs are frequently sufficient for the kids. It is undesirable to change the animals to a new paddock if let out late in the day from shearing as they may not be able to find the best shelter the first night.

1.3 Foraging

Goats evolved in a semi-open grass/scrub and often mountainous environment. Their preference for browsing is well known. However, there are variations between and within goat breeds as well as due to rearing conditions.

A trial in Texas examined the relative proportions of browsing and grazing in Angora goats, a Mexican meat goat and Rambouillet sheep. In this trial it was found that Angora goats occupied a position between the Mexican goat and the Rambouillet sheep in terms of the proportion of grazing in its daily foraging.
Local experience suggests that goats born and reared in a pasture-only
situation will adapt well to a grazing-only environment. However, if these
animals are at a later stage given access to a paddock containing browse they
are more likely to use this better than would sheep in a similar situation.

Differences in grazing selectivity between sheep and goats is an area that can
be exploited with advantage by farmers. Trials in Victoria have shown that
goats have a preference for the grass component of the pasture with a
resulting increase in the clover component. This is generally recognised as
an improvement in pasture quality.

Goats are more likely to eat some of the broad-leaf weeds compared to
sheep under similar circumstances. There has been some very encouraging
results with thistles where goats tend to eat off the flower head, thus
preventing seed set and further multiplication of the plant. There is,
therefore, scope for goats in pasture manipulation. There is also scope for
exploitation of complementary grazing habits of sheep and goats whereby a
proportion of goats can be run with sheep at a total stocking rate over and
above the normal sheep stocking rate. In this case the additional goats would
result in an increased overall productivity from a given area of land. The
degree of increase in productivity will vary with different pasture systems.
It would tend to be greater in a less improved pasture situation.

1.4 Digestive system

Goats and sheep are both referred to as small ruminants with many broad
similarities. There are however, some important differences.

Trials comparing the efficiency of forage use can be summarised as follows:-

* On high quality feed sheep are marginally more efficient in their feed
  conversion than are goats.

* On feed with low digestibility, goats are superior to sheep.

Goats are able to ingest and process more dry matter per day on a per kilogram
body weight basis. The reason that sheep lose weight on dry feed with a low
digestibility is that they are not able to eat enough of this feed to maintain
body weight. The superiority of goats in respect to their ability to live on
poor quality roughage needs to be explored further, especially in respect to
straw use in the grain growing areas. The combination of straw and a
supplement of protein or nitrogen requires further investigation.

It is now commonly believed that goats have a higher metabolic rate, at least
in some systems, than sheep. We do not as yet have hard evidence to say that
these difference may influence areas such as trace mineral recommendations as
compared with sheep. One area where the species difference has a practical
effect is in anthelmintic treatments. Goats appear to metabolise and/or
excrete some anthelmintics very quickly, this is especially true for the
Levamisole group. This complicates worm control in goats. Producers are
advised to seek individual veterinary advice on this topic.

2. Farm management requirements

Most farms developed for sheep production can run goats, in most cases without
any significant modification to their infrastructure.
2.1 Handling of goats

Compared to sheep, goats are more agile and quicker to detect any weaknesses in handling (restraining procedure).

i) Fencing

The analogy "a chain is only as strong as its weakest link" is very applicable to goat fencing requirements, because they are very quick to spot any weak point. Compared to Merino sheep, goats do require a higher standard of fencing. Their ability to get under or through a fence is comparable to British breed sheep. Goats are more likely to go under or through a fence than over it. Therefore, it is important to ensure that there are no gaps under the bottom wire due to uneven ground surface. Goats are very adept at climbing on any suitable object such as logs or rocks adjacent to the fenceline and diagonal strainer struts can be a problem. In general, a fence height of 0.9 to 1.0 m is adequate for internal fences. Any animal that is a habitual jumper is best culled.

Most of the fencing designs fall into one of the following categories:

* An old fence with some weak spots. This type of fence can be upgraded with so called electric wire outriggers. The outriggers come in a variety of shapes such as; treated timber applied either as a crossarm or a short stake in the ground; ordinary timber as above plus an insulator; proprietary metal clamps with insulators, poly pipes. The "hot wire" is placed approximately 20 cm out from the existing fence. The height above ground will vary, depending on where is the weakest spot, typically at about 30 cm.

* A new fence of conventional construction. These types of fences are typically constructed from prefabricated ring or hinge-joint material. My own preference is for a six line prefabricated material with a barbed wire on the bottom and one on the top. The bottom barbed wires serves two purposes. It is more effective than a plain wire in stopping animals crawling under the fence and it also makes sense to have a single wire closest to ground where corrosion is greatest since it is simpler to replace.

* A new plain wire electric fence. A five to six plain wire construction would be adequate in most situations. Alternative wires are electrified and earthed. The construction cost is generally less than for the conventional prefabricated fence. However, it is usually not as foolproof as a conventional fence.

The choice between different fence types will depend on several factors such as; degree of stock control required; time available for supervision and cost.

ii) Yards

The standard sheep yard height is typically 70 to 75 cm. A goat can jump this barrier quite easily. Two options are; increase the height (at least of the perimeter) by 25 to 30 cm; or by keeping the dog(s) on the outside of the yard goats quickly learn that they are better off inside than outside the yard.

Working races should be relatively short and narrow. Goats, especially young animals, have a tendency for crowding on top of each other at the far end of the race when they are being drenched or similar operations. Individuals
at the bottom of the pack therefore run the risk of suffocation if it takes too long to empty the race.

iii) Shearing shed

The basic sheep shearing shed doesn't need any major modification except maybe the height of some of the partitions. Cashmere fleece classing is performed on a solid table or a wool table with a cover on it to stop the fine fleece falling through.

Some cashmere producing goats are shorn in a standing position. This requires a flexible down tube or a pneumatic or electric hand piece. With this system goats are restrained in a special head lock device.

2.2 Animal health requirements

The basic animal health requirements will be similar to those required for sheep in the same environment.

i) Worm control

Worm control in goats is basically similar to sheep. The two main differences are that anthelmintics (drenches) at the sheep pro rata dose rate may not be as effective and goats may not develop the same level of age related host resistance to the worms as compared with sheep.

For more details see the paper on "Worms in goats and their control" included in these proceedings.

ii) Vaccination

The requirements for vaccination are the same as for sheep when they are run under similar husbandry conditions.

Under some conditions goats may be susceptible to enterotoxaemia (Pulpy Kidney). This applies especially when there are significant changes in the quality and quantity of feed. Feral goats brought into agricultural areas should be vaccinated, especially against enterotoxaemia. Domesticated goats on a rotational grazing system, or on high levels of hand feeding, should also be well protected against enterotoxaemia.

iii) Lice control/eradication

Basically the same principles apply as for sheep lice control. Eradication is technically possible. Once this is achieved there should not be any need for annual post-shearing treatment. Products registered for sheep lice control are also used on goats. Most producers prefer the synthetic pyrethroids.

Products registered for cattle lice control have been responsible for problems in goats and should not be used.

For lice treatment of unshorn feral goats, contact the nearest Department of Agriculture animal health officer.

iv) Miscellaneous conditions

Goats are susceptible to footrot. For any suspect feet problems, contact the nearest Department of Agriculture office.
Goats do not suffer the typical blowfly strike problems as seen in sheep. They can obviously get struck if there are specific mitigating factors such as illhealth. Summer kidding can result in fly strikes.

Goats can occasionally get their horns caught in fences, especially where a post has narrowed the normal 30 cm spacing between vertical droppers. The so-called sickle shaped horns are worse in this respect.

Summary

Goats can be run on most sheep farms with minimal changes required to the infrastructure or current husbandry practices.

Goats may be used to a advantage in specific pasture management or weed control. Goats may also be superior to sheep in the use of poor quality roughage.

Finally, goats can offer the Australian farming industry new export opportunities.
Sheep and goats between them produce a wide variety of fibres with very different uses. In reality, there is not one but half a dozen different fibre markets. This means that these classes of fibres do not compete with each other directly.

An earlier session focussed on goat fibre types. Wool also comprises many types from superfine apparel wools to coarse carpet wools.

The individual market fortune of each fibre type responds to the circumstances of its particular use as well as to supply shifts. I will discuss wool, mohair and cashmere separately, but still in fairly general terms. I do not have specialist knowledge of these fibres, their user and their marketing. As the paper was prepared from limited information, it will lack some of the detail and conviction you would no doubt like.

Three general observations are worth noting:

1. At present, the prices of all fibres look good relative to grains, due to the huge overhang of grain stocks and the continued subsidization of European and U.S. production. This is creating a lot of interest in grazing as an alternative to cropping.

2. However, future prices are more relevant than present prices, in terms of deciding what to produce in 1987, 1990 or 1995. In addition, it may take several generations of breeding to substantially change fibre quantity or quality from present levels. That is, there is a limit to how quickly we can respond to demand changes.

3. The differences in average profitability of different fibres are unlikely to be very large in the long term. It is worthwhile to note the broad similarities of sheep and goats in terms of husbandry costs and stocking rates, and to observe the typical levels of per head production.

   e.g. compare
   * a sheep producing 21 micron wool - say 5.0 kg @ $4/kg $20
   * a goat producing cashmere - " 0.25 " " $100/kg $25

Note: Whilst this may not be achieved in the first or second cross from feral does, established breeders regard this as a potential production.

Wool

The market for most fine-medium Merino wools seems very sound at present, as reflected by recent upward adjustments of reserve prices by the Australian Wool Corporation (AWC). Wool prices have risen steadily and been relatively stable over the past decade, but underlying the recent strength in sale prices has been the falling value of the Australian dollar (see Figures 1, 2). In real terms (discounted for inflation) prices do not look so bright (Figure 3).
Figure 1 - AWC Market Indicator and Floor Price

Source: AWC

Figure 2 - Average auction price - Australia

Source: BAE
Figure 3 - Real Wool Prices and Closing Stocks

Real Wool Prices and AWC Closing Stock

Source: AWC

We cannot and should not expect this to continue indefinitely. Future improvement in the $ Aust. is a real possibility, and would have the reverse effect. Furthermore, there has been a substantial and faster-than-expected rise in Australian sheep numbers (Figure 4). With continued interest in higher wool production to offset loss of grain income, the increase in wool supply is bound to restrain or depress wool prices. Australian production is predicted to reach 919 million kg by 1990, compared to the 1985-86 level of 812 m kg.

Figure 4 - Australian Sheep Numbers and Shorn Wool Production

Source: AWC
While these factors should not cause any sudden and dramatic fall in wool prices, there is reason to be conservative in budgeting wool prices for the next 5 years. The present AWC minimum reserve price for your particular type of wool seems an appropriate budgeting figure to use for long term projections.

**Goats**

Recent statistics in Figures 5 and 6 show that

i) goat numbers have been rising in all States of Australia.

ii) NSW is the dominant goat farming state.

iii) domestic goat numbers and fibre production are very small compared to sheep and wool.

![Figure 5 - Goat Population](chart)

Source: Report of the NSW Goat Marketing Development Task Force

**Figure 6 - Australian Sheep and Goat Populations and Fibre Production 1984-85**

![Graph showing sheep, goats, wool, mohair, and cashmere production](chart)
Mohair

Figures 7 and 8 show world and Australian production and price movements over recent years.

The large fluctuations are cause for caution in expanding production, though they are apparently not so wild since the introduction of an Industry Support Programme in Texas. The International Mohair Association estimates the world market could "absorb" a production of 30 million kg, but it seems to me that if fashion influences are so strong for major end uses, there must be considerable uncertainty about consistently maintaining very lucrative prices at this level of production.

There seems reason to believe that Texas, South Africa and Turkey will not increase their production significantly, though there is some doubt about Argentina, where production doubled to 1.2 million kg over the period 1979-1984. Australia could therefore probably increase its production well beyond the 0.5 million kg level of 1984, without a big impact on price.

Figure 7

WORLD PRODUCTION OF MOHAIR 1954-84
(MILLION KG)

Source: Task Force report
Source: Task Force report

Western Australian mohair production was estimated at only 44,329 kg in 1984/85, well behind the 195,035 kg from New South Wales. Mohair selling is less centralised and co-ordinated than wool selling. The three main pastoral houses handled between them almost half the clip in 1984, with almost 40% handled by the two pools (AMBA and AMMO). AMBA (Angora Mohair Breeders of Australasia) had the largest single share (29% approx.) nationally, and has a well established system of receivals, transport, classing, testing, pooling and warehousing in Western Australia.

Costs of selling locally through the AMBA pool are believed to average around 7 percent of gross proceeds, plus a classing cost of around 15 cents/kg for reasonably-well prepared clips. Freight to Perth is not much different to the cost for wool.

Prices for main lines range from around $10/kg for adult fleeces (fibre diameter say 34 micron) to a top of around $15/kg for superfine kid (as fine as 23 micron). However, crossbred, stained and cotted hair bring the clip average price down. Over the 6 years 1979-1984, the mean price for all lines at the 15 AMBA Pool sales was $7.55/kg. Vegetable fault can be costly, as its removal damages the lustre of mohair. Fortunately, our region seems less prone to this than much of the nation's agricultural area.
It is difficult to reconcile such statements as:

"world shortage of mohair at present"... in a paper by Prof. J.V. Evans, appended in the March 1986 Report of the NSW Goat Marketing Development Task Force

and,

"mohair values had fallen between 32 and 47 percent, from kids through to adult grades:" in Wool Record April 1986, based on an interview with the managing director of a Bradford mill.

Clearly, it would seem unwise to budget on an overall clip average price of more than $10/kg.

The Task Force report favours moves towards "orderly marketing" but I see that as a very slow process, and one that will have limited benefits to producers.

**Cashmere**

World production is said to be around 3500 tonnes per year, with China the dominant producer, growing around 2000 gonces of white cashmere. Australian production has been estimated at 15-20 tonnes per year.

Cashmere is a very small and relatively infant industry in Australia, but is reckoned to have considerable potential for growth. The Task Force refers to an estimated national production of 180 to 200 tonnes of raw fibre by 1995.

Prices for cashmere down vary considerably due to colour and fibre diameter. Prices currently offered for down delivered to the Australian Cashmere Growers Association Pool in Sydney are shown in Table 1.

**TABLE 1  Cashmere Down Prices, Sydney, July 1986**

<table>
<thead>
<tr>
<th>Colour</th>
<th>Fibre diameter (microns)</th>
<th>Buyer 1</th>
<th>Buyer 2</th>
<th>Buyer 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>≤ 16.5</td>
<td>105</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.6 - 18</td>
<td></td>
<td>100</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.6 - 18.5</td>
<td>83</td>
<td></td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>≤ 18.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grey</td>
<td>≤ 16.5</td>
<td>78</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.6 - 18</td>
<td></td>
<td>68</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.6 - 18.5</td>
<td>60</td>
<td></td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>≤ 18.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brown</td>
<td>≤ 16.5</td>
<td>68</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.6 - 18</td>
<td></td>
<td>50</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16.6 - 18.5</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤ 18.5</td>
<td></td>
<td></td>
<td>63</td>
</tr>
</tbody>
</table>
Whereas the fleece of a selected feral doe may yield only 90 grams of white cashmere, four generations of breeding and selection can raise this to 200 grams. Thus there is a changing mix of colour and fibre diameter through the establishment years of a cashmere enterprise, and fibre income budgeting is a complex business.

As with mohair, Australian cashmere producers seem destined to remain price takers, but the indications are that cashmere prices will remain firm for a long time. It appears that the modest overall level of production, and the continuity of demand in the U.S. will protect the industry from any drastic price reduction.

Mention should be made of intermediate fibres referred to as "coarse cashmere" and "cashgora". These are produced by some crossbred goats. The Task Force report suggests that careful marketing of such products could be economically worthwhile.
A REVIEW OF THE AUSTRALIAN GOAT MEAT INDUSTRY
L.G. King, Meat Marketing Committee, A.C.G.A., Region 61

Australian goat meat markets

To date the main goat meat trade has been in the export of feral animals of varying quality. However, with the recent expansion of other goat enterprises, there are now a significant number of young cull animals available for the supply of high quality goat meat (chevon or capretto).

In the past, goat meat has been used for manufacturing, but now meat for the domestic market is generally sold through butchers and open air markets and, in some cases, to restaurants and hotels.

Domestic markets

1. Cull market (9-18 months old)

This consists mainly of does and bucks which are no longer suitable for fibre production or breeding. Wether goats can also be included in this category. These goats usually weigh from 10-20 kg (dressed weight).

2. Cull market (ferals, aged bucks and does)

This type of stock is boned out for use in domestic smallgood production, pet food and other manufacturing purposes. The use of feral goats in pet food does not represent a premium market and demand will fluctuate depending upon the relative availability and cost of alternative sources of meat. It is believed that only negligible amounts of goat meat are used in manufacturing (pies, sausages and pet food). Goat meat has the distinctive advantage of being bland in taste and does not "spew" when cooked.

3. The kid meat market

Kid meat is tender and well accepted by many communities in Australia such as the Italian, Yugoslav, Lebanese, Greek and possibly the Indian.

Demands from these groups is difficult to gauge. In most cases the older people have been brought up with goat meat forming a large part of their diet. For this reason, they do not need educating as to the benefits of goat meat and will actively seek it out. This is not so however, with the younger generation, who are often similar to other Australians in their tastes and are not particularly concerned with goat meat.

Young wethers are sold on the domestic market in "prime eating" condition at 3 to 8 months old. Carcases generally range from 6 to 12 kg, though under 10 kg carcases with a 2-3 mm backfat would be most suited for this market. Many cashmere and Angora male kids are sold to buyers, live from the property, at 5 to 12 weeks of age. These sales are common by studs with small doe numbers and in areas where wholesalers and agents refuse to pick up and transport small consignments of goats.

In recent years the numbers of butchers selling goat meat has increased. These butchers are now reasonably well spread throughout the Metropolitan areas of Australia's cities, whereas, in early days they were to be found in areas of high population.
Kids in particular require special care when slaughtered as factors such as stress, fear and bad lairage all lead to a darkening of the otherwise pink "veal like" meat.

Factors likely to limit the expansion of this domestic table market are:

1. An irregular and inadequate supply of suitable goats to the abattoir.
2. A lack of distributors and outlets.
3. A lack of suitably equipped abattoirs to handle the goats.
4. High cost of slaughter (in comparison to lamb).
5. There is no commonly available system for describing goat carcases or live goats for slaughter.
6. Low skin values.
7. A preference for white goats as hair contamination on these carcases is less obvious.

Export markets

Australia's most stable goat meat export markets are with countries containing large populations of Moslems, Indians, Spaniards or Greeks. While their preference is mostly for young freshly killed goats, they generally prefer goat in any form to almost all other meat.

Export by State

Australia's goat meat exports declined by 31% in 1983/84 to 3433 t. This represented 0.6% of Australia's total meat exports (571,216 t). Goat meat exports in 1985 increased by 27% on the previous year.

The decline in all States for 1984 is reflected in slaughtering numbers where a 28.3% fall in total numbers slaughtered can be noted. The recent pastoral droughts were largely attributable to this decline. The following table indicates goat meat exports by State of production.
Goat meat exports - by State of production
(tonnes shipped weight - year ended June)

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>N.S.W.</td>
<td>826</td>
<td>790</td>
<td>312</td>
<td>1102</td>
<td>814</td>
<td>543</td>
<td>571</td>
</tr>
<tr>
<td>Victoria</td>
<td>17</td>
<td>53</td>
<td>289</td>
<td>100</td>
<td>92</td>
<td>22</td>
<td>134</td>
</tr>
<tr>
<td>Queensland</td>
<td>347</td>
<td>722</td>
<td>879</td>
<td>994</td>
<td>1196</td>
<td>973</td>
<td>983</td>
</tr>
<tr>
<td>South Australia</td>
<td>678</td>
<td>1016</td>
<td>1598</td>
<td>1520</td>
<td>1465</td>
<td>802</td>
<td>1417</td>
</tr>
<tr>
<td>Western Australia</td>
<td>1859</td>
<td>1325</td>
<td>989</td>
<td>1275</td>
<td>1420</td>
<td>1093</td>
<td>1258</td>
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<tr>
<td>Tasmania</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3727</td>
<td>3906</td>
<td>4066</td>
<td>4992</td>
<td>4994</td>
<td>3433</td>
<td>4370</td>
</tr>
</tbody>
</table>


The total value of Australia's goat meat exports declined from $A 7.9 million (F.O.B.) in 1983 to $A 5.65 million (F.O.B.) in 1984, a fall of 28.5%.

Bone-in carcases form the largest portion of goat meat exports with 85-90% of the total tonnage being exported in this form. The remainder is largely in the form of full boneless carcases with specific leg cuts and trunk meat representing only minor exports.

Exports by country of destination

North/Central America: Trade development with the U.S.A. and Canada has been limited by the high rejection rate of carcases for hair contamination. (The number of rejections to Puerto Rico and the Caribbean is very low.) Further development of these markets is limited by the strict import inspection criteria applied.

The Caribbean: Although the trade experienced a slight decline in 1983/84, exports to the Caribbean have increased markedly since 1979. The Caribbean demands lean goat carcases under 18 kg and above 18 kg in the form of boneless product of at least 85% chemical lean (90% visual lean). Some distributors have been replacing goat meat with supplies of cheap mutton from New Zealand and lean beef from South America. Demand is from the local population who are traditional goat keepers and also from the Indian and Chinese communities.

Canada: Canadian imports of Australian goat meat have decreased remarkably and in 1983/84 only 5 t of bone-in carcases were imported. This has been due to high prices and rejections based on hair and hide contamination. Regular suppliers have reportedly pulled out of the market, as a result of the rejection rate and the resultant high rejection insurance. The market has beenpredominately among Pakistanis and Indians.
Taiwan: From 1978/79 to 1982/83 goat meat exports to Taiwan increased by nearly 400%. In 1983/84 however, the level declined to 570 t, a decrease of 49% (all but 2 t were bone-in carcases).

Taiwan imports goat meat for both manufacturing and consumption during festivals when it is eaten as a delicacy. Skin-on goats are demanded for festivals and a premium is paid for these carcases. The skin-on market to Taiwan requires under 20 kg carcases, whereas the skin-off market requires an 18-27 kg carcase.

Skin-on goat carcases command a premium which varies on the market, but generally is about 20-40% above prices for skin-off carcases.

Malaysia: Because Malaysia lacks handling and storage facilities for fresh/chilled meats, frozen goat meat is preferred. Malaysia's import of goat meat from Australia remained fairly constant for the 4 years up until 1981/82, but has since declined markedly. In 1983/84, 367 t were exported — a decline of 32% on the previous year. Demand is greatest for bone-in goat meat weighing less than 18 kg, with a fresh reddish colour. Peak demand is in November (Deepavali) and Halal slaughter is required for all goats.

Singapore: The main consumers of goat meat are Indians and Pakistanis. Demand is greatest during festivals (Hari Raya, Puasa, Deepavali and Hari Haji Maji) and Halal slaughter is essential. Lean carcases of about 18 kg are preferred, (especially "billy" which is usually leaner and light red). Demand is affected by income and the availability of substitutes.

Hong Kong: There is no local production of goat meat in Hong Kong. It is a winter food consumed by the Chinese between October and February. Many Chinese, especially the older generation, find the smell of goat meat offensive, a factor which may limit the expansion of the market.

Okinawa: A potentially lucrative market. Demand is for skin-on carcases.

Fiji: The main Pacific islands importer of Australian goat meat. Demand is for bone in carcases.

Mauritius: Mauritius has a population of about one million people of which a high proportion are of Indian origin. The Hindu sector demands goat meat and sheep meat. All goat meat exports to Mauritius have been as frozen carcases.

Middle East: Very little Australian goat meat has been imported by Middle East countries since 1977/78 when 1649 t were imported. Halal slaughter is essential. There has recently been an increase in the live goat trade to the Middle East as the meat from live animals is a preferred product.

Reunion Island: Because Reunion Island is a French dependency, goat meat exports are controlled by the EEC Sheep meat/Goat meat Voluntary Agreement.

Italy/Cyprus: There is likely to be considerable potential in these markets. However, because of the EEC quota on goat meat and sheep meat entering the EEC, the return for goat meat would need to be higher than for mutton and lamb before exporters consider supplying these markets.

Live goat exports

Live goat exports are mostly for slaughter and consist of feral animals of mixed sex, weights and age groups. The average weight of these goats is about 30 kg although this is extremely variable.
The Middle East is Australia's major live export market and has a requirement for lean animals. In many cases there is no difference between goat meat, lamb or mutton at the retail level in the Middle East. Goats for export at 25-30 kg (liveweight) are currently fetching about $25.00/head at exporters yards.

The Malaysian export market is affected by irregular supply, high freight costs and the maintenance of body weight before slaughter in Malaysia. In the long term there may be a potential for imports of breeding goats to upgrade Malaysia's herds.

Slaughtering of goats

About 90% of the goats slaughtered in Australia are skinned in the same way as sheep. Because of the sticky surface of the carcase, hair becomes attached and is difficult to remove. Some markets (e.g. Taiwan) demand a skin-on carcase in which case goats may be scalded and dehaired in a similar process to pig dressing.

Butchers often find goats harder to skin than sheep. This is because the selvedge will not separate from the skin as readily. Male goats are harder to front than sheep.

Skin-on carcases

The goats are stunned, stuck and dehorned in the same way as are skinned goats. The front feet are cut-off below the knee joint. The goats are then scalded in 64-66°C water, about 2-4°C hotter than for pigs. The extra temperature is needed because of the longer, thicker hair of the goat. The carcase then passes through the dehaider, a series of beaters paddling against the body. On coming out of the dehaider the carcase is washed down by a continuous spray and then manually shaved to remove any remaining hair. This is usually all the hair removal required for young males and does. Older stock may have hair remaining on the withers and neck. This is difficult to remove because of the wrinkles in this areas and for this reason the area is usually skinned.

The skin-off method only applies to white goats and goats over 18 kg whereas the skin-on method applies to goats under 18 kg. Angora goats cannot be used for the skin-on trade because of dehairing problems.

Goat carcases undergo the same inspectional scrutiny as sheep and cattle. All visceri and glands are checked for abnormalities and condemned if necessary. Condemnations may also be made if the carcases are dirty or contain excessive quantities of hair.

Slaughtering charges (ex W.A. Meat Commission)

As at July 1, 1986 $/hd

1. W.A.M.C. treatment charge on carcases
   - Local and export. $6.39
     Flat rate (irrespective of weight) (to be
     increased
     to $7.50)

2. P.H.D. inspection fee 0.38
   (local only)
3. Livestock slaughter (Export Inspection Charge Act)
   (local and export)  
4. Livestock slaughter Levy Act (A.M.L.C.)
   (Billy goats)  
5. Muslim slaughter kill

Slaughtering charges are slightly higher for goats than for sheep or lambs.

Skins and hides

In Australia, feral goats provide virtually all the goat skins available for export. The value of goat skins is largely associated with their use as leather and the fibre on skins is considered worthless. Goat skins yield some of the finest leathers such as velours, suede and chamois for clothes, chevreaux for fine shoes, saffian, morocco, secrace and glazed kid for gloves, book binding, fine leatherware and luggage.

The following table shows goat skin exports and value for 1983-1985.

<table>
<thead>
<tr>
<th>Year</th>
<th>kg</th>
<th>Value ($A) F.O.B.</th>
<th>Value/kg ($A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982/83</td>
<td>151,599</td>
<td>489,467</td>
<td>$3.23</td>
</tr>
<tr>
<td>1983/84</td>
<td>176,525</td>
<td>328,492</td>
<td>$1.86</td>
</tr>
<tr>
<td>1984/85</td>
<td>574,507</td>
<td>319,239</td>
<td>$0.56</td>
</tr>
</tbody>
</table>

The demand for goat skins has not been great and the absence of a domestic goat skin industry has meant that returns to the producer from the skins has been minimal. Most of these skins would not have been graded before export.

Hide prices

The world price for goat hide varies from $A 2.00 to $A 4.00 (rough salted). Australian produced skins must also be priced at around the world price. Pricing of skins below the world price would bring virtually no return to the producer and merchants whereas pricing above the world market would make then unattractive and difficult to sell.

Angora goat skins are similar to Merino skins and are not suitable as a general purpose leather, but can be used for linings.

Finished, tanned kid or goat leather would bring between $A 5.40 to $A 26.90 per sq. metre whereas crust leather (tanned, but not finished) would bring $A 9.70 to $A 13.00 per square metre. An average sized goat skin would be about 0.37 to 0.46 square metres with large adult skins varying between 0.74 and 0.92 square metre. Adult skins are usually very poor quality.
Factors affecting the development of a goat skin industry include:

1. There is no systematic and uniform method for worldwide classification of goat skins.

2. To date, skins offered to local tanneries have all been feral goats of mixed age, sex, fibre types.

3. Practical experience in the tanning of goat skins is not widely available in Australia.

4. Education is required at the abattoir level to improve the standard of flaying, trimming, preservation and grading.

5. Goats to be slaughtered for skin and meat value must be kept free from skin damage such as ectoparasites, fences, bush spikes, thorns, grass seeds and horns during transport and handling.

Future of the Australian goat meat industry

Australians, in general, consume large quantities of meat. In recent years there has been an increasing awareness of the high cholesterol values and associated health problems of the red meats. Chicken and other white meats are therefore becoming more popular with Australian consumers because of their lower cholesterol values.

The fact that goat meat contains considerably less fat than other red meats should be exploited in goat meat promotion within the health conscious Australian household. Opportunities also exist in promotion of goat meat to the wider Australian community.

The outlook for Australia's goat meat export market is promising. It is likely that Australia's export market will continue to demand our product. However, high prices may affect consumption levels in some markets. Whereas the mutton export trade is characterised by relatively high numbers of importing countries, (and therefore alternative markets), the goat meat export trade is limited by the number of countries importing goat meat. For this reason the market may be deemed "fragile".

Over the past few years the price competitive South-East Asian markets have reduced goat meat imports as a result of price increases. Most shipments are now entering the Caribbean. Cheap New Zealand mutton is acceptable in some markets and this factor may limit demand for Australian goat meat in the Caribbean. The Mediterranean and Middle East regions appear to have the most potential for Australian goat meat sales.

As domestic goat industries expand and feral eradication continues, it is likely that the proportion of domestic goats to feral goats slaughtered will increase. As these cashmere, mohair and dairy industries expand, markets for kid meat must be developed both locally and overseas. In addition to the already partly developed markets in Australia there is no reason why, with sensible promotion, goat meat should not find its way into more Australian households.

Before the industry can undergo further major development there must be distinct improvements in the co-ordination and quality of supplies, particularly with the domestic goat. Marketing channels and regulation require further development.
Further research is required at all levels of the industry, but in particular at the producer level. It is necessary to identify and develop production systems for kid meat which will allow rapid turn-off of a high quality animals to:

1. yield producers adequate returns; and
2. satisfy consumer preferences.

Research into stress causing factors in goats would also aid product quality.

Markets must also be actively sought which will provide adequate returns for goat meat by-products, i.e. skin and offal. The current small export market for goat offal needs attention. There may also be potential for offal markets in Australia.

Correct training of slaughtermen and increased care in skin removal is important if the goat skin industry is to survive.

The developmental stages of the Australian goat meat industry are filled with challenges and problems. Many factors have to be considered and strong foundations have to be set. An organized, unified approach is essential if factors of supply, quality demand and grower returns are to be maintained. Without these ingredients it is likely the industry will flounder and remain segmented.

References


GOAT ESTABLISHMENT OPTIONS AND COSTS
Bruce Shields, Agribusiness Counsellors Pty Ltd

The foremost questions to be answered when a farmer is considering the integration of a new enterprise into his farming system must be:

What advantages and future benefits are offered?
What will establishment and integration involve?
What will the establishment costs be?
How long before financial benefits are derived?

Thankfully it is not my job to answer all of these questions today. Previous speakers have pointed out the potential benefits goats offer. To summarise these:

1. Increased fibre returns

   Purebred Angoras cutting 1.5 kg twice yearly
   Sale price = $8/g
   $24/head

   Better cashmeres cutting 200-300 g
   Sale price = $95-110/kg
   $20-30/head

   Merino ewes cutting 4.5 kg @ 22 micron
   Sale price = $3.50/g gross
   $15-16/head

2. Higher fecundity

   Kidding % - Angoras
   - Cashmeres
   90-130%
   100-160%

   Lambing % - Merinos
   70-85%

3. Better meat returns

   Goat meat - 10 kg +
   "Capretto" (baby goat) 6-10 kg
   65-85¢/g
   $1-2/kg

   Mutton
   Lamb
   25-35¢/kg
   80¢-$1/kg

Goat establishment options and costs

4. Higher stocking rates

Run 3 does to 2 ewes.

Experience in this area is not conclusive, especially in large scale situations.

The requirements for establishment of a goat enterprise obviously must be a base flock of breeding does and a good buck or two.
Establishment options and goat availability

What are the options?

1. Purchase a flock of on-bred does
   - Capital requirement will be high
   - Flocks of a reasonable size and quality are not readily available, especially cashmeres.

2. Purchase domesticated feral does
   - Compound fencing costs are avoided
   - Does can generally be inspected before purchase.

3. Purchase feral does
   - These are subject to APB domestication requirements
   - Does are trucked direct from station to compound. Pre-sale inspections are difficult.

In my opinion most prospective goat farmers, having limited financial resources and wanting to start with 200 to 300 does, will have no option but to purchase feral breeding does. These should be considered as incubators to produce more productive and profitable on-bred animals.

Feral does, in the main, are of limited productive value and consequently values of these must be reasonable (not greater than $20/head ex bush) for establishment costs not to become prohibitive.

The likely availability of both domesticated and feral does this coming season is hard to assess. Demand is increasing.

Domesticated does are available from a number of large-scale goat traders, other does are likely to be available from smaller compounds constructed in the last two seasons. How many compounds are there in your district?

The key to feral availability is the growing awareness amongst pastoralists of the increasing demand. Last season those receiving $20/head on station were netting double the likely carcass value at the abattoir. Improved catching facilities and favourable weather conditions should see significantly increasing numbers of feral does available for domestication.

Goat establishment options and costs

Establishing a reliable source either personally or through a stock and station agent is a key factor in establishment. Stressful handling of goats before arrival in the compound can result in heavy losses, obviously causing an escalation in establishment costs per surviving doe.

Establishment costs

The following case studies highlight the variability in establishment costs, either domesticating feral does or purchasing does already domesticated. See attached table "Cashmere establishment costs".

-38-
Factors contributing most significantly to this variability:

1. **Death rate**
   - Ferals - 2%-22% range
     - 8%-12% reasonable expectation
   - Domesticated - 2%-14% range
     - 5%-10% to be expected

   **Added cost to survivors**
   - Ferals @ $24 landed = $2-$3/head
   - Domesticated @ $36 landed = $2-$4/head

2. **Compounds**
   - Costs $60/ha to $380/ha or $2.05/ha to $5.80/ha*
     (dependent on size and use of existing fencing)
   - Stocking rates - 10-63/ha
   - No correlation between stocking rate and deaths.

3. **Feed costs**
   - Domestication only - $2-$6/ha
   - If stocking rate 20-25/ha - $4-$5/ha

4. **Animal health**
   - Ferals - 30¢-$4/ha
   - Domesticated - $1.50/ha

*Assumes 1/3 of cost only written off against 1st batch domesticated.

**Comparison of alternatives**

<table>
<thead>
<tr>
<th></th>
<th>Domesticate ferals</th>
<th>Buy domesticated</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>&quot;Best bet&quot;</strong></td>
<td><strong>&quot;High costs&quot;</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Cost of does - landed</strong></td>
<td>$23.50</td>
<td>$25.00</td>
</tr>
<tr>
<td><strong>Compound - 1/3 cost/head</strong></td>
<td>2.50</td>
<td>5.50</td>
</tr>
<tr>
<td><strong>Deaths - 8% or 12%</strong></td>
<td>2.00</td>
<td>3.00</td>
</tr>
<tr>
<td>- 7%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Feed costs</strong></td>
<td>4.00</td>
<td>5.00</td>
</tr>
<tr>
<td><strong>Animal health</strong></td>
<td>0.50</td>
<td>2.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$32.50</td>
<td>$40.50</td>
</tr>
</tbody>
</table>

If APB regulations relaxed

- reduce fence height to 1.2 m - reduce fencing costs
- reduce time req't to 6 weeks - double through put
- cut feed costs
## CASHMERE ESTABLISHMENT COSTS

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
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<tbody>
<tr>
<td><strong>Does</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compound Size</td>
<td>408</td>
<td>300</td>
<td>290</td>
<td>318</td>
<td>100</td>
<td>321</td>
<td>200</td>
<td>100</td>
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<tr>
<td>Stocking Rate/ha</td>
<td>16ha</td>
<td>16ha</td>
<td>30ha</td>
<td>5ha</td>
<td>8ha</td>
<td>17ha</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Losses - to 31 May</td>
<td>35</td>
<td>37</td>
<td>5</td>
<td>9</td>
<td>22</td>
<td>35</td>
<td>16</td>
<td>2</td>
</tr>
<tr>
<td>% Losses</td>
<td>8.5%</td>
<td>12.3%</td>
<td>1.7%</td>
<td>2.8%</td>
<td>22%</td>
<td>10.9%</td>
<td>8%</td>
<td>2%</td>
</tr>
<tr>
<td>Date Arrived</td>
<td>20 Mar</td>
<td>Mar</td>
<td>31 Jan</td>
<td>25 Jan</td>
<td>31 Mar</td>
<td>31 Jan</td>
<td>Mar</td>
<td>31 Mar</td>
</tr>
<tr>
<td><strong>Fencing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compound Fencing</td>
<td>$6,500</td>
<td>$4,100</td>
<td>$1,765</td>
<td>$1,900</td>
<td>$800</td>
<td>$4,045</td>
<td></td>
<td></td>
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<tr>
<td>Cost/Metre</td>
<td>$3.60</td>
<td>$2.50</td>
<td>$0.75</td>
<td>$2.10</td>
<td>-</td>
<td>$2.40</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Other/Electric Fencing</td>
<td>-</td>
<td>-</td>
<td>$970</td>
<td>$350</td>
<td>-</td>
<td>$1,115</td>
<td>$500</td>
<td>$535</td>
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<tr>
<td><strong>Total</strong></td>
<td>$6,500</td>
<td>$4,100</td>
<td>$2,735</td>
<td>$2,250</td>
<td>$800</td>
<td>$5,160</td>
<td>$500</td>
<td>$535</td>
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<tr>
<td><strong>Livestock</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does Cartage</td>
<td>$8,620</td>
<td>$6,400</td>
<td>$5,560</td>
<td>$7,900</td>
<td>$2,500</td>
<td>$6,850</td>
<td>$7,000</td>
<td>$3,500</td>
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<tr>
<td><strong>Total</strong></td>
<td>$8,620</td>
<td>$7,170</td>
<td>$6,905</td>
<td>$7,900</td>
<td>$2,667</td>
<td>$8,197</td>
<td>$7,140</td>
<td>$3,667</td>
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<tr>
<td><strong>Feed &amp; Animal Health</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hay</td>
<td>$860</td>
<td>$755</td>
<td>$610</td>
<td>$1,285</td>
<td>$200</td>
<td>$1,950</td>
<td>$50</td>
<td>$120</td>
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<tr>
<td>Grain</td>
<td>525</td>
<td>400</td>
<td>-</td>
<td>525</td>
<td>90</td>
<td>75</td>
<td>$280</td>
<td>$50</td>
</tr>
<tr>
<td>Drenches, Vaccines, etc</td>
<td>200</td>
<td>650</td>
<td>100</td>
<td>90</td>
<td>170</td>
<td>1,567</td>
<td>170</td>
<td>50</td>
</tr>
<tr>
<td>Other Costs</td>
<td>-</td>
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<td>-</td>
<td>150</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$10,205</td>
<td>$8,925</td>
<td>$7,765</td>
<td>$9,875</td>
<td>$3,087</td>
<td>$11,714</td>
<td>$7,720</td>
<td>$3,887</td>
</tr>
<tr>
<td><em><em>Cost/Doc</em>(incl 1/3 compd)</em>*</td>
<td>$27.35</td>
<td>$33.93</td>
<td>$27.25</td>
<td>$32.00</td>
<td>$39.57</td>
<td>$40.95</td>
<td>$41.95</td>
<td>$39.66</td>
</tr>
<tr>
<td><strong>Bucks</strong></td>
<td>4</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Ratio %</td>
<td>1:100</td>
<td>1:100</td>
<td>1:75</td>
<td>1:80</td>
<td>1</td>
<td>1:75</td>
<td>1:70</td>
<td>1:1</td>
</tr>
<tr>
<td><strong>Average/Head</strong></td>
<td>$1,220</td>
<td>$640</td>
<td>$1,550</td>
<td>$1,500</td>
<td>$400</td>
<td>$1,500</td>
<td>$1,200</td>
<td>$400</td>
</tr>
<tr>
<td>TOTAL EXPENDITURE</td>
<td>$16,705</td>
<td>$13,665</td>
<td>$10,705</td>
<td>$13,625</td>
<td>$4,287</td>
<td>$18,374</td>
<td>$9,420</td>
<td>$4,822</td>
</tr>
</tbody>
</table>

* Does Surviving to 31st May
Goat establishment options and costs

Possible savings:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fencing</td>
<td>$2.00</td>
</tr>
<tr>
<td>Deaths - down 1/3</td>
<td>1.00</td>
</tr>
<tr>
<td>Feed costs</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$5.00/head</td>
</tr>
</tbody>
</table>

A cost saving of 12-15% or $4 to 5,000 in establishment costs for a commercial goat enterprise domesticating 1,000 does.

Any farmer considering the purchase of 500 or more does could readily spread the cost of an 8-10 ha compound using existing fencing to achieve a lower establishment cost by domesticating his own feral does.

As the difference in the cost on a per head basis may vary up to $8/hd any decision as to which option should be taken will be determined by the cost of erecting a compound and the likely numbers of does to be purchased over the coming two to three seasons.

Summary

The first year of goat farming will be virtually all cost. Minimal income can be expected from cashmere ($1-$2/hd) and the sale of coloured male kids.

Costs if establishing a feral breeding flock are likely to be $35 to $45 per head whether purchased domesticated does or ferals. Variability in cost is most likely to be determined by death rates and costs of compound erection.

There are no "fast bucks" to be made from goat farming, patience and a sound breeding programme will see financial benefits three to five years after establishment.

If financial resources are not available to sustain the establishment costs during the initial breeding up period then goats will only compound a deteriorating financial situation.

Diversification into goat farming offers potential profits to large scale sheep and wheat farmers who have the necessary livestock management and breeding skills.
ECONOMIC COMPARISON OF MOHAIR, CASHMERE AND SHEEP
G.J. Parlevlist, B.Sc.(Agric.), Bridgetown

Summary
The returns likely to be derived from goat fibre and goat livestock are not readily predictable. Current mohair prices can be established, but the industry is in an early stage of development and has artificially high prices for livestock, due to supply limits, as well as extra demand from New Zealand. Similarly, cashmere is a new industry. As a result, budgets are 'rubbery' to say the least.

The high Angora prices currently achievable make this the more profitable enterprise. Cashmere is a very profitable second, with the average commercial sheep flock a bad last. Reduced Angora breeding stock prices result in cashmere profitability overtaking Angora.

Cashmere production requires a lower capital involvement and has a large initial fibre production.

The mohair budgets are improved because of cashmere fibre production in the first five years of a build-up situation.

Introduction
This talk is meant to compare the profitability of cashmere, mohair and sheep production systems. This is in the light of currently gloomy predictions for wool and sheepmeat products. There is potential for sheep graziers to improve their profitability by introducing goats into their production systems.

There are several factors which will reduce adoption of goats by sheep graziers. Firstly, is the unfavourable attitude towards goats i.e. they are agents of the Devil, smelly, destroyers of vegetation. Secondly, and more importantly, the cost and lack of suitable livestock. Thirdly, the perceived greater labour requirement.

The main way to convince farmers to go into goats is to clearly demonstrate a significantly improved profitability.

I will look at several options involving goats and the influence of prices on the levels of profitability.

I have tried to use realistic values in the analysis and have benefited from the diverse attitudes and opinions on mohair and cashmere by my colleagues, Jim Maddams and John Karlsson.

However, the end result is my own over-simplified budget and cash flow. I make no apology for them and anyone interested in going into goats needs to do their own homework and budget. The budgets are based on white selected feral does.

Background
The sheep industry in Australia has been in existence for over 100 years, it is well developed and has significant marketing and research support. Flocks are mainly commercial, with studs supplying rams. High numbers of animals means livestock prices are low. Wool prices have a support mechanism and are steady.
The Angora industry is fledgeling and has developed into a stud orientated industry. It has some market support, but little research backing. Livestock prices are high in a high demand, low supply situation.

The cashmere industry has re-emerged only in the last few years. It is dominated by two to three buyers, one of which has actively pushed for the industry. The cashmere industry is based on feral goats being bred-on with high cashmere producing bucks.

The numbers game

The assumptions used, and some of the simplifications made, will allow holes to be found in the tables and graphs displayed. This, coupled with the lack of long-term data, makes the results a little 'rubbery'.

However, independent budgets produced by several authors reflect a basic underlying fact. Currently, goat enterprises can, and should, produce a higher per hectare and per D.S.E. return than sheep.

It is also a fact that, in the initial stages, a goat enterprise may require a greater labour input and certainly, a higher capital input.

Consequently, if a 'farmer' needs short-term funds, goats, particularly mohair, may not be the right economic decision.

The tables and graphs generated for this discussion are the end result of a large number of calculations. The results could have been presented differently, but I feel this is the most appropriate format.

I repeat that the numbers are meant to be a guide only and producers should always do their own budgets in light of their needs, expectations and perceived end result.

Enterprise gross margins per hectare

My first step in this exercise was to generate sets of gross margins for fully developed flocks, mobs or herds of sheep and Angora and cashmere producing goats.

These are based on 40 hectares, allows a lower D.S.E. rating for goats, and uses recognized average production factors. A stocking rate of 10 D.S.E.'s per hectare is maintained.

I then varied the yield and price of fibre for each to obtain an indication of the sensitivity.
<table>
<thead>
<tr>
<th>Sheep wethers ($/ha)</th>
<th>Cut (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.5</td>
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<tr>
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</tr>
</tbody>
</table>

Culls sold $22, replacements bought $20, superphosphate 100 kg/ha, no interest charges, insurance $150, sundries $300, animal costs $2.50 per head.

<table>
<thead>
<tr>
<th>Sheep self replacing ($/ha)</th>
<th>Cut (kg/hd)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.5</td>
</tr>
<tr>
<td>2.50</td>
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<tr>
<td>Price 3.25</td>
<td>53.79</td>
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<tr>
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<tr>
<td>3.75</td>
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<tr>
<td>4.00</td>
<td>74.05</td>
</tr>
<tr>
<td>4.25</td>
<td>80.81</td>
</tr>
</tbody>
</table>

Flock - 216 ewes, 5 rams, 66 hoggets, 80% lambing, sell cull ewes $8, lambs $18, feed 25 kg per head at $200 kg/ha, buy rams at $200, animal costs $2.50, superphosphate 100 kg at $135/tonne, sundries $300, insurance $50, no interest.
### Cashmere wethers ($/ha)

<table>
<thead>
<tr>
<th>Price $/kg</th>
<th>0.10</th>
<th>0.15</th>
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<th>0.25</th>
<th>0.30</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<tr>
<td>95</td>
<td>5.71</td>
<td>65.13</td>
<td>124.55</td>
<td>183.97</td>
<td>243.39</td>
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<tr>
<td>100</td>
<td>11.96</td>
<td>74.51</td>
<td>137.05</td>
<td>199.60</td>
<td>262.15</td>
</tr>
<tr>
<td>105</td>
<td>18.21</td>
<td>83.89</td>
<td>149.56</td>
<td>215.24</td>
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<tr>
<td>110</td>
<td>24.47</td>
<td>93.27</td>
<td>162.07</td>
<td>230.88</td>
<td>299.68</td>
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<tr>
<td>125</td>
<td>43.23</td>
<td>121.42</td>
<td>199.60</td>
<td>277.79</td>
<td>355.97</td>
</tr>
</tbody>
</table>

508 wethers, sell wethers $15, buy wethers $25, fertilizer 200 kg/ha, sundries $400, animal costs $2.26 per head.

### Cashmere self replacing ($/ha)

<table>
<thead>
<tr>
<th>Price $/kg</th>
<th>0.10</th>
<th>0.15</th>
<th>0.20</th>
<th>0.225</th>
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<th>0.30</th>
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<tbody>
<tr>
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<td>183.75</td>
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<td>95</td>
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<td>211.89</td>
<td>238.67</td>
<td>269.84</td>
<td>321.63</td>
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<tr>
<td>100</td>
<td>136.58</td>
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<td>347.52</td>
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<td>520.45</td>
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</table>

Flock - 200 does, 110 hoggets, 240 kids, kid cashmere $5 premium, kids about one-third cut adults, buy bucks $500, feed 25 kg per head at $200/t for does, insurance $200, sundries $400, sale culls $15, 18 months - $28, bucks cut 0.35 kg, wethers young 0.25 kg, or that ratio.

Increasing the value of cull does by $20 to $40, increasing the value of hoggets by $10 to $35, and increasing young hoggets by $10 from $20 to $30, increases gross margin by $65 per/ha.
Mohair wethers ($/ha)
Cut (kg/hd)

<table>
<thead>
<tr>
<th></th>
<th>1.0</th>
<th>1.5</th>
<th>2.0</th>
<th>2.5</th>
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</thead>
<tbody>
<tr>
<td>7.30</td>
<td>-43.69</td>
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<tr>
<td>8.10</td>
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<td>67.64</td>
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</tr>
<tr>
<td>9.00</td>
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<td>33.87</td>
<td>90.16</td>
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<tr>
<td>Price</td>
<td>10.00</td>
<td>-9.92</td>
<td>52.63</td>
<td>115.18</td>
<td>177.73</td>
</tr>
<tr>
<td>$/kg</td>
<td>11.00</td>
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<td>71.40</td>
<td>140.20</td>
<td>209.00</td>
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<td>92.04</td>
<td>167.72</td>
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<td>197.74</td>
<td>280.93</td>
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<tr>
<td></td>
<td>14.60</td>
<td></td>
<td></td>
<td></td>
<td>321.59</td>
</tr>
</tbody>
</table>

Buy wethers at $30, sell at $15, superphosphate at 200 kg/ha at $135/t, animal costs $2.26, no insurance, sundries $400.

Increasing wethers sale price by $5, increases gross margin by $13/ha.

Mohair self replacing ($/ha)
Cut per head (kg)

<table>
<thead>
<tr>
<th></th>
<th>1.0</th>
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<tbody>
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<td>7.30</td>
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<td>147.41</td>
<td>172.81</td>
<td>284.08</td>
<td>337.78</td>
</tr>
</tbody>
</table>

Flock - 200 does, 110 hoggets, 240 kids, sell does at $15, young hoggets at $23, animal costs $2.26, insurance $200, feed 25 kg/ha at $200/t, buy bucks at $1500, superphosphate at 200 kg/ha at $135, sundries $400, kid fleece $1 premium.

If buck price goes down by $500, gross margin goes up $12/ha. If doe/young prices go up to $50, gross margin goes up $70/ha.

A comparison of the gross margins, keeping in mind the limitations of the gross margin comparisons, indicates that cashmere and Angora self replacing flocks are likely to be more profitable than wether mobs and very much more profitable than sheep.

Mohair under current livestock prices is likely to give a higher gross margin.
How to get there

The next set of data generated was to determine the cash flow while breeding goats up from feral to full blood Angora or high cashmere producing animals. They are compared to sheep.

The enterprises start with 300 breeding females and build-up to about 600 D.S.E.'s or 60 hectares. The assumptions used are listed in the appendix.

Based on these, sheep produce more income in the first two to three years, but both cashmere and mohair become increasingly profitable after that time. The degree of profit depends on prices paid for livestock. The real profit refers to the annual increase in value of livestock retained on the farm.

Cashmere generally gives a quicker return than Angora in years 0 to 3 or 5, depending on Angora livestock prices.

When Angora livestock are highly priced, real profit (includes value increase of stock on hand) is ahead of cashmere, but by year 2/3, cashmere real profit has surpassed mohair. It stays this way until about year 6, after which mohair continues to increase profit, both real and cash.

Generally, the cash flow is better with cashmere until year 6.

When Angora livestock are more realistically priced, then cashmere is ahead until year 10, after which both are about the same. Another feature is that peak debt is not as great for cashmere as for mohair.

The reasons are clear. Feral animals may already produce cashmere fibre, a selection breeding programme will quickly improve per head production. Cashmere producing bucks are cheaper and females can be mated younger.

It takes several crosses from feral to start producing a reasonable quality/quantity of mohair.

Which is more profitable starting with ferals or cross-breds?

This is, to a certain extent, an academic exercise, since there are very limited numbers of say third cross Angora or cashmere producing does available.

The following assumes a farmer can buy 100, third cross Angora or cashmere producing goats.

At reasonable Angora livestock prices, cashmere more rapidly improves its profitability until it levels out around year 5. The Angora enterprise dips lower then develops more slowly, but does level off later and at higher profits.

At high Angora livestock prices, mohair cash flow goes lower and only catches cashmere around year 5. After year 5, Angora is way out in front. In terms of real profit (taking increased stock in-hand value into account), mohair is in front from Year 1.

Comparing an Angora enterprise starting with 100, third cross animals and an enterprise starting with 300 ferals, provides an interesting, but expected result. The third cross enterprise, despite the lower number of animals, very quickly achieves normal production (on 60 hectares) by year 6/7. The
enterprise starting with ferals, does not stabilize until year 15. As a result of starting with the lower number of third cross does, additional sheep could be run to improve profit in the first three years of both enterprises, but particularly that of the 100 cross-bred does.

A similar situation exists with cashmere.

Kidding time - cashmere

All the budgets assume cashmere bearing feral goats can be mated at eight to ten months. As a result, herd improvement and buildup can occur more quickly than if female goats are mated at 18 months as is the case with Angoras.

A comparison of the two options suggests no real difference with only a more even profit for the eight to ten month mating.

How would a sheep grazier go into goats?

There has been a lot of emphasis placed by various experts on goats, that goats and sheep are partly complementary. They suggest that one goat can be run with every ten sheep. If this is the case, then herein lies the obvious entry point.

Retain existing sheep numbers and slowly build-up goat numbers.

The concept is expected to improve pasture production since goats browse the roughage and weed component of the pasture, thereby increasing wool production from sheep.

The grazier can maintain current income levels with only the investment in the original goats, fencing and subsequent buck purchases being required.

At this stage the farmer has to chose which enterprise to go into.

Once the goats breed up to competitive levels, the farmer replaces his sheep with goats to whatever level he prefers.

Example: If a farmer has 6000 sheep he could run an additional 300 to 600 goats. Which translates to a long-term income of $20 to 40,000 for mohair and $15 to 30,000 for cashmere.

Conclusion

There appears to be more money in goats than sheep. There are additional funds required as well as additional management skills. However, a long-term improved profit can be obtained.
Appendix 1: Assumptions for mohair

1. Start with 300 selected feral does and six bucks.

2. Replace bucks one per year and purchase additional bucks to maintain 2% buck/doe ratio.

3. Does mated February/March, kid July/August. Female kids mated at about 18 months.

4. Percentage: 120% ferals and adult does 100% young females/1st kid

5. Sell all wethers in second year after second shearing.

6. Death rate: Ferals 3 to 5%  
   Kids 10%  
   Young maiden 10%  
   Does 5%  
   Wethers 5%

7. Prices:

<table>
<thead>
<tr>
<th>Sell</th>
<th>Buy</th>
<th>On-Hand</th>
<th>Type</th>
</tr>
</thead>
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8. Cut:

<table>
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<td>-</td>
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<td>P</td>
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<td>-</td>
</tr>
<tr>
<td>Buck</td>
<td>3.00</td>
<td>-</td>
</tr>
</tbody>
</table>

Prices - cashmere $100  
mohair $10
Cull all lower cross animals as far as possible
Ferals shorn once a year
Interest 15%
200 kg/ha superphosphate
Animal health/feed $5 per head
Aim at 600 D.S.E. or 60 hectares
Initial years can carry some sheep.
Mohair cut twice a year.
Appendix 2: Assumptions for cashmere bred-on ex feral

1. Start with 300 selected feral does and six cashmere producing bucks.

2. Replace bucks one per year and purchase additional bucks to keep at 2% ratio.


July dropped doe kids mated April following year at 8 to 10 months. September dropped doe kids held over until 17 months.

4. Kidding %:
   - Feral: 120%
   - July kids (8 to 10 months): 50%
   - September kids (17 months): 100%

5. See all wethers in following year after second fibre cut.

6. Death rate:
   - Ferals: 3 to 5%
   - Kids: 10%
   - Young maiden does: 10%

7. Prices:

<table>
<thead>
<tr>
<th>Sell</th>
<th>Buy</th>
<th>On-Hand</th>
<th>Type</th>
</tr>
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<tbody>
<tr>
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<td>65</td>
<td>F3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>F4</td>
</tr>
</tbody>
</table>

8. Cashmere cuts (kg):
   - Feral: 0.060
   - Bucks: 0.300
   - Does and wethers F1: 0.125
   - F2: 0.175
   - F3: 0.225
   - F4+: 0.250
All cashmere at $100
Cull all lower cross to select for higher fibre producers.
Ferals shorn once
Interest 15%
Use 200 kg/ha superphosphate
Animal health, feed - $5 per head
Aim at - 600 D.S.E. on 60 hectares
Initial year can run some sheep
Initial stock assumed to be bought with loan over 5 years.
Appendix 3: Assumptions for sheep

1. Start with 300 ewes and six rams.
2. Replace rams to retain 2%.
3. Mate January/February, lamb June/July.
4. Lambing 80%.

Purchase value:

<p>| | |</p>
<table>
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<tbody>
<tr>
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<tr>
<td>Ewes</td>
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</tr>
<tr>
<td>Wethers</td>
<td>17</td>
</tr>
<tr>
<td>Lambs</td>
<td>18</td>
</tr>
</tbody>
</table>

Wool $3.3 per kilogram
Cut rams 5, ewes 4.5, hoggets 4 kilograms per head
ANGORA MOHAIR BREEDERS OF AUSTRALASIA LIMITED
Graham Larke, Chairman, Western Australian Division

The breeders of Angora and mohair goats are represented by a breed society
commonly known as the A.M.B.A. which stands for Angora Mohair Breeders of
Australasia Limited. It is structured as a company limited by guarantee and
registered in the Australian Capital Territory.

The A.M.B.A. was formed in June 1983 to replace the two breed societies which
had been in existence before that date. Some of the objects of the A.M.B.A. are:

1. To promote, develop, foster and support:
   (a) investigation and research to improve both Angora goats and Mohair.
   (b) the study, acquisition, dissemination and application of knowledge
       and information.
   (c) the interest of authorities and individuals in Angora goats and
       mohair.
   (d) the establishment of standards designed to improve the breed.

2. To represent the interests of breeders.

3. To administer a herd book.

The A.M.B.A. is not just designed as a stud society and, although we are
responsible for the herd book and stud registrations, that is only one part of
our responsibilities for we try to foster the industry in whatever way we can.

The structure of the organisation is controlled by a board of directors
consisting of one or two directors from each State depending on whether there
are more or less than 300 members in that State. Currently New South Wales
and Victoria have two directors and the other States one. I have the
privilege of representing this State.

This National Board is chaired by the National President who is elected by the
total membership and we are fortunate to currently have another Western
Australian in that position – Phillip Johnson from Gnowangerup.

Each State is known as a division which is further divided into regions. In
Western Australia we have five regions and these are most important, as they
have the closest contact with members. They are usually the body to run field
days or seminars. They have regional meetings from which ideas are formulated
into proposals to go forward to the division or National Board. They are the
place where information can be gained and other breeders can be met and I urge
any new breeders or intending breeders to make contact with your regional
president or secretary and become involved in this part of the A.M.B.A.

Each region nominates one member on to the division executive and together
with seven others elected by all the division members, makes a total of 12 in
Western Australia. This executive elects a chairman and secretary from within
that 12 and they conduct the business of the division as a whole.

So we have regions, divisions and a National Board, and a National Annual
General Meeting at which any member can propose motions and vote.

-58-
The division in this State has a newsletter published four times a year and nationally we have "The Journal" also published four times a year, though next year this will increase to six. The journal is free to members, but can be purchased by non-members for $20 annual subscription.

The A.M.B.A. is closely associated with the Angora Mohair Research Foundation which we support financially and have representatives on their Board. This organisation assists various forms of research and is currently supporting a three year research programme titled "Reduction of kemp in Australian mohair". This is being run in conjunction with the University of New South Wales, under the leadership of Professor Evan Roberts, at an estimated cost of $40,000 per year.

The A.M.B.A. has also been involved with the International Mohair Association for some years and is an associate member of that organisation. Now that Australia's production of mohair has exceeded 500,000 kilograms of mohair, we are able to become a full member and, at the last National Annual General Meeting, this was approved. However, we do have some difficulty because membership of the I.M.A. is conditional upon a levy per kilogram of mohair produced and, in Australia, this requires statutory support.

The I.M.A. is a very worthwhile organisation with most of its funds going into promotion. It also provides a forum for all sections of the industry as it includes manufacturers and retailers, as well as breeders.

The A.M.B.A. has almost 3000 members and its membership is increasing all the time. The National Office is situated in Canberra and is administered by a Chief Executive Officer who, together with his staff, is responsible for the day to day running of the society's affairs. As I mentioned at the beginning, the A.M.B.A. has been in existence for only three years and resulted from the merging of the two previous societies.

The merging of these two societies and particularly, merging the two herd books has caused considerable administrative problems and much time has unfortunately been expended on this. However, I am pleased to say that lately more attention is being given to other industry needs and the drawing together of buyers and brokers, to formulate and agree on uniform classing codes for mohair, was quite an achievement initiated by the A.M.B.A. Becoming involved in fighting the Australian Workers Union claim for a ridiculously high shearing award in Tasmania, is another example, and moves to collect, and then disseminate the latest market information, are all examples of recent moves to become involved and assist the industry generally.

I would like to say that I believe the A.M.B.A. has a very challenging, but very exciting, future ahead, as indeed does our whole industry. It is estimated that it may not be that long before mohair production has grown from the present 500,000 kilograms to 10 million kilograms, and as the industry grows, so it will need strong leadership and strong representation. Members who join now, will not only get a great deal of assistance provided by the printed material available and by meeting other breeders, but they will also have the opportunity to contribute their thoughts and ideas to help us all collectively ensure that the A.M.B.A. continues to grow and develop as we would like it too, and maintain a strong and helpful voice for this rapidly developing, exciting and rewarding industry.
THE AUSTRALIAN CASHMERE INDUSTRY
O.R. Kirwan, President Region 61, A.C.G.A.

In this paper, I will give a rather brief outline of the origins of the Cashmere Growers Association in Australia. I will outline the association's aims and objectives as a body representing producers' interests.

As with mohair production, there was interest in cashmere production in the later part of the 19th Century in Australia. For various reasons, interest declined and cashmere production almost disappeared until the 1970's.

An article published in the Journal of the Australian Institute of Science, discussed the possibility of a cashmere industry in Australia. Dr Ian Smith, of the Sydney University, had been working on feral goats from the western districts of New South Wales for some time and it was on his work that the article was based.

The C.S.I.R.O. measured fibre samples from some of these goats and found that they produced commercial cashmere. Helen Newton Turner and Fred Moylan were shown these samples and both expressed keen interest. Fred Moylan sent samples of coloured cashmere to two processors in Bradford, United Kingdom. Both agreed the fibre resembled cashmere and one, Dawsons, expressed interest in obtaining a quantity of it. So began the exciting Australian cashmere industry.

It was not until 1978 that a producer body was mooted. The first official meeting was held at Belrose in New South Wales and it was decided to call the body the Australian Cashmere Goat Society. People from Victoria also attended. Shortly afterwards a group to be known as the Victorian Cashmere Group, was formed in Victoria with Tim Squire-Wilson as President.

In 1980 an interested grower and solicitor, Mr Hugh Witham took the initiative to draw up a constitution and incorporate the New South Wales body. He advised the Victorian body and expressed the hope that a single body could represent growers. Also in 1980, the Cashmere Goat Breeders Society of New South Wales was formed. Under Elaine Kaldy, their objective was production of super fine cashmere. In fact this group was responsible for the Australian Wool Testing Authority becoming involved in testing of cashmere fibre. At this time the Victorian group were producing a newsletter, the foundation for Snippet.

The three groups worked actively to promote cashmere when outlets for fibre were very limited. They worked mainly on breed society lines as the commercial industry objective must have been quite difficult to envisage then.

However, in August 1980, Dawsons purchased a property at Adelong, "Kinross". Kinross has since been the hub and motivating force behind this new industry in Australia.

In November 1981, a meeting at the Melbourne College of Textiles decided to disband the Victorian Cashmere Group and to amalgamate with the A.C.G.S.

In the next 15 months, Regions of the A.C.G.S. proliferated throughout New South Wales and Victoria and some were formed in other States as well. Elders Pastoral Stud Stock Officer, Mr Colin Wilson, circularised known cashmere breeders in Western Australia on March 22, 1982, with the view to forming a Region in Western Australia. This was duly formed in August of that year with about 13 members.
How were 13 members actively growing cashmere in the West then?

In 1980, Mr Lance Palmer of Northam, while in Victoria inspecting Angora goats, met the Squire-Wilson's and became interested in cashmere. He purchased a black buck from them which he joined to does he was using to upgrade for mohair. Others also had realised that when upgrading from feral stock the first cross with an Angora buck produced some off-spring which grew a very fine white secondary coat. There was now a market for this previously discarded fibre. Indeed, much of it shed onto the ground from the animals before the normal shearing time for Angoras, late August and September.

During 1981, Miss Sylvia Baker of Campersic Road, Swan View, approached Mr Palmer to value goats which she had been on-breeding since about 1968. Lance realised their potential for the cashmere industry. As Miss Baker was at that time in poor health, she sold most of them to Lance Palmer, from whom many early cashmere breeders purchased their first buck.

This was the start of Region 61. We now have some 120 members in the Region and quite a few other breeders who have not joined as yet.

In March 1983, total Australian membership was about 320. After the television programme "A Big Country" featured the cashmere industry in the same year, membership snowballed to 650.

With a commercial industry developing so rapidly, the A.C.G.S. concentrated on educating producers to produce the type of fibre required by the main purchaser, Dawsons. The first national seminar on cashmere was held at Glenormiston Agricultural College.

In New South Wales, a Goat Industry Committee was formed with cashmere, mohair, milk and meat producers involved. The aim was to represent and promote the industry and to liaise with the government etc. A steering committee was formed to improve marketing of goat products, especially meat.

In 1984, the New South Wales Cashmere Society was wound up and Elaine Kaldy became an honorary member of the A.C.G.S. National Council. One body now represented all cashmere growers. Miss Lucinda Bell was the first full-time employee, she had spent three years with Dawsons at Kinross, totally involved with the upgrading of animals and fibre handling.

Kinross Cashmere Company, led by Fred Moylan, played a leading role in promoting the industry. Financial support was given to many research projects Australia wide. Their staff attended field days from north Queensland to Geraldton. Money was loaned to the A.W.T.A. to purchase the Fibre Fineness Distribution Analyser which greatly improved fibre testing accuracy.

The Kinross Annual Day in March became the premier event on the cashmere calendar.

Dawsons' support stabilized our growing industry by providing a ready market for under 19 micron cashmere. Dawsons set their price each March for the following 12 months.

Following this example, Giovanni Nesti of Filato, Biagoli, Modesto also set a 12 month price.

Representatives of Bertrand SPA of Italy and Chinese and Japanese buyers also visited the country. Taija of Japan have bought cashgora through
Maruberie Australia Ltd. American companies Forte' and Amicale have also shown keen interest, in fact Forte was the main buyer at our first pool, purchasing coarser cashmere.

In addition, four or five European processors have shown interest in the Australian product. An active national committee, headed by Jim Browne, has initiated many approaches on behalf of growers, to establish a firm base from which our industry can grow further.

In 1985 the decision was taken to set up a small lots pool to accommodate those who could not get together the 10 kilograms required by Dawsons. The concept was broadened to accept all lots of cashmere from whole bales to just fleeces. The idea was commendable; to put it into action proved far more demanding than was at first envisaged. It took tireless work by many dedicated people. Mention must be made of Hugh Hopkins of the A.W.T.A., whose expertise and skill has been invaluable to our industry. Richard Levinge, Jim Browne and Lucinda Bell also worked hard in establishing the first pool.

Hugh Hopkins is off to America for a couple of years with Richard Forte'. Certainly their gain is our loss. I hope he will return to Australia in the future with even broader experience and I wish him the success he deserves.

In March 1986, Dawsons withdrew from the Adelong premises, where they had purchased grower's fleeces, in favour of the new pool, which is to be named the Australian Cashmere Corporation. Sir Alan Smith was here in Australia and, having seen that the A.C.G.A. were now willing and capable of organizing the marketing of fibre, he declared that Kinross was no longer to act in this capacity.

Other buyers have indicated that they will support the pool set up by the A.C.G.A., namely Biagoli and Forté.

Success of this pool lies in the uniformity of classing and clip preparation. Guidelines have been set with this aim in mind. In time, the A.C.G.A. will instigate a register of classers who have qualified under this single classing system.

Dawsons withdrew a year earlier than expected which threw the pool straight into marketing fleece without any phasing in period. The pressure has been enormous, but I'm sure that the industry will meet the challenge.

Recently, the A.C.G.A. National Committee, advertised for an Executive Director of the pool, or Cashmere Corporation. It is hoped that the right person can be found to establish this marketing system.

Growers can assist in the smooth running of the four pools held each year, which close in February, May, September and December, by forwarding their fleece early, at least a month before the closing date.

The need for a body to guide, advise and foster the cashmere industry has become pressing now that Dawsons have completed their five year plan of development in Australia. The idea of such a body was discussed by Fred Moylan and myself several years ago as it applied particularly to Western Australia.

Some discussions have taken place with livestock selling agents. It is not envisaged that such a body would take the place of the A.C.G.A., but rather it would co-ordinate necessary promotion, research and development. Having in
mind the expertise and experience at both national and international level that would be available to such a body, I believe it would be tremendously advantageous to producers.

The A.C.G.A. is very conscious of the importance of goat meat and live export marketing to the industry.

Meat marketing has many and various problems. In the local market, other established and accepted industries spend huge amounts of growers' money on advertising and promotion. On the international scene there is a surplus of most agricultural produce, including meat, which is making inroads into the traditional goat meat markets.

However, as our goat meat marketing now includes domesticated animals as well as the traditional feral goat, the picture will change dramatically. The more sophisticated markets in Italy, Greece and Canada demand much better presentation and higher quality. We are confident that there are markets for domestic goat meat, but until stock numbers multiply, there may be problems in maintaining supply.

On the local scene, there is a ready demand within our community for various types of goat meat. In particular, capretto or kids up to 10 kilograms dressed weight, are sought. Once again, quality is paramount.

The Region 61 Committee is making extensive enquiries into various avenues to market this product. We are contributing to the newly formed Primary Products Promotion Unit which will help promote goat meat on the local market.

But, as with other producers, we will have to contribute towards promotion of our products and marketing systems to sell them.

The Australian Cashmere Growers Association is truly a commercial organization dedicated to promotion of cashmere fibre and goat meat sales as an adjunct.

I believe we can use our hitherto scorned feral goat, still declared vermin, to establish a very worthwhile export earner for Australia. The only proviso is that the intrinsic value of the goat must be in proportion to the fibre and meat it can produce. A stud syndrome or breed society mentality must be avoided in the long term interest of all concerned.
WORMS IN GOATS AND THEIR CONTROL
G. de Chaneet, Senior Veterinary Parasitologist,
Department of Agriculture, Bunbury

Goats are susceptible to infection with

* Barber's pole worm (*Haemonchus contortus*) which occurs in high rainfall areas (> 760 mm rainfall annually), and where there is significant rain during warm weather. These areas are mostly within 50 kilometers of the coast.

* Black scour worm (*Trichostrongylus* spp.) and small brown stomach worm (*Ostertagia circumcincta*) which are common throughout the agricultural areas.

Angoras are also susceptible to the small brown stomach worm of cattle (*O. ostertagi*).

There are many other worms but these are generally less significant than those mentioned above.

**Biology of the worms**

The roundworms have direct life cycles. Eggs passed in the dung of infected animals hatch in the dung on the ground if temperature and humidity are favourable. Hatching may occur within days of deposition or may be delayed many weeks by dry conditions. Larvae that hatch from eggs develop into infective larvae in one or two weeks. Each egg produces one infective larva. Each adult worm produces many eggs — *Haemonchus* is particularly fecund.

Infective larvae migrate out of dung onto herbage. Very few migrate higher than 10-12 cm up plants. Animals grazing plants below this height ingest the larvae which then develop to adult worms in about three to four weeks.

*Haemonchus* worms suck blood from the host and this may cause anaemia. The other worms damage the lining of the stomach and intestines thereby interfering with digestion. The suppression of appetite is one of the most significant effects of worm infestations and is a major cause of loss of production.

**Disease**

Because worm infections derive from infective larvae on pasture, one of the principal factors in development of disease is the existence of a large population of infective larvae on pasture. For *Haemonchus* such populations can develop during the warmer months of spring, summer and early autumn and for the other worms during the cooler months of autumn, winter and spring. Irrigation of pastures during warm weather is particularly favourable for *Haemonchus*.

If sufficient worm larvae are ingested by a goat to overcome the goat's resistance then disease occurs. All grazing goats have worms but not all have sufficient worms to produce disease. Sheep develop a strong resistance to worms by the time they are about 18 months old. Goats do not develop such a strong resistance and may suffer disease as adults. Lactating ewes, and probably does, lose their resistance while lactating and may suffer disease and contaminate pastures very heavily with worm eggs.
Factors which result in the development of large populations of infective larvae on pastures and their ingestion by goats are:

* Contamination of pasture by young goats and lactating does.

* High stocking rates on the whole farm (overstocking) leading to inability to manage pastures, close grazing by goats and increased contamination.

* Seasonal conditions - long wet springs, wet summers and wet autumns are favourable for development of larvae. Most larvae die after 6-8 weeks of hot, dry weather (on dry pasture).

The signs of disease in goats are basically those of anaemia in the case of Haemonchus infection and gastro-enteritis for the other worms. These are manifest as weakness, development of bottle jaw and pale membranes of the mouth and eye for anaemia, and weight loss and diarrhoea for gastro-enteritis.

Control

Anthelmintics (drenches) are used as a crutch by some goat owners to prop up deficient management. Regular drenching which uses the approach of cure today, reinfect tomorrow is the principle used. It produces short term gains but can end in disaster because it encourages the development of resistance to anthelmintics by the worms. There are now goat herds in the south-west that are infected with profoundly resistant worms.

Control relying solely on drenching is compromised by the recently recognised fact that the anthelmintics are not all metabolised in goats in a similar way to that in sheep. This means that sheep dose rates may not be appropriate in goats - innocent underdosing may be further encouraging development of resistance.

The principles outlined in the CRACK programme for worm control in sheep can be applied to control worms in goats that are grazing pastures.

**Crack down on worms**

* Check your goats for drench resistance.

* Reduce drenching.

* Avoid using broad spectrums when possible.

* Check the dose rate.

* Keep resistant worms off your farm.

**Check your goats for drench resistance**

Resistance is likely to be widespread in goat worms. Every farm is likely to have a problem peculiar to it and without first testing for drench resistance it is impossible to suggest which group of broad spectrum drenches is the one to use on a particular farm. Resistance testing identifies which drenches are effective.

Resistance tests can be done by veterinary practitioners. They are best done using young animals because these animals are usually the wormiest. The field test currently used measures the effect of drenching on the output of worm.
eggs in the dung of test animals. A comprehensive test involves monitoring
worm egg counts of 30 weaner animals (45 are initially selected to allow for
animals that may prove unsuitable due to low egg count). In small flocks, a
modified test would have to be done, perhaps without the use of untreated
control animals. Such modified tests must be interpreted with great caution.

Having determined which particular drenches can be used it is appropriate to
wonder how they will be used.

Reduce drenching

A worm control programme should rely as little as possible on drenching so as
to preserve the efficacy of the drenches. This means that there is a need to
assess completely the significance of worm control in the goat production
enterprise. I suggest that in the high rainfall areas good worm control is
essential to any sort of goat enterprise. How can this be achieved in grazing
situations without heavy reliance on drenching?

1. Examine management

Some management systems are biologically untenable. Goats that are forced
to graze at high stocking rates on small farms without the opportunity to
be moved to "safe" pastures occasionally will always suffer from worms.
Regular drenching will only prop up the system for a short time.

There must be the opportunity to move animals so as to avoid heavily
contaminated pastures. This means that the farm cannot be completely,
heavily stocked with goats. If it is desired to run many goats on a small
area then "off pasture" maintenance of the goats using total hand feeding
is probably the only way that the worm problem can be overcome. Long term
grazing rotations using mature wether sheep or mature cattle to graze
pastures after they have been grazed, and contaminated by goats, should also
control worms.

2. Use routine preventive drenches

In dryland (non-irrigated) farming situations drenching sheep with
effective broad spectrum drenches (selected after conducting a resistance
test) during summer has a dramatic effect on parasitism for many months.
It prevents autumn contamination of pastures and thus breaks the annual
cycle of worm infection. These summer drenches should work for goats on
dryland farms.

Drenching for prevention involves treating the whole flock to stop
contamination, not just treating obviously wormy individuals.

The susceptibility of lactating does to worms should be countered by
drenching them as late as possible before kidding, and again about 4-6
weeks later. For sheep in areas where Haemonchus is a problem, a
prelambing treatment with Sepronver® (Smith Kline Animal Health) is
recommended as is a drench for lambs at weaning using Sepronver® and a
broad spectrum drench. Sepronver® is not registered for use in goats —
using broad spectrum drenches alone at these times will do a lot to reduce
the chance of Haemonchosis occurring.
3. Monitor worm control

Faecal worm egg counts, which can be done by a veterinary practitioner, can show how wormy goats are and how successful a drench has been. They are probably the most useful management tool available to a goat farmer who grazes goats on green pastures during summer, who thus cannot get much benefit from a summer drenching programme. Regular determination of worm egg counts for one or two years on a farm will provide a lot of information on how worms are behaving on the farm and provide confidence in deciding whether or not to drench.

Samples should be collected from 10-15 goats. Fresh samples that are not contaminated with soil are needed. If assessing the effect of a drench, collect the samples 10-14 days after drenching.

4. Do not drench without a reason

Each drench given to goats should be given for a definite purpose. Don't drench just because you happen to have all the goats mustered or because you want to try out a new drench.

Avoid using broad spectrum drenches where possible

In areas where Haemonchus is a problem in sheep, we recommend that narrow spectrum drenches be used when drenching sheep to control Haemonchus, in order to preserve the broad spectrum drenches for control of other worms. There are no narrow spectrum drenches that are registered for use in goats, so if they are used, be careful - some are likely to be toxic to goats.

Check the dose

It is important that goats not be underdosed. Underdosing can encourage development of resistance by allowing partially resistant worms to survive and breed.

Dose animals on a weight basis. Weigh a few animals to ensure that weight estimates are not grossly in error - most people, even experienced stockmen, are not able to accurately assess the weights of animals. Check the accuracy of the drench gun and service it regularly; most drench guns are woefully inaccurate because of poor maintenance.

Take care and do not rush drenching. Deposit the full dose carefully into the mouth of each animal and give it time to swallow the drench - drench spilt in the race doesn't kill many worms! Don't allow air bubbles to develop in the drench delivery system. Agitate the drench regularly if it is a suspension that tends to settle out.

Keep resistant worms of your farm

Because resistance is widespread, you stand a good chance of introducing resistant worms to your herd if you introduce goats or sheep from another farm. Ideally you should know the resistance status of the worms in the animals you plan to introduce, but practically this is unlikely. Consequently you must assume any introduced sheep or goats carry resistant worms and act accordingly.

The best approach we have been able to devise for sheep is to isolate the introduced animals, preferably in yards or a shed, and treat them with double
doses of two drenches, one from each of the two groups of broad spectrum
drenches. This will eliminate susceptible worms and mildly resistant worms.
It will not kill resistant worms. Consequently, dung samples should be
examined for worm eggs 10-14 days after the second drench. The result of the
egg count will show how successful the drenching has been. Finally, the
animals should be released onto the wormiest paddock so that they acquire
plenty of the farm's strains of worms, and any resistant worms in their
residual worm burdens are diluted. If the double drenching does not clean
them out, professional help should be sought before the obviously highly
resistant worms are released onto your farm.

Anthelmintic-drenches

The drenches available for goats are all primarily sheep drenches. The work
to determine their efficacy and safety has been done in sheep. Any goat work
is done as an afterthought and is fairly superficial.

Recent work has shown that goats may metabolise drenches differently from
sheep. For example, after oral dosing with Levamisole, the blood
concentration of Levamisole is initially higher in goats (breed or type
unspecified) than in sheep. However, the concentration falls more rapidly in
goats than sheep, such that the half life of Levamisole in goats is about half
what it is in sheep. Other work, reported so far only in a preliminary form,
suggests that the metabolism of benzimidazoles in goats differs from that in
sheep.

The emerging picture suggests that in some circumstances sheep dose rates may
not be ideal for goats. Simply increasing the dose rate may not be the
appropriate solution because of problems of residues and toxicity. It may be
found that alternative dosing procedures such as prolonged dosing, as may be
achieved with multiple dosing, sustained release devices or rigidly controlled
water or feed medication, may be more appropriate.

Because of the uncertainty of action of anthelmintics in goats and the
prevalence of resistance, it is imperative that goat farmers monitor the
effects of drenching their goats, using worm egg counts.

The drenches that are registered for use in sheep are shown in the attached
table. Some are not registered for use in goats but are included because they
are being used by some goat owners and may be registered in the future.

Conclusions

Goats may be infected with sheep worms and Ostertagia of cattle. The
epidemiology of worm disease in goats is similar to that in sheep with the
exception that adult Angora goats do not develop a strong resistance to worms
so will suffer more than sheep if forced to graze heavily stocked, short
pastures.

Worm control is complicated by the development of anthelmintic resistance.
This necessitates the adoption of the approach to worm control advocated in
the CRACK programme. Each farmer needs to access his own management and
develop worm control programmes that are relevant to his management, after
first determining what drenches are effective on his farm.

Routine preventive drenches that should be used are summer drenches for all
goats on dry summer pastures, pre- or pre- and post-kidding drenches for does,
and a weaning drench for kids.
Further reading

The similarity of the epidermiology of worm disease in sheep and goats means that information about sheep worms is useful to the goat farmer.

Relevant Department of Agriculture farmnotes are:

"Principles of worm control in sheep" 77/84
"Barbers pole worm in sheep" 124/84
"Anthelmintics resistance of worms in sheep" 80/85
"Worm drenches for sheep" 95/85
<table>
<thead>
<tr>
<th>Drug</th>
<th>Formulations</th>
<th>Dose rate of drench (mL per 10 kg of liveweight)</th>
<th>Withholding period (days)</th>
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<tbody>
<tr>
<td><strong>Broad spectrum drenches:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Group 1 (Benzimidazoles)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albendazole</td>
<td>Valbazen *Closal (1)</td>
<td>2.0</td>
<td>10</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Febantel</td>
<td>Rintal</td>
<td>2.0</td>
<td>21</td>
</tr>
<tr>
<td>Fenbendazole</td>
<td>Panacur</td>
<td>2.0</td>
<td>14</td>
</tr>
<tr>
<td>Mebendazole</td>
<td>Telmin</td>
<td>2.0 to 3.0</td>
<td>7</td>
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<tr>
<td></td>
<td>Mebendazole</td>
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<tr>
<td>Oxfendazole</td>
<td>Synanthic Systamex</td>
<td>2.0</td>
<td>10</td>
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</tr>
<tr>
<td>Thiabendazole</td>
<td>Thibenzo *Ranizole (2)</td>
<td>2.5</td>
<td>0</td>
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<td></td>
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<tr>
<td><strong>Group 2</strong></td>
<td></td>
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</tr>
<tr>
<td>Levamisole (3)</td>
<td>Big L Citarin Cyverm Levamisole Levicur Nilvax Nilverm Ripercol</td>
<td>2.5 but varies with product</td>
<td>3</td>
</tr>
<tr>
<td>Morantel</td>
<td>Exhelm E</td>
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<tr>
<td><strong>Narrow spectrum drenches:</strong></td>
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<tr>
<td><strong>Group 3 (Salicylanilides)</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>*Rafoxanide</td>
<td>*Ranide *Ranizole (2)</td>
<td>2.5</td>
<td>28</td>
</tr>
<tr>
<td>*Closantel</td>
<td>*Seponver *Closal (1)</td>
<td>2.0</td>
<td>28</td>
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<td></td>
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<td></td>
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<tr>
<td><strong>Group 4 (Organo phosphates)</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>*Naphthalaphos</td>
<td>*Rametin H</td>
<td>5 mL/sheep</td>
<td>7</td>
</tr>
</tbody>
</table>

(1) CLOSAL is Albendazole + Closantel.
(2) RANIZOLE is Thiabendazole + Rafoxanide.
(3) Some brands of levamisole are not registered for use in goats.
* NOT registered for use in goats.

-70-
ANGORA FLOCK IMPROVEMENT
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Introduction

In all serious farm animal breeding operations, the basic breeding objective is to obtain and maintain maximum animal genetic gain. To achieve this we need to ensure that the best animals are used as parents. The problem however, is to define "best" and to make the appropriate genetic evaluation of all candidates.

This paper will attempt to outline a logical and objective approach to the unbiased evaluation of Angora goats, illustrate principles involved in comparisons between goats reared on different properties and finally, look at the effect of different breeding programmes.

A. Definition of breeding goals

The first critical step in all breeding programmes is to define the breeding goals.

There is an inverse relationship between the number of traits included in the selection process and the genetic response achieved in each of these traits. The breeder must therefore temper the desire to include too many fancy traits in the selection process, otherwise there will be less progress made in the economically important production traits.

Other basic genetic factors that have a bearing on breeding objectives include; the interaction (correlation) between different traits; the heritability of specific traits, and the cost and practicability of testing of different traits.

The following is a list of four major breeding objectives based on quantitative traits. These traits have been selected based on their ability to determine the overall profitability of a commercial Angora breeding enterprise.

1. Increased value of fleece production

* increased fleece weight.
* optimum fibre diameter.
* decrease in the medullated fibre content.
* a narrow fibre diameter range (bucks)
  - based on individual fibre measurements
  - a narrow histogram (visual presentation)
  - a low standard deviation and coefficient of variation.
* a medium face cover score, as the upper limit.

2. Optimum body growth rate and weight

* optimum birth weight (if available).
* high weaning weight.
  - corrected for age, rearing type.
* high body weights at;
  - late summer (6 to 9 months), 12 and 18 months of age.
* high growth rate at;
  - weaning, 12 and 18 months.
3. **High fecundity**

* pedigree information if available.
* low age at sexual maturity.
* for does;
  - conception early in mating period
  - high kidding and weaning rate.
* for bucks;
  - large testicular size at sexual maturity
  - high libido
  - good semen quality and quantity
  - high conception rate.

4. **Good general soundness**

* good general conformation.
* good resistance to gastro-intestinal parasites.
* good adaptation to local environment.

B. **Genetic factors affecting angora breeding**

The scope of this paper will only allow for a brief review of some of the genetic factors affecting animal selection responses.

1. **Heritability**

The heritability of a trait is the proportion of an animal's superiority that is passed on to the offspring. Heritability estimates are considered in the design of breeding programmes since they are used to predict the selection response.

The magnitude of the heritability from different traits also signify which selection method will be most efficient. In general, for traits with a heritability of 30 per cent and higher, it is most efficient to base the selection on the individuals own performance. In Angora goat breeding, body weight and most of the fleece traits fall in this category. Fecundity is an example of low heritability. In this case, additional information from pedigree performance is useful.

Currently there is a lack of reliable estimates of heritability for Angora production traits.

2. **Correlated responses**

The correlation between different traits refers to a situation where a genetic or phenotypic relationship exists between two or more traits. From a practical breeding point of view, we need to make sure that by selecting for one trait we do not cause an unacceptable deterioration in another trait(s).

An example of a negative correlation is found between increasing face cover and decreasing fecundity and body weight.

3. **Selection differential**

The selection differential is the difference between the average performance of selected parents and the average performance of the unselected flock from which they are drawn.
The selection differential is determined by:

(a) the proportion of animals selected.
(b) the reproductive potential.
(c) the herd structure.

4. Generation interval

Generation interval refers to the time interval between generations. It is defined as the average age of the parents when their offspring are born.

5. Breeding value

The breeding value of an animal is its value as a breeder or a parent.

The estimated breeding value for a single trait is calculated by multiplying the selection differential achieved for a parent with the heritability for a given trait. The true breeding value is defined as the average performance of its offspring.

The correlation between the "true" and estimated breeding value gives a measure of the accuracy of selection.

6. Genetic gain

Genetic gain obtained in each generation depends on the average male and female selection intensity applied for a trait multiplied by the heritability of the same trait.

The generation interval can be quite variable, it is therefore preferrable to express the genetic gain achieved each year as follows:

\[
\text{Annual genetic gain} = \frac{\text{selection differential} \times \text{heritability}}{\text{generation interval}}
\]

In the annual genetic gain equation, heritability can be regarded as a fixed trait. For the two variable traits, the selection intensity should be as high as possible and the generation interval as short as possible. These interactions can be illustrated in the following examples.

Theoretical distribution of annual greasy fleece weights

![Diagram showing theoretical distribution of annual greasy fleece weights.](attachment:image.png)

-73-
(a) Selection differential(s)

Does  (i) 0; (ii) 0.25 kg; (iii) 0.5 kg
Bucks  (i) 0.5 kg; (ii) 1.0 kg; (iii) 1.5 kg; (iv) 2.0 kg.

(b) Generation interval (L)

Does  (i) 3 kids at 1 year 1,2,3 2.0 years
     (ii) 3 " " 2 years 2,3,4 3.0 "
     (iii) 4 " 1 year 1,2,3,4 2.5 "
     (iv) 4 " 2 years 2,3,4,5 3.5 "
     (v) 6 " 2 years 2,3,4,5,6,7 4.5 "
     (vi) 8 " 2 years 2,3,4,5,6,7,8,9 5.5 "

Bucks  (i) 2 mating seasons 1st at 1 year 1,2 1.5 years
     (ii) 2 " 2 years 2,3 2.5 "
     (iii) 4 " 2 years 2,3,4,5 3.5 "
     (iv) 6 " 2 years 2,3,4,5,6,7 4.5 "

(c) Heritability

30 per cent

Annual genetic gain $\Delta G = \frac{\text{selection differential (S)} \times \text{heritability (h}^2\text{)}}{\text{generation interval (L)}}$

Example

1. Low efficiency  
   $S_f = 0$, $S_m = 0.5$  
   $S_k = 0.25$ kg  
   $L_f = 5.5$, $L_m = 4.5$  
   $L_k = 5.0$ years  
   $\Delta G = \frac{0.25 \times 0.3}{5} = 0.015$ kg/yr

2. Medium efficiency  
   $S_f = 0.25$, $S_m = 0.5$  
   $S_k = 0.375$ kg  
   $L_f = 4.50$, $L_m = 3.5$  
   $L_k = 4.0$ years  
   $\Delta G = \frac{0.375 \times 0.3}{4} = 0.028$ kg/yr

3. Maximum efficiency using A.I.  
   $S_f = 0.5$, $S_m = 2.0$  
   $S_k = 1.25$ kg  
   $L_f = 3.0$, $L_m = 1.5$  
   $L_k = 2.25$ years  
   $\Delta G = \frac{1.25 \times 0.3}{2.25} = 0.167$ kg/yr

Time taken to increase flock average by 1.0 kilogram.

Example 1:  67 years
Example 2:  36 years
Example 3:  6 years

-74-
C. Unbiased evaluation of breeding animals

An evaluation of the previously illustrated example of annual genetic gain indicates that there is considerable scope for increasing the efficiency of the Australian Angora goat industry. In order to maximise genetic gain, we need to implement a breeding programme based on sound genetic principles.

The two initial steps involving a recognition of some basic genetic principles influencing genetic gain and the definition of the breeding goals, have been discussed.

In this section the practical methodology of the breeding programme will be discussed. The two main requirements in this respect are:

* unbiased evaluation and identification of superior animals.
* implementation of an effective breeding programme.

1. Performance testing

The first step in the evaluation of an animal is to obtain information about its production potential.

Measurement, testing, recording and evaluation are costly in time and money. We therefore need to carefully evaluate the effectiveness of this procedure. The most efficient use of these limiting resources involves spending most on the evaluation of the bucks as they have the potential to contribute most to the next generation. As an example, if one buck is mated to 50 does, then he contributes 50 per cent to the progeny "gene pool" whereas each doe only contributes 1 per cent.

The second major consideration is how accurate is one measurement of a trait compared to several measurements of the same trait, this is also referred to as the repeatability. In general, two or three measurements can be expected to improve the accuracy of the description of a trait compared to one measurement. The additional benefit from further measurements over time, of the same trait, then begins to level out. The major drawback in performing many measurements over time, is that it tends to increase the generation interval. There is therefore a need to compromise between maximum accuracy and the need to keep the generation interval short. In general, for fleece traits, the third shearing (18 months) should provide a good indication of an animal's adult production potential.

2. Measurements and evaluation categories

There are two broad categories of measurements and evaluation.

(a) Visual or subjective evaluation

Visual assessment is a useful adjunct in the selection process for the following reasons;

* it provides a simple on the spot selection method.

* conformational faults and congenital defects can be observed early in an animal's life, these animals can then be excluded from the more costly evaluation later in the programme.
However, subjective assessments are subject to inaccuracies, especially in regard to the economically important production traits. For these traits between animal differences follow a continuous progression rather than in clearly visible discrete differences. As an example, in a South Australian study, the phenotypic correlation between a visual kemp score and an objective measurement of medullation was only 11 per cent.

(b) **Objective measurements**

Most of the economically important traits are of a quantitative nature. This follows because these traits are determined by many genes.

If we evaluate a large number of animals for a quantitative trait, we find that all animals between the worst and the best are distributed on a normal distribution curve. In this situation the production of an individual animal can best be described by objective measurement.

3. **Optimising testing procedures**

In a practical breeding programme we need to arrive at an optimal combination between subjective and objective measurements. This generally results in the best overall evaluation, as well as providing the most cost effective combination.

To optimise the allocation of costly testing procedures we can institute a step-wise screening procedure, illustrated diagrammatically as follows;

<table>
<thead>
<tr>
<th>Bucks</th>
<th>Does</th>
</tr>
</thead>
<tbody>
<tr>
<td>X X X X X X X X X X</td>
<td>Kidding mortalities</td>
</tr>
<tr>
<td>X X X X X X X X X X</td>
<td>Marking (congenital def.)</td>
</tr>
<tr>
<td>X X X X X X X X X X</td>
<td>Weaning (B.W. etc.)</td>
</tr>
<tr>
<td>X X X X X X X X X X</td>
<td>1st shearing</td>
</tr>
<tr>
<td>X X X X X X X X X X</td>
<td>2nd shearing</td>
</tr>
<tr>
<td>X X X X X X X X X X</td>
<td>3rd shearing</td>
</tr>
<tr>
<td>X X X X X</td>
<td>Objective fleece testing</td>
</tr>
<tr>
<td>X X X X</td>
<td>Select. for breeding</td>
</tr>
<tr>
<td>X X</td>
<td>Fecundity</td>
</tr>
<tr>
<td>X X</td>
<td>Progeny testing</td>
</tr>
<tr>
<td>X</td>
<td>Select. for A.I./Reference sire</td>
</tr>
</tbody>
</table>

4. **Ranking of animals**

The observable and measurable traits of an animal are referred to as its phenotype. The phenotype represents the sum total of its genotype plus environmental influences as per the following simple equation.

\[
\text{Phenotype} = \text{genotype} + \text{environment}
\]

In breeding we are interested in the genotype as this is what is passed on to the next generation. Therefore, when a comparison is made between animals, we must take every step possible to minimise and/or standardise the environmental influence, see the following example;
Correlation between genotype and phenotype

Phenotype = Genotype + variable environment Poor
Phenotype = Genotype + standardised environment Good

The between animal comparison can be categorised as follows;

(a) Contemporary comparison

This refers to animals of similar age, reared under similar conditions on the same property. This system will allow for the standardization of some of the environmental influences. However, there are still differences due to maternal and rearing type differences.

The following is a hypothetical example of how corrections could be made for weaning weight in goats (the actual correction factor for each category is obtained by estimating the means for each of the categories and comparing them to one reference category).

<table>
<thead>
<tr>
<th>Category</th>
<th>Correction (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single buck kid reared as single, dam six-tooth</td>
<td>0</td>
</tr>
<tr>
<td>&quot; &quot; twin, &quot;</td>
<td>+2.00</td>
</tr>
<tr>
<td>Twin &quot; &quot; twin, &quot;</td>
<td>+2.00</td>
</tr>
<tr>
<td>&quot; &quot; single, &quot;</td>
<td>+1.00</td>
</tr>
<tr>
<td>Triplet &quot; &quot; triplet, &quot;</td>
<td>-3.00</td>
</tr>
<tr>
<td>&quot; &quot; twin, &quot;</td>
<td>+2.50</td>
</tr>
<tr>
<td>&quot; &quot; single, &quot;</td>
<td>+1.50</td>
</tr>
<tr>
<td>Doe kid to adjust to buck kid</td>
<td>+0.75</td>
</tr>
<tr>
<td>Kid born to four-tooth</td>
<td>+0.50</td>
</tr>
<tr>
<td>Kid born to two-tooth</td>
<td>+1.00</td>
</tr>
<tr>
<td>Every day ± 100 days of age</td>
<td>+0.10</td>
</tr>
</tbody>
</table>

In regard to fleece production evaluation, we can overcome some of the early rearing-type and time of birth differences by concentrating on the third shearing. However, this may not account for all of the early environmental differences as secondary follicle initiation and development takes place up to weaning time. A twin born and reared animal may therefore have a lower phenotypic fleece weight than a single born and reared animal, but the twin may be superior in genotype and therefore pass on more favourable genes to its progeny. There is therefore a case for a correction in favour of the twin fleece weight later in life as well.

(b) Non-contemporary comparison

The above mentioned contemporary comparison does not allow for a valid comparison between properties or even between different age groups on the same property.

A valid between property comparison can be accomplished by the following methods viz.:-

-77-
* A sire referencing scheme.
* Best linear unbiased prediction (B.L.U.P.).

The sire referencing scheme is based on the establishment of genetic linkages between properties by the use of one or more reference sires. These sires are mated to a randomly allocated group of does on each of the co-operating properties. The average merit of these progenies can then be compared to the average of similar mating groups produced by one or more home bred sires.

The home bred sires breeding values can also be compared indirectly via the common reference sire to home bred sires on other properties where the same reference sire has been used.

B.L.U.P. is a very high power computer system which uses all available information of an individual as well as its relatives to come up with a best overall assessment.

Considering the stringent requirements involved in valid unbiased evaluation of animals, it is rather disheartening to look at the current stud/commercial structure of the Angora industry. Repeating the following equation;

\[
\text{Phenotype} = \text{genotype} + \text{environment}
\]

I have spent considerable time on emphasising how important it is to minimise and/or standardise the environment. However, in the current Angora industry the name of the game is to go in the opposite direction and do everything possible to hide the true Genotype by addition of as much environmental influence as possible. This problem can probably only be overcome by breeder controlled group breeding schemes.

D. Selection methods

When more than one trait is included in the selection process we need to consider two requirements viz.

* it may not be possible to measure all traits at the time.
* how is the information from each trait combined in the selection process.

1. Independent culling levels

With this method selection for each trait is carried out independently of other traits. There are also less time constraints in this method.

A step-wise selection or culling can be implemented as follows;

* post-partum identification; cull kids with physical faults.
* weaning; cull for low weaning weight, etc.
* shearing; select breeding animals based on fleece value.
* fecundity; culling for poor performance.

With independent culling levels selection can be implemented without extensive records or the need to make overall assessments of all records.
2. Index selection

The main drawback of the independent culling levels is that an animal may just fail to qualify for the selection criterion for trait A. However, the same animal may be very superior with regard to trait B.

In a practical breeding programme we are interested in the total breeding value of an animal. There is therefore a need to collect information on traits identified in the breeding objectives. The next step is to define the relative value of individual traits in the overall evaluation.

The construction of selection indices depends on several considerations such as the economic value of a unit change of the trait as well as any correlated changes in other traits.

The selection index \( I \) is normally calculated in a linear equation as follows:

\[
I = b_1 X_1 + b_2 X_2 + \ldots + b_q X_q
\]

where, \( b_1 \) to \( b_q \) are independent weighings that have been allocated

\( X_1 \) to \( X_q \) are individual measurements or scores.

Index selection is generally considered the most efficient selection method. However, it would not be cost efficient to include all contemporaries in all tests up to the point of identification of top animals in a group. In practice, a step-wise screening procedure is employed as illustrated in the section on optimising testing procedures.

E. Breeding programmes

The following essential prerequisites have been discussed;

* Definition of breeding goals.
* Definition of genetic factors affecting Angora breeding.
* Unbiased evaluation of breeding animals.
* Selection methods.

The final step is to bring the above information together in an overall breeding programme to meet our original objective, which is to achieve and maintain maximum annual genetic gain.

Breeding programmes can be categorised in two main types as follows;

* The traditional stud and commercial industry.
* Group breeding schemes.

1. Studs and commercial flocks

The traditional stud commercial industry is typically of a pyramidal structure, a few studs at the top and a large commercial base. At the early stages of the Australian Angora industry this structure was virtually inverted, that is mostly studs and very few commercial flocks.
The inverted pyramidal structure is obviously not sustainable once the emphasis changes from pedigree recording and sale of animals to a reliance on commercial fibre production.

In the traditional stud/commercial industry there is a one-way gene flow from the top (studs) to the base (commercial flocks). This results in two major drawbacks to this system viz.

(a) Superior animals in the bigger base population are not allowed to enter and contribute to genetic gain in the closed stud tier.

(b) Having a relatively small closed stud population increases the rate of in-breeding depression.

2. Group breeding schemes

Group Breeding Schemes (G.B.S.) are theoretically of value in any animal breeding industry. However, in practice, they are mainly confined to the more advanced farming countries as follows;

* Dairy cattle in the north-west of Europe and North America.
* Sheep in the north-west of Europe, Australia and New Zealand.
* Dairy goats in the north-west of Europe.
* Cashmere goats in Western Australia, New South Wales and New Zealand (1985/86).

The Scandinavian G.B.S's began in the 1930's, following the development and adoption of artificial insemination in dairy cattle. These G.B.S's are, by now, highly developed and very effective breeding organisations.

Most of the G.B.S's for sheep in Australia and New Zealand have evolved from a historical familiarity with the structure of the existing stud industry. As a result, they have adopted a similar pyramidal structure with the top studs replaced with a so-called nucleus flock. In these G.B.S's the top portion of the female progeny in the contributing flocks are moved into the central nucleus, this is referred to as an open central nucleus structure.

Comparing a stud flock of a given size with an open central nucleus of a similar size, it can be demonstrated that the G.B.S. has a genetic advantage of 15 to 20 per cent. This advantage is due to a wider genetic base and less inbreeding.

3. Decentralised group breeding schemes

The central nucleus based G.B.S's have some potential disadvantages which can be categorised as follows;

(a) The movement of animals from many different sources into a central location, be it a central nucleus or a testing station, has the potential to become an efficient method of disseminating disease. This risk includes most of the infectious and parasitic diseases. It is therefore desirable to minimise the movement of large numbers of breeding animals.

(b) The genotype of an animal interacts with its environment. Animals may therefore perform differently in different environments. This becomes important to the individual breeder
if the environment of the central nucleus (or stud) is very different from the local situation. In this case, a buck that performed well at the sire breeding centre, may not be of the same value at the end users property.

(c) In a G.B.S. it can be assumed that some breeders would prefer to retain their "top" animals on the property rather than sending them off to a central nucleus.

In theory it would be desirable to include all breeders in a G.B.S. However, in practice this would be an unrealistic aim. The following example refers to the proposed structure of the Western Australian Cashmere Group Breeding Scheme and the associated commercial industry.

(i) Nucleus breeders

* Breeders in this category have a nucleus and a base flock.
* Each year young bucks undergo performance and progeny testing.
* Between property comparisons are achieved with a sire reference scheme.

The annual progeny testing and reference sire comparison will identify the top bucks. These will be used widely throughout the following season. For maximum benefit these superior bucks should be used through A.I.

(ii) Contributing breeders

Some breeders although supporting the G.B.S. concept may not wish to be fully involved in the more intensive aspects of the G.B.S. It is however, important that all superior animals are identified and utilised for the overall benefit of the industry.

For breeders in this category the simplest method is to identify the top three to five per cent of the does and move them to a nucleus breeder, where their genetic potential can be fully used.

Breeders in this category will be assured of above average bucks from the nucleus breeders at a reasonable cost.

Top performance tested bucks generated in this category will be available for other contributing breeders and commercial producers.

(iii) Combined G.B.S. members and commercial breeders

Some producers with large numbers of goats may for management reasons wish to run the majority of their goats as a commercial enterprise. These breeders can make a significant genetic contribution by identifying their better does and establish a nucleus flock and produce most of their own flock buck requirements.

Breeders in this category can belong to the G.B.S. either as contributing or nucleus breeders. It would be advantageous for most large commercial producers to adopt this system.
Summary

There is considerable scope for implementation of genetic improvement programmes in the Angora goat industry.

There is a lack of objective unbiased information on sale animals' breeding value, it is therefore not possible to predict selection responses.

Group breeding schemes have several theoretical advantages.

* a large effective population size which provides the potential for a higher selection intensity and faster genetic improvement.

* a low rate of inbreeding.

* fosters the use of objective measurement and the structuring of optimum breeding schemes.

* they may facilitate a real and valid comparison between animals located on different properties.

* they may be able to employ more sophisticated animal evaluation techniques such as selection for host resistance to parasites.

* members of group breeding schemes can be expected to benefit in terms of the most up-to-date information and methodology in animal breeding.
APPENDIX 1

THE IMPORTANCE OF MARKETING AND CLIP PREPARATION

Joan Eggleston
Western Australian Pool Co-ordinator

The classing and marketing of the mohair clip is an integral and important part of an angora/mohair enterprise. It is of major significance as the effort applied in this area will either maximise or minimise the financial returns and so a suitable marketing structure is vital.

In considering a marketing structure account must be taken of the basic requirements of buyers. For mohair, these are:

* To understand the needs of the end user, in this instance the manufacturers, because they are the buyers.
* To present the raw product in such a way that will satisfy the requirements of buyers and attract their attention.

Needs of manufacturers

Manufacturers vary a great deal in their requirements and any one mill will usually only handle a particular narrow range of fibre.

Mills are generally distinguished as "Spinners" or "Top makers".

* Spinning mills accept only the good quality fibre taking the raw fibre through to the yarn stage.
* Top makers take the less attractive more faulted fibre and, with extra machinery, produce a "Top" which can be sold to spinners.

Mohair is mainly bought by 'top makers'.

Mills use their own skill and objective data to build-up processing lots of large volume from the purchased fibre. These lots are called "runs". Even in an enterprise as large as the Australian wool industry, the size of lines produced by individual wool growers are far too small to provide the volume necessary for the manufacture of a 'run'.

Small lot sizes present difficulties, inefficiencies and higher costs in the marketing system.

Manufacturers requirements can be summarized as follows:

* Sale lots must be classed as to fall into reasonably narrow and well described, quality ranges.
* Sale lots must be available in large packages.
* Fibres should be available on a regular basis with no delivery problems.
Marketing structure

To satisfy the requirements of the end user (the buyer) the following have to be considered:

* The very small quantities produced by individual growers who are separated by distance.

* The twice yearly shearing which effectively halves the volume of production thereby reducing the potential lot sizes.

To build lot sizes attractive to the manufacturer, the answer is to amalgamate clips from different growers. This needs a classing technique to produce uniform lines of distinctly different fibre for "pooling".

A further necessity is to be able to describe each of these lines so that they are readily recognisable by the buyer. This allows for equitable valuation and sale.

The following classing and coding technique, developed by the grower operated mohair marketing pool (now registered as the National Mohair Pool Ltd.), relates specifically to mohair and the marketing structure takes into account the factors mentioned.

This structure and classing technique has earned the respect and support of the buying fraternity and has instilled confidence into the mohair industry. It has the added advantage of being straightforward and easily understood, allowing growers to class their own clips with confidence, thereby being able to assess its true value. In addition, the knowledge is useful when selecting or culling stock.

The classing and coding technique

In practice, most mohair falls into a limited number of clear quality descriptions.

In Australian mohair, at present, there are five basic quality components to be considered when classing.

These are:

Staple structure
Length
Fineness
Kempiness
Faults

Yield is a quality component. Australian mohair has a very high average yield of 94 per cent and for classing purposes, at present, yield is not taken into account. If and when Texan cross animals are introduced into the Australian flock, this parameter will need to be considered because Texan mohair has a heavy grease content which may affect the clean yield.

Staple structure

Refers to the compactness or density of each staple that makes up the fleece.
Length

Is designated as 'A', 'B' or 'C' and is a very important factor in the processing of mohair

'A' length = 12.5 cm minimum
'B' length = 9 to 12.5 cm.
'C' length = 5 to 9 cm
anything shorter than 5 cm (2 inches) = LOX line

Finessess

Is defined on fibre diameter. It does not refer to the animal. There are five divisions of fineness in common use: Fine Kid (under 24 μm); Kid (25 to 28 μm); Young Goat (29 to 32 μm); Adult (33 to 35 μm); Strong Adult and Buck (over 35 μm).

Kemp

Is a short, white, medullated fibre. It is prickly, has no strength, and is difficult to remove entirely. To the manufacturer of fashion fabrics and fine velours, kemp is a most undesirable fault.

Other faults

Cotting, urine and dung stains, vegetable matter, heavy burl contamination and pigmented fibres.

Mohair is used for many different products and so the terms used to identify the lines are descriptive rather than graded. The latter refers to valuation; hence mohair of say 30 micron fibre diameter, with a uniform staple length of 13 centimetres and no kemp, would be identified as 'A YG'. The same type of mohair with a kemp content would be identified as 'A KYG'. 'A' refers to length, 'K' to kemp content and 'YG' to division of fineness.

A teaching service, by appointment, is available at the Pooling Centre in Albany, where mohair producers may class their own clip under supervision. Alternatively, a clip may be consigned to the Pooling Centre for classing. In this event, growers are strongly advised to remove stained mohair from the fleece or any that contains vegetable matter before packing so that clean fleece is not contaminated.

The National Mohair Pool is completely grower orientated and, in Western Australia, there are some 300 or more growers involved. It is a non profit marketing service open to any mohair producer regardless of flock numbers or clip weight. If the National Mohair Pool can be of service in any way, we would be pleased to hear from growers. Producers are welcome, indeed encouraged, to visit the Pooling Centre at any time while it is operating.

National Mohair Pool - classing schedule

Best lines
Free or nearly free of kemp and vegetable matter, free of stains and cotts. Should not be able to see kemp at arms length.

Longer (> 12.5 cm)
A&B FINE KID  A KID  A YOUNG GOAT  A ADULT  A&B HAIR
A&BFK  AKID  AYG  AA  A&BH
<table>
<thead>
<tr>
<th>Shorter (9 - 12.5 cm)</th>
<th>B KID</th>
<th>B YOUNG GOAT</th>
<th>B ADULT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BKID</td>
<td>BYG</td>
<td>BA</td>
</tr>
</tbody>
</table>

**Kempy lines**

As above for freedom of faults, but showing kempy fibre.

<table>
<thead>
<tr>
<th>Longer (&gt; 12.5 cm)</th>
<th>A KEMPY KID</th>
<th>A KEMPY YOUNG GOAT</th>
<th>A KEMPY ADULT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AK KID</td>
<td>AK YG</td>
<td>AKA</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shorter (9 - 12.5 cm)</th>
<th>B KEMPY KID</th>
<th>B KEMPY YOUNG GOAT</th>
<th>B KEMPY ADULT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BK KID</td>
<td>BK YG</td>
<td>BK A</td>
</tr>
</tbody>
</table>

**Extra kempy lines**

Mohair showing heavy kempy, including longer crossbred mohair.

<table>
<thead>
<tr>
<th>Extra kempy lines</th>
<th>EXTRA KEMPY KID</th>
<th>EXTRA KEMPY ADULT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>XK KID</td>
<td>XK A</td>
</tr>
</tbody>
</table>

**Short lines**

Fibre less than 9 centimetres, PNF of faults, but may be slightly kempy.

<table>
<thead>
<tr>
<th>Short lines</th>
<th>SHORT KID</th>
<th>SHORT ADULT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C KID</td>
<td>C A</td>
</tr>
</tbody>
</table>

**Overgrown**

Fibre more than 17 centimetres in length, PNF of fault, but may be slightly cotted. Often show fleeces.

<table>
<thead>
<tr>
<th>Overgrown</th>
<th>OVERGROWN KID</th>
<th>OVERGROWN ADULT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OGGKID</td>
<td>OGA</td>
</tr>
</tbody>
</table>

**Crossbred**

Longer types included in extra kempy lines.

<table>
<thead>
<tr>
<th>Crossbred</th>
<th>GUARD HAIR (XB2)</th>
<th>CASHGORA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>XB</td>
<td>GD</td>
</tr>
</tbody>
</table>

**Outsorts lines**

These lines are both skirtings and faulted fleece.

<table>
<thead>
<tr>
<th>Outsorts lines</th>
<th>COTTED</th>
<th>HARD COTTS</th>
<th>STAINS</th>
<th>LOCKS</th>
<th>PIGMENTED</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>COT</td>
<td>HCT</td>
<td>STN</td>
<td>LOX</td>
<td>PIG</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VEGETABLE FAULT</th>
<th>VEGETABLE FAULT XB</th>
<th>CARBONISING</th>
</tr>
</thead>
<tbody>
<tr>
<td>VFP</td>
<td>VFX</td>
<td>CBO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NO COMMERCIAL VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCV</td>
</tr>
</tbody>
</table>
Appendix 2

Selling cashmere through the A.C.M.C.

Lucinda Corrigan
Public Relations Officer A.C.G.A.

Introduction

As the Australian cashmere industry has matured to the point where it is now operating a single seller system, the guidelines for classing and preparing cashmere for sale are being fine tuned.

The Australian Cashmere Marketing Corporation (A.C.M.C.) is the marketing arm of the Australian Cashmere Growers Association (A.C.G.A.) and operates a warehouse at Guildford in Sydney. It handles the total Australian clip. The A.C.M.C. is in close contact with the major cashmere processors and purchasers of the Australian clip who visit Australia regularly and give feedback on how they wish to see fibre presented for sale.

In 1987, the A.C.G.A. introduced a system of owner classer registration which will enable the grower who follows the guidelines to sell their clip and attract the least possible costs.

Each grower has the opportunity to market their clip by objective measurement and be paid according to the test results, or to pool their cashmere in A.C.M.C. lines and be paid according to the average test result of the pooled lines. These options are clearly outlined on the consignment notice which each grower must forward with their clip.

Growers may be aware of the lines which the A.C.M.C. markets to its overseas buyers, although these lines do not necessarily effect the lines which the individual grower may market. Provided that the grower follows the standards set by the A.C.M.C., his own lines may be determined by his breeding goals. For example, the A.C.M.C. markets three main lines of white fleece, below 16.5 μm, 16.5-18.5 μm and a coarse buck line. The grower may choose to market a white weaner line, white doe line and buck fleeces separately after testing, or he may choose to combine the white weaners and does, both good quality cashmere, and have it tested as a single lot.

Clip preparation

Growers selling their fibre through the A.C.M.C. need to follow the guidelines for clip preparation, available from the A.C.G.A. The basic rules are that white lines must be white. Cashgora must be removed from cashmere fleece lines. Stains, cots and vegetable fault must be removed from white fleece and all forms of contamination should be absent.

These guidelines form the basis of preparation of lines for sale. The lines which a producer forms will depend on what test results he requires, what quantity he is marketing, and how many animals he has. Provided that the fleece is sent to the A.C.M.C. in non-contaminated lines following the guidelines, the fleece will be tested and put into tested lines ready for sale. For the producer who does not want his fleece tested and requires pooling through the A.C.M.C. lines, the following are the lines they should prepare. Fleece received in these lines may be pooled and sold at minimum expense.