FIBRE PRODUCTION FROM GOATS

INTRODUCTION

D.L. STAPLETON*

The genus Capra contains a wide variety of species and subspecies and the influence of man is marked in the development of breeds designed for the production of milk, meat and fibre. Commercial goat textile fibres include mohair, cashmere and goat hair though only the first has reached commercial significance in Australia. While cashmere-producing goats have been found in feral populations and several breeders have attempted to breed these animals no great progress has been made. Consequently this symposium will concentrate on the Angora and mohair production.

The role of the goat in grazing systems has been recognised in many countries though some concern has been expressed about the potential damage that goats may do under some conditions. The preference for woody plants has been used to great benefit in both South Africa and the U.S.A. in areas where scrub encroachment has threatened grazing lands. It would seem that the intelligent use of goats in the grazing system can benefit landowners.

If in certain cases the goat can be of use in the grazing system, further economic advantage in terms of a marketable product is needed for efficient use of land resources. The production of meat and fibre present themselves, and have been recognised, the former in terms of harvesting a feral population and the latter as the upgrading of flocks for the production of mohair. In both cases a supply of breeding stock is required and this and efficient production requires high levels of reproductive performance. A knowledge of mohair quality is also required both for selection of breeding stock and for informed sale operations. It is in these areas that this symposium is set. To place the present industry in context a representative of the industry was requested to present a paper.

THE DEVELOPING ANGORA-MOHAIR INDUSTRY IN AUSTRALIA

L.M. STAPLETON?

It is not the writer's intention to present in this paper the early history of the Angora goat. Many authors have done this most adequately. Nor is it the intention to cover the early history of this animal's introduction into Australia in the mid-nineteenth century. Authors such as Wilson (1873), Blaxland (1903) and Mitchell (1977) amply cover the rise and fall of the popularity and use of the Angora and its product, Mohair. What it is proposed to do is to record the development from the late 1960's to the present date.

Prior to 1971 the only, breed records of Angora goats in Australia were kept by the Goat Breeders' Society of Australia (G.B.S.). About this time a group of breeders formed the Angora Mohair Association of Australia (A.M.A.A.) and this group was responsible for considerable promotional work and increased public interest was evident. During the next three years interest continued to grow. Most "historic" Angora breeders continued to register their animals with the G.B.S. which was not prepared to hand over the 'historic Herd Book and its control to the A.M.A.A. Moves were initiated by the G.B.S. breeders to negotiate with the G.B.S. Federal Council to relinquish control of the Herd Book to another

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society, to be known as the Angora Breed Society (A.B.S.) of Australia. The G.B.S. appointed the National Mohair Council in 1973 to set up the new society's structure, compatible with the G.B.S. When this was accomplished, on 30th March 1975, the Herd Book and records were handed to A.B.S. and it was announced that Mr. L.M. Stapleton had been elected the Foundation National President of the new society.

Since 1975 both the A.B.S. and the A.M.A.A. have worked independently but with some rapport to administer and promote the Angora-Mohair industry in Australia. Membership growth has exceeded all expectations and a very conservative estimate of the number of Angora-Mohair enterprises would be 3,000 as at 30th June 1980. These enterprises are located in all states of Australia.

At the present time, people are entering the industry at about 50 a month and this is the major reason for the continuing buoyant prices being paid for animals. This in turn is contributing to the viability of the industry generally.

ANGORA NUMBERS

To indicate the development in animal numbers, Table 1 is provided. The table presents the total number of animals registered with the G.B.S. prior to the formation of the A.B.S. and those registered each year since. The outstanding feature of the table is the very high growth rate each year. Looking at the overall Australian scene, it must be recognised that a similar situation is occurring with animals in the A.M.A.A. system, although those records are not available. In addition to the above, there is a considerable number of mohair producing animals not registered at all e.g. wethers and females which belong to people conducting what may be called "commercial flocks".

TABLE 1 Angora Breed Society animal registrations

<table>
<thead>
<tr>
<th></th>
<th>PB does</th>
<th>App A</th>
<th>App B</th>
<th>App C</th>
<th>App D</th>
<th>PB bucks</th>
<th>Total</th>
</tr>
</thead>
</table>
| Prior to
| 1975   | 1,556  | 216   | 347   | 560   | 612   | 993      | 4,284 |
| 1976   | 436    | 109   | 199   | 387   | 242   | 200      | 1,573 |
| 1977   | 567    | 197   | 367   | 594   | 370   | 362      | 2,457 |
| 1978   | 855    | 367   | 654   | 946   | 627   | 595      | 4,044 |
| 1979   | 1,170  | 644   | 1,215 | 1,776 | 1,078 | 748      | 6,631 |
| 1980   | 1,510  | 850   | 1,610 | 2,300 | 1,400 | 1,001    | 8,671 |

App = Appendix. App D. to A. = 1st to 4th cross.

MOHAIR PRODUCTION AND MARKETING

In 1975 research was commenced by the A.B.S. to ascertain whether or not the society should establish a marketing operation controlled by producers. Subsequently, in 1977, following a comprehensive report, the society authorised its National Director to proceed to set up Pooling Centres throughout Australia, based on the experimental one established at Cudal, N.S.W.

At the present time seven Pooling Centres are operating: at Cudal, Maitland, Marulan and Armidale in N.S.W., Albany in W.A., Skipton in Vic. and Strathalbyn in S.A. The scheme has been an outstanding success and has received considerable support from growers and manufacturers. It should be pointed out that the operation does not as yet handle the major percentage of mohair being
produced as many growers still support traditional auction systems conducted by wool brokers. It does however, provide a direct outlet alternative for mohair to manufacturers, in a form acceptable and commended by them and controlled by the producers themselves. It will, no doubt, play an increasingly important role in marketing as production increases. This operation, with its built-in safeguards, has contributed to the encouragement of people to enter the mohair production industry.

Table 2 outlines the results and growth of the A.B.S. Producer-Controlled, Marketing Operation. It is estimated that Australia produced 70,000 kg of mohair in 1979 and that substantially increased quantities will reach the market in 1980.

<table>
<thead>
<tr>
<th>Year</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>693</td>
</tr>
<tr>
<td>1978</td>
<td>2,791</td>
</tr>
<tr>
<td>1979</td>
<td>16,670</td>
</tr>
</tbody>
</table>

ANGORA STUD INDUSTRY

Unlike other primary industries, there does not appear to be any chance of an oversupply situation on world mohair markets. If there is a problem in mohair production it would be one of undersupply. Australia produces less than 1% of world production. With this in mind efforts have been made in Australia to increase the number of animals by what is known as "upgrading" from milk or feral females, using the small number of so called "purebreds" as a genetic base. This has been most successful and has accounted for the accelerating increase in numbers of mohair-producing animals. Attempts have also been made to use "ovum transfer" to increase numbers rapidly. While clinically successful, results however have been disappointing in many instances, and quite disastrous for some enthusiasts. Artificial insemination has little to commend it for this purpose as the quality of donor bucks needs strict control and there is no evidence that this has been the case.

The fact remains that a continuing demand for Angora goats is evident, amply displayed at a recent auction sale where approximately 500 animals grossed in excess of $700,000. Dozens of auctions with yardings of between 100 and 300 animals have returned comparable average prices. There is therefore clear evidence of large scale commitment of funds and confidence to the industry.

Another important factor which has contributed to the growth and stability of the industry is the great variety of people who have entered it, and have brought with them expertise in some form or another and of course, their capital. This is continuing.

The view that present prices for animals are too high and are holding the industry back is completely without foundation and cannot be substantiated in any way. The reverse view is more logical and indeed is one of the main bulwarks of real development as it has enabled substantial capital improvements to be made on properties and some well-planned and equipped establishments are in existence.
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It is necessary that limited comment be made about the existence of the two substantial and viable organisations administering the industry. Much credit is due to them and it could be said that their viability, varying philosophies and indeed competition has contributed to the success of the industry to date. Any suggestion that the existence of the two has retarded growth cannot be substantiated; nevertheless a union of the organisations may soon occur.

The reconstitution of the Mohair Research Foundation has been accomplished with both the A.B.S. and the A.M.A.A. adequately represented, together with additional producer councillors. The research committee of this Foundation consists of scientists in relevant fields. It is hoped that future Angora research will be promoted and co-ordinated by the Foundation and that Government agencies will participate financially.

The economics of an Angora establishment may be more attractive than some papers indicate, and when such factual information as shown in Table 3 is studied, an even greater growth rate may be anticipated. In this table details of an enterprise established in 1971 with two G.B.S. registered Angora does and 15 age Saanan milk goats are presented. The property was a 270 ha, mixed farming (cereal crop/fat lamb) unit yielding an annual gross income of $15,000 to $20,000. Approximately 30 ha were devoted to the Angora enterprise.

### TABLE 3

Financial summary of an Angora stud enterprise

<table>
<thead>
<tr>
<th>Year</th>
<th>Purchases</th>
<th>Sales</th>
<th>Source of Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1971</td>
<td>Initial purchase</td>
<td>nil</td>
<td>1st cross wethers</td>
</tr>
<tr>
<td>1972</td>
<td>3 P.B.+15 Saanans</td>
<td>$86.35</td>
<td>1st cross wethers+culls</td>
</tr>
<tr>
<td>1973</td>
<td>nil</td>
<td>$782.00</td>
<td>wethers+culls</td>
</tr>
<tr>
<td>1974</td>
<td>$490.00=1 buck</td>
<td>$496.00</td>
<td>bucks+culls+mohair</td>
</tr>
<tr>
<td>1975</td>
<td>$1000.00=1 doe</td>
<td>$2,332.00</td>
<td>bucks+culls+mohair</td>
</tr>
<tr>
<td>1976</td>
<td>$2250.00=2 bucks</td>
<td>$8,456.00</td>
<td>bucks+culls+mohair</td>
</tr>
<tr>
<td>1977</td>
<td>nil</td>
<td>$6,190.00</td>
<td>bucks+culls+mohair</td>
</tr>
<tr>
<td>1978</td>
<td>$22,280=2 bucks</td>
<td>$30,520.00</td>
<td>bucks+does+culls+mohair</td>
</tr>
<tr>
<td>1979</td>
<td>nil</td>
<td>$66,100.00</td>
<td>bucks+does+culls+mohair</td>
</tr>
<tr>
<td>1980</td>
<td>$3003=1 buck + 35 feral does</td>
<td>$85,000.00</td>
<td>bucks+does+culls+mohair</td>
</tr>
</tbody>
</table>

**Stock on hand at market value**

- 25 P.B. bucks @ between $2000 to $10,000   $125,000
- 45 P.B. does @ between $3000 to $5000   $180,000
- 23 App A. does @ $1000   $23,000
- 2 App B. does @ $500   $1,000
- 40 feral does @ $25   $1,000

**Total**   $330,000
THE USE OF REPRODUCTIVE TECHNIQUES IN GOAT BREEDING

N. W. MOORE*

Accurate information on the numbers of hair-producing goats in Australia and on mean hair production is lacking, but there seems to be general agreement that numbers and production are presently too low to allow the expression of the potential that mohair (or other goat fibre) production might have in the Australian scene. Hence the need to expand as rapidly as possible the number of animals producing mohair of acceptable quantity and quality.

Techniques which can be used to increase numbers fall into three categories. First, increase in numbers of progeny of animals already producing mohair; second, grading-up to hair production of non-hair-producing animals; and third, importation of hair-producing animals. Current legislation is such that it is unlikely that importation will make a contribution to numbers in the foreseeable future, and hence we are restricted to the first two categories.

ARTIFICIAL INSEMINATION

AI allows the wide-scale use of particular sires for mating with hair-producing females and for grading-up. Insemination procedures for goats are essentially similar to those in sheep (Salamon 1976), the only difference of note being that in the doe semen can be deposited deep into the cervix, whereas in most ewes it is extremely difficult to penetrate the cervix. Semen can be collected, either by artificial vagina or by electroejaculation and when used fresh, semen can be diluted with heat-treated cows' milk. Conception rates in excess of 60% have been achieved with semen collected by electroejaculation and diluted up to 2:1 (milk:semen) and using a volume of 0.1 ml (Moore and Eppleston 1979a).

Early work on frozen storage of buck semen using procedures successful for bull and ram semen was disappointing. Survival following thawing was poor with generally less than 30% of sperm retaining their motility after freezing and thawing. French workers have shown that removal of seminal plasma from dairy goat semen prior to freezing improved survival (Corteel 1975) and in dairy goats, conception rates in excess of 65% have been obtained with frozen buck semen (Corteel 1976).

Current work on Angora semen suggests that it can be successfully frozen, but as yet insufficient animals have been inseminated to fully assess its fertilizing capacity (Salamon personal communication).

CONTROL OF TIME OF MATING

In the mating season

Effective use of AI is largely dependent upon control of time of mating to allow groups of does to be inseminated on predetermined dates. Oestrus can be synchronised in cyclic does by either intravaginal progestagen pessaries or prostaglandins (Corteel et al. 1976; Moore 1974; Hernshaw et al. 1974). Most Angora and Angora cross does show oestrus 36-48 hours after the removal of pessaries (Moore and Eppleston 1979a), suggesting that AI might be carried out at a fixed time of about 48 hours after removal. Dose of progestagen is important as is duration of insertion of pessaries. Present indication for Angoras is 30 mg "Cronolone" (G.D. Searle) in pessaries inserted for around 18 days. A small dose

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(a bout 300 i.u.) of pregnant mare serum gonadotrophin (PMSG) given at the time of removal may well increase the precision in the time of oestrus (Moore unpublished data). When a single injection of 100 ug of a prostaglandin analogue "Estrumate" (I.C.I.) is used oestrus occurs one day later and with somewhat less precision than after pessaries (Moore and Eppleston 1979a). Further, it appears in the doe, as in the cow and ewe, that corpora lutea during the first 4-5 days after oestrus are not sensitive to the luteolytic action of prostaglandins. This problem may well be overcome, as in the other species, by two injections spaced 10-12 days apart.

In the non-breeding season

The Angora doe, like many breeds of sheep and goat, is a short-day breeder with peak breeding activity occurring during late summer, autumn and early winter (February-June) and any attempt to increase the frequency of kidding will involve the induction of oestrus and ovulation during the non-breeding season. Further, it is likely that does will have recently kidded. Pessaries with PMSG will induce oestrus and ovulation in the anoestrous does, but fertility is dependent upon stage of anoestrus and time of treatment post-partum. In dairy breeds conception rates at induced oestrus do not reach an acceptable level until around one month before the start of full breeding activity and during lactation full fertility is not restored until some three months after kidding (Corteel 1975). Should the Angora behave similarly then there seems to be little chance of markedly increasing the frequency of breeding. However, in the ewe, early weaning coupled with control of the photic environment to simulate that occurring after the summer solstice will hasten return to normal fertility (Robinson 1974), but it remains to be seen if similar procedures will be effective in the goat.

EMBRYO TRANSFER

In brief, transfer involves superovulation of donor females with PMSG or pituitary extracts, mating; collection of embryos and their transfer to recipient females.

Moore and Eppleston (1979b) have demonstrated the value of transfer in Angoras. They obtained 393 Angora kids from 121 angora does, a kidding percentage of 325% and this did not include kids born to the donors as a result of mating after transfer. When the best procedures are used it seems possible to obtain 5-6 kids from each donor doe. A major question which remains unanswered is can does be effectively used as donors on two or more occasions.

In the Angora, the application of the technique lies in two areas. The first and more obvious is the increase in pure-bred animals and this is already being done by commercial operators. The second, is in up-grading. It is likely that up-grading will make a greater contribution to numbers of hair-producing animals than will multiplication of pure-breds, particularly as large numbers of feral animals suitable for use in up-grading are readily available. Table 1 will serve to illustrate the value of transfer in up-grading. Third cross animals should produce hair of sufficient quality and quantity for harvesting. Using conventional methods of natural service or AI and assuming 100% kidding, one-half kids female, young females mated at 14 years of age (giving a generation interval of 2 years) then from a base population of 400 feral does after six years there would be only 50 third-cross does ready for mating. If transfer were used once on the first batch of first and second-cross does and assuming 5 kids per donor half of which will be female, then after six years there would be 1,250 third-cross does ready for mating; a 25 fold increase over conventional procedures. In practice it would be highly desirable to rigorously select
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donors and thereby increase quality as well as numbers. The arithmetic becomes
even more impressive if donors were to be used at a younger age. There are
indications that pre-pubic does can be used as donors (Moore unpublished data)
and if this were done giving a generation interval of one year then the 1,250
third-cross does would be available in Year 4.

TABLE 1 Grading-up of feral animals

<table>
<thead>
<tr>
<th>Year</th>
<th>Base</th>
<th>Conventional breeding</th>
<th>Use of transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1st</td>
<td>2nd</td>
</tr>
<tr>
<td>0</td>
<td>400</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1</td>
<td>400</td>
<td>200</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>400</td>
<td>400</td>
<td>300</td>
</tr>
<tr>
<td>3</td>
<td>400</td>
<td>400</td>
<td>300</td>
</tr>
<tr>
<td>4</td>
<td>400</td>
<td>400</td>
<td>300</td>
</tr>
<tr>
<td>5</td>
<td>400</td>
<td>400</td>
<td>300</td>
</tr>
<tr>
<td>6</td>
<td>400</td>
<td>1,000</td>
<td>600</td>
</tr>
</tbody>
</table>

FROZEN STORAGE OF EMBRYOS

Kids have been born following the transfer of embryos frozen and stored in
liquid nitrogen (Bilton and Moore 1976) and Bilton and Moore (1977) have shown
that frozen cattle embryos can be successfully transported between countries. If
restrictions on the import of goats are relaxed the potential of frozen storage
for the cheap and rapid import of animals could be immediately exploited.

Finally, a word of warning. Techniques for rapid increase in numbers are
largely proven, but their application will at best be of little consequence, and
at worst disastrous, unless the vital hair production characteristics are ident-
ified and strict attention is given to the selection of these characteristics.

THE USE OF GOATS IN GRAZING SYSTEMS AND THEIR PLACE IN WEED CONTROL

P. J. HOLST

F.A.O. (1976) data indicate that 15% of the total world population of
grazing domestic animals are goats. The relative value of the products from
these goats has been estimated as 35.6% meat, 58.4% milk, 1.7% fibre and 4.3%
felts (McDowell and Bove 1977). The proportion varies with each country, for
example, fibre production from Angora goats is significant in the United States,
South Africa and Turkey, and on a lesser scale in Argentina; meat production
assumes greater importance in Mexico and Pakistan. Surprisingly, Australia,
with its vast rangelands and grazing potential contributes little to the world
population of goats. From an estimated 1.5 m feral goats we export approximately
4000 tonnes of goat meat and 250,000 skins (Australian Bureau of Statistics).

THE CONCEPT OF DIETARY PREFERENCES

All grazing animals have preferences for some forages and these preferen-
ces determine the order in which the plants are eaten. The extent that these

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Plants are eaten or not eaten determines the plant's growth and survival and in turn may alter the vegetation over short or extended periods of time. Examples of this can be seen in the emergence of weeds in pasture and, in the semi-arid areas, the loss of preferred perennial species to be replaced by woody weeds (Harrington et al., 1979) or less desirable annuals.

To a large extent the botanical composition and stability of a pasture or rangeland reflects grazing pressure where grazing pressure includes not only the total biomass and its management, but also what animal species are present. Unfortunately, in the selection of animal species there is a tendency for graziers to respond to the short term market price for wool and meat with insufficient thought given to the economics of pasture establishment and maintenance. With its different, though not exclusive dietary preferences, the goat may have a useful role in total farm viability.

The Control of Weeds in Pastures

There are essentially four management procedures available for the control of weeds in pasture.

a) Changes in livestock management - manipulation of stocking rates, timing of livestock moves, or combinations of these.

b) Changing livestock species or using combinations of them.

c) Cultural practices such as cultivation, cropping, pasture rotation and pasture species.

d) Use of herbicides - alone or in combination with some of the above.

When deciding on a method of weed control the operator is confronted with such problems as cost, increased labour input, acquisition of new management skills, chemical residues in livestock, and difficulty of terrain. The disturbing feature of controlling weeds in the future is the increasing difficulty for individual farmers to implement satisfactory control procedures.

Backlow (1976) appealed for new approaches to methods of weed control appropriate to our extensive system of agriculture and considered biological and ecological methods the most appropriate. Kajons and Holst (1977) contend that the established dietary preference habits of the goat may be used to complement the conventional methods of weed control and enhance its efficiency at a lower cost.

From 1975 the New South Wales Department of Agriculture has been investigating the control of selected weeds by using goats. The examples provided largely refer to that state but it is to be expected that weeds suitable for control by goats await identification throughout Australia. Control is effected by:

a) preventing flowering and subsequent seed dispersal

b) preferential grazing, thus placing a weed at a competitive disadvantage to preferred species

c) with some shrubs, mechanical damage either by ringbarking or .
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d) combination of the above and/or complementary methods of control.

In all cases it is important that the management programme provides for the replacement of the weed by a preferred plant species.

SPECIFIC APPLICATIONS

Blackberry (Rubus fruticosus) is a widespread weed of high rainfall areas of South Eastern Australia and its control is often associated with the use of 2, 4,5-T herbicide. Kajons and Holst (1977) outlined the strategies involved in its control. Because of its high palatability to the goat, its control by goats is not difficult. Sweet briar (Rosa rubiginosa), a nuisance weed, is also highly palatable and is readily controlled.

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Campbell et al (1979) describe the use of goats to control serrated tussock (Nassella trichotoma), galvanised burr (Bassia birchii) and variegated thistle (Silybum marianum); three pasture weeds causing concern to graziers. The net annual loss, assessed in terms of loss of potential wool production, caused by serrated tussock alone, is $11.8 million (Vere and Campbell 1979).

The experiments reported by Campbell et al (1979) reflect the individuality of each weed situation and the need for considerably more information to be collected. Holst and Campbell (personal communication) are continuing their research into serrated tussock and have included some of the management factors such as stocking rate and complementarity with sheep.

Poa tussock (Poa labillardieri), a serious weed of the southerntablelands of N.S.W., is readily eaten by goats (Campbell and Holst 1978) with a resultant reduction in the amount of seed produced and plant vigour. Associated preferred plant species are also eaten, but the amount is not sufficient to prevent their successful competition with the tussock.

Goats have shown preference for species of thistle such as nodding thistle (Carduus nutans) and scotch thistle (Onopordum acanthium) to an extent that they cause their destruction. However, stage of plant maturity appears to be important and it is uncertain if seed production and dispersal are prevented.

The browsing behaviour of goats and the inclusion of many shrub species in their diet (Wilson et al.1975), encouraged research on the use of goats to combat the problem facing pastoralists in western N.S.W. and south western Qld. Unfortunately goats would not appear to provide a practical solution to the problem (Harrington 1979) though mulga (Acacia aneura), hopbushes (Dodonaea spp.) and silver turkey bush (Eremophila bowmii) may be exceptions in specific situations. No range situation has been studied long enough to demonstrate long term effects on herbage production.

GOATS IN A GRAZING SITUATION

As a species, goats offer the grazer an opportunity to diversify his pastoral income by providing another group of animal products. With their freedom from flystrike, high fecundity and diversity of products, goats are particularly suitable in mixed farming enterprises. Though readily assimilated in cattle/sheep enterprises, widespread adoption of goats awaits the realisation of the full economic potential of goat products and their marketing. In this respect mohair production from Angora goats is different, in that it already has established markets and 'a marketing system.
In a pasture weed control programme using goats, it is to be expected that goats will include some of the desirable plant species in their diet. The amount will vary with the growth, maturity and availability of the weed and the desirable pasture species. Regardless of the ecological advantages of biological control, most graziers seek visible monetary income and thus the value of goat products assumes importance. These products include milk, meat, cashmere, mohair and leather. In most cases meat, fibre and skins are income earners.

Vere and Holst (1979) compared the cost of chemical control of blackberry with biological control using goats and concluded that the latter method was most favourable. Other weed control applications have not been satisfactorily defined.

The few gross margin analyses available on goats as a grazing animal (Whitelaw and Gisz 1977; Maher and Truelove 1978), for meat production (Mitchell 1978), and for Angora production (Whitelaw and Gisz 1977; Maher and Truelove 1978, Mitchell 1978), would indicate that production from goats can be economically viable.

**EXPERIENCE OF SOME OVERSEAS EXPERIMENTS**

Overseas research has demonstrated the role of the goat in the control of sucker regrowth (du Toit 1972; Magee 1957), utilisation of browse (Anon. 1957), and multi species land use in pastoral areas (Anon. 1957; Merrill 1954). The long-established meat and Angora goat industries of the United States and South Africa are largely based on the usefulness of the goat in multi-animal species systems on pastoral country.

Little has been published on the use of goats for weed control or as a complementary grazing animal. Changing attitudes to the use of herbicides and the improved marketing prospects for goat products should stimulate research in these areas.

It is expected that the number of fibre-producing domesticated goats in Australia will continue to increase with or without the utilisation of goats for weed control on improved pastures, or rangeland. Given the high cost of farm labour in Australia, the cost and availability of herbicides and the increasing pressure of environmentalists it is reasonable to suggest that goats will become important in the control of those weeds that are high on their order of forage preferences. If so, non-fibre goats for meat may also increase in numbers.

**MOHAIR CLASSING AND ITS ROLE IN MARKETING**

D. L. STAPLETON

As with wool, real differences in mohair quality exist both between animals and between clips and the production of classed lines of specific types facilitate the equitable sale and the subsequent manufacture of mohair yarn. Provided the classing technique produces lines of discrete quality, acceptable to the manufacturer' without creating undue cost or requiring highly skilled classifiers, the technique should be acceptable to the mohair industry. Other considerations such as lot size, producer and buyer confidence and the actual method of sale also influence the acceptance of a classing system. Whatever system is to be adopted it is highly desirable that it be uniform across the industry.

Australian mohair production is characterised by a large number of small
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clips, rarely larger than 50 kg, and containing mohair of widely varying quality. Most producers have embarked on up-grading programmes and so produce quantities of "crossbred" mohair as well as mohair from "purebred" animals. Under these circumstances traditional wool marketing techniques, though being fostered by several brokers, suffer from necessarily high handling charges and non-uniform classing (and description) thus leading to inefficient selling.

In 1977 the Angora Breed Society of Australia established a Mohair Pooling and Marketing Scheme designed to provide a method of collecting, classing, pooling and disposal of mohair. The method of classing was described by Stapleton (1979) and was developed after extensive consultation with both manufacturers and producer representatives from both South Africa and the United States of America. The method was based on the assumption that manufacturers require the removal of fault types and the subdivision of the remaining mohair in terms of fibre diameter, staple length and the degree of kemp fibre present in the fleece. It was accepted that most manufacturers sort classed lines extensively and that only major divisions in quality were necessary.

Accordingly the following major lines were established:- Australian Kid (AK), Kempy Kid (KK), Short Kid (SK), Australian Adult (AA), Kempy Adult (KA), Short Adult (SA), Crossbred 1. (XB1), Crossbred 2. (XB2) and Extra Strong (XST). Fault lines included Locks, Overgrown, Stains, Cotted, Vegetable fault (purebred and crossbred) and Pigmented.

MATERIALS AND METHODS

To determine whether the classing technique produced measurable differences, the nine major lines of mohair from six pooling operations carried out in 1979 were sampled during classing. Approximately 10 samples were taken from each line in each pool and measurements of scoured yield, staple length, mean fibre diameter and medullation profile were made using techniques described by Stapleton (1978). Since there were unequal sample numbers statistical analysis was carried out using an approximate two-way analysis of variance (Snedecor and Cochran 1967).

RESULTS

Line size and price obtained

Table 1 presents mean line weights and mean prices obtained for the six pools. It can be seen that while the total amount of mohair in the main lines was 6000 kg and returned $58,915 ($9.82/kg), individual pools and pooled lines were extremely small.

<table>
<thead>
<tr>
<th>Line</th>
<th>AK</th>
<th>KK</th>
<th>SK</th>
<th>AA</th>
<th>KA</th>
<th>SA</th>
<th>XB1</th>
<th>XB2</th>
<th>XST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>98</td>
<td>166</td>
<td>25</td>
<td>119</td>
<td>194</td>
<td>25</td>
<td>208</td>
<td>105</td>
<td>60</td>
</tr>
<tr>
<td>Price ($/kg)</td>
<td>15.68</td>
<td>12.60</td>
<td>12.62</td>
<td>11.52</td>
<td>9.70</td>
<td>8.44</td>
<td>7.57</td>
<td>3.51</td>
<td>7.81</td>
</tr>
</tbody>
</table>

Table 1 Mean mohair line size and price

Measurement

Tables 2 and 3 summarise the results of measurements and analyses carried out on the sampled mohair. It can be seen that between pool differences reached significance only for scoured yield and staple length while between line
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differences reached significance for all measurements except scoured yield.

TABLE 2  Mean values for six mohair pools

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Pool A</th>
<th>Pool B</th>
<th>Pool C</th>
<th>Pool D</th>
<th>Pool E</th>
<th>Pool F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scoured yield</td>
<td>90.9^ab</td>
<td>92.2^a</td>
<td>90.3^b</td>
<td>88.6^c</td>
<td>89.9^bc</td>
<td>86.2^c</td>
</tr>
<tr>
<td>Staple length cm</td>
<td>12.4^a</td>
<td>11.3^abc</td>
<td>11.0^bhc</td>
<td>12.1^ab</td>
<td>11.2^abc</td>
<td>10.7^c</td>
</tr>
<tr>
<td>Fibre diameter μm</td>
<td>28.4</td>
<td>28.2</td>
<td>27.3</td>
<td>27.3</td>
<td>28.3</td>
<td>28.9</td>
</tr>
<tr>
<td>Kemp %</td>
<td>5.5</td>
<td>6.3</td>
<td>6.7</td>
<td>6.7</td>
<td>6.9</td>
<td>5.1</td>
</tr>
<tr>
<td>Other medullation %</td>
<td>4.9</td>
<td>4.0</td>
<td>5.1</td>
<td>4.8</td>
<td>5.6</td>
<td>5.9</td>
</tr>
</tbody>
</table>

Superscripts denote significant differences (P < 0.05)

TABLE 3  Mean values for nine mohair lines

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Line AK</th>
<th>Line KK</th>
<th>Line SK</th>
<th>Line AA</th>
<th>Line KA</th>
<th>Line SA</th>
<th>Line XB1</th>
<th>Line XB2</th>
<th>Line XST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scoured yield</td>
<td>89.3</td>
<td>90.1</td>
<td>89.4</td>
<td>90.0</td>
<td>90.5</td>
<td>90.1</td>
<td>89.5</td>
<td>89.4</td>
<td>89.4</td>
</tr>
<tr>
<td>Staple length cm</td>
<td>13.3^a</td>
<td>12.6^ab</td>
<td>7.6^c</td>
<td>13.3^a</td>
<td>13.3^a</td>
<td>9.2^c</td>
<td>11.2^h</td>
<td>8.3^c</td>
<td>14.0^a</td>
</tr>
<tr>
<td>Fibre diameter μm</td>
<td>24.8^abh</td>
<td>25.6^h</td>
<td>22.6^a</td>
<td>31.0^c</td>
<td>30.8^c</td>
<td>32.0^c</td>
<td>27.6^h</td>
<td>25.0^h</td>
<td>34.7^c</td>
</tr>
<tr>
<td>Kemp %</td>
<td>4.6^a</td>
<td>6.2^a</td>
<td>5.4^a</td>
<td>4.0^a</td>
<td>6.0^a</td>
<td>4.1^a</td>
<td>8.8^b</td>
<td>11.9^c</td>
<td>4.8^a</td>
</tr>
<tr>
<td>Other medullation %</td>
<td>4.4^a</td>
<td>4.2^a</td>
<td>3.3^a</td>
<td>7.5^b</td>
<td>4.1^a</td>
<td>4.1^a</td>
<td>4.0^a</td>
<td>3.0^a</td>
<td>11.0^c</td>
</tr>
</tbody>
</table>

Superscripts denote significant differences (P < 0.05)

DISCUSSION

The A.B.S. pooling operation is carried out throughout Australia though sale of mohair is handled centrally at the National Headquarters at Cudal, N.S.W. At the time of writing, seven centres had been established. Mohair examined in this study was drawn from the original three centres and, in general, between pool differences were non-significant indicating a degree of uniformity in the Angora population and classing technique. The uniformity of the population is not surprising since stock is widely transported. However the apparent differences in scoured yield may be due to regional and between contributor effects. There is no evidence to indicate other differences in quality except for the observation of differing amounts of vegetable fault in different pooling centres.

Since staple length is largely a function of shearing interval, differences in this measurement may be attributable to differences in contributors to the various pools. Nevertheless staple length of individual lines fell within the
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Expected differences were achieved between lines and in all cases except kemp level, the classing objectives were met. The distinction between "best" and "kempy" lines was not clear suggesting that the price differentials ($3.08 for kid and $1.82 for adult) may not be justified. It should be noted that buyers are quite capable of exploiting supposed differences achieved by over-classing, though in this case lack of skill or attention to this aspect of classing may have been the reason for the similarity of the two lines.

Where comparable, the measurements of quality are similar to those obtained for the Angora population and reported by Stapleton, (1978). In that study measurements on "purebred" doe fleeces indicated scoured yield values of 91.7%, staple length values of 13.2 cm, mean fibre diameters of 24.4 and 26.6 µm for kid and values ranging from 29.2 to 34.7 µm for adult mohair, kemp values of 4.2% and other medullated fibre levels ranging from 2.7 to 8.1%. Crossbred kemp levels were lower than those found in this study but this may be due to the greater quantities of mohair from lower crosses entering the pools. The level of kemp present, even in the "best" lines, is high compared to levels in "Cape" and "Texan" mohair. Values of between 3.1 and 4.1% were reported by Uys (1964) for South African and between 0.7 and 1.6% for Texan mohair (Pohle et al. 1972). Cape and Texan mohair samples examined by Stapleton (1976) were found to have values of 1.6 and 1.8% respectively.

The high levels of other medullated fibre in Australian Adult and Extra Strong lines agrees with the findings of Stapleton (1976) who indicated that older animals and bucks produced higher levels of this type of fibre.

The prices obtained for the mohair were high and were obtained in an exceptional year. Prices have since fallen to more realistic levels but still compare more than favourably with wool. The price differential between lines remains though fault lines have proven difficult to sell.

It would appear that the classing system does achieve real differences in quality though it falls short of an absolute description factor which would allow general sale by description. Scoured yield and staple length are important to the manufacturer and it would appear that some form of pre-sale measurement could be useful to assess the value of the lines. The inability to achieve differences between "best" and "kempy" lines also requires further consideration.

SUMMARY AND CONCLUSIONS

D. L. STAPLETON

The mohair industry though small is rapidly growing and has reached a stage where it can offer a viable enterprise to the pastoral industry of Australia. Mohair is a specialty textile fibre and requires special knowledge and handling though this is not beyond the grazing community. The high price of purebred stock presents the uninitiated with conceptual problems but it also allows rapid return of capital. The use of up-grading allows the conversion of feral stock to mohair producers in several generations. This process, and the accelerated breeding of purebred stock, can be aided by techniques to manipulate the reproductive process though care is needed both in assessing effectiveness and selecting superior stock.

The goat has a different dietary preference compared to sheep and cattle and it is possible to utilise this in some cases for weed control. This may
provide an additional benefit to graziers but profitability will probably lie in
the products of the animal. Mohair is the most obvious product though meat
markets are being established rapidly. Marketing of rural products is a complex
business and is aided by adequate classification and description of the product.
The classing (and sale) technique described above appears to achieve these
objectives.

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