CHAPTER 6

SHEARING

Introduction

6.1 Shearing, or the process of removing the wool from a sheep, is necessary as today's sheep has lost the capacity of its ancestors to shed its fleece naturally. Fleece growth depends on many factors, including the breed of the sheep, its condition and environmental conditions. In 1986-87 the average Australian fleece weighed 4.51 kg.[1]

6.2 If the wool is not harvested, it continues to grow indefinitely, causing great discomfort to the sheep. Apart from having to bear the additional weight of the fleece, the sheep may become wool-blind, it may become more prone to attack from external parasites or, if female, she may lose her lamb because of the difficulty the latter experiences in suckling.

6.3 A graphic illustration of the results of non-shearing was provided to the Committee in the form of 160 sheep which had been confiscated from a property near Bombala in southern New South Wales by the RSPCA on the grounds of neglect. The animals had staple lengths of up to 54 cm; they were crawling with lice and encrusted with dags; and entwined in their fleeces were barbed wire, twigs, twine and assorted insects. Many of the sheep had difficulty in walking, feeding or suckling their young.[2]

6.4 In Australia, shearing is normally performed annually, although the Committee was informed that some carpet wool sheep were shorn twice a year.[3] Depending on owner preference and the availability of shearers, shearing can take place in any month of the year, with the peak period ranging from April to November.

The timing of shearing

6.5 The timing of shearing has a considerable bearing on sheep welfare, as in the two to three weeks following shearing, the sheep is highly susceptible to adverse climatic conditions, particularly driving rain, wind and cold. The Committee noted that some of the worst cases of post-shearing losses of sheep occurred in December, a month in which such conditions would not normally be expected.[4]

6.6 The most appropriate time for shearing in the various districts was canvassed by many groups and individuals who appeared before the Committee, as was the question of the timing of lambing in relation to shearing. Advocates for most alternatives were found. Adherents of autumn shearing insisted that it was safer, because of the relatively mild weather generally experienced then. Others favoured winter shearing so that the ewe lambing in spring would be more likely to seek a sheltered spot, thus enhancing the survival chances of both ewe and lamb. Supporters of spring shearing, post lambing, maintained that there was less likelihood of damage to the foetus if the pregnant ewe did not have to go through the stressful shearing process. Summer shearing was not advocated, on human rather than animal welfare grounds.

6.7 The Committee concluded that the timing of shearing was not a major sheep welfare issue, provided that two points were borne in mind. Firstly, sheep need to go into shearing in good condition, so that they can better cope with the shock of the sudden loss of a warm fleece and are physically strong enough to be able to eat more and thus to stay warm. Secondly, adequate shelter needs to be provided for the sheep after shearing. This may take the form of trees, shelter belts of tall non-palatable grasses or shrubs, sheds, or sheep coats. Trees, shelter belts and sheds have been discussed in Chapter 3, as they pertain equally to the survival of the new-born lamb.

Sheep coats

6.8 Post-shearing losses were a source of worry to the majority of witnesses appearing before the Committee. One method advocated for preventing such losses, particularly in the tablelands, was the use of sheep coats. Sheep coats are generally constructed of lightweight plastic, sometimes with elasticised fronts. They are available in various sizes to fit neatly over the sheep, leaving the breech free. Costs range from two to five dollars, although as Dr Brennan graphically illustrated at a Committee hearing, makeshift coats can be prepared at little cost from plastic garbage bags.[5] Research has shown that such coats are nevertheless quite efficacious in the short term. One experiment by Ellis et al. showed that such coats succeeded in keeping alive even wet sheep which showed acute signs of hypothermia.[6] The better-quality coats are reusable.

6.9 The Committee was informed that up to one million sheep are now being protected by sheep coats in Australia, particularly in the colder areas of New South Wales and Victoria.[7]

6.10 Advocates of sheep coats point to their many advantages, in addition to saving sheep from climatic extremes. The currently used fabrics, such as polyethylene, are rain-resistant yet allow a free flow of air, so problems with lumpy wool or fleece rot are reduced. Burrs, grass seeds and dirt are eliminated from the covered area, thus improving sheep comfort and wool quality. Coated sheep show marked bodyweight gains, particularly in the winter months. The labour involved in coating or decoating the sheep is not prohibitive and can normally be combined with routine husbandry procedures. It has also been claimed that the use of coats reduces the incidence of body strike,[8] although the evidence here is more equivocal.

6.11 Other groups and individuals, while accepting the value of coats as thermal insulators, felt compelled to criticise them on other grounds. The Australian Veterinary Association representatives pointed out how poorly sheep coats wear in timber or scrub country. They also alluded to the potential for wool contamination from weathered artificial fibre particles.[9] Dr Meischke commented that the problem of fit had not yet been adequately resolved. In the case of coats left on all year, fleece growth results in the coat becoming progressively tighter, and either restricting the sheep's movement or tearing.[10] The labour involved in coating the sheep was such that Dr Osborne deemed it "prohibitive" in an extensive situation.[11]

6.12 On balance, the Committee believes that the value of sheep coats as protectors from cold and wind stress has been proved. The Committee is not in favour of the mandatory use of coats on newly shorn sheep, as many properties provide other adequate forms of shelter, or do not experience climatic extremes which would require their use. However, in the colder areas of the country, the Committee believes that the use of coats for at least three weeks post-shearing is invaluable. It urges the relevant departments of agriculture to continue their advocacy of the coats as a means of reducing post-shearing losses. It further urges manufacturers of the coats to continue work on the fabric and design of the coats.

The shearing process

6.13 Shearing is normally carried out in purpose-built sheds by teams of contract shearers, using a power-driven metal handpiece consisting of a cutter and a comb. The sheep are yarded some time in advance of the process and deprived of food and drink, sometimes for up to 24 hours. They are then urged up a

race, penned, caught, upended, dragged to the shearing station and shorn. The time taken per sheep by a skilled shearer ranges from 1.5 to 3 minutes, depending on the size of the sheep, its fleece characteristics and degree of body wrinkle.[12]

6.14 Not surprisingly, research has shown that the sheep finds this process quite stressful on a number of counts. Being rounded-up, yarded, separated from its fellows for the shearing itself, being involuntarily rotated and possibly being nicked or cut, have been shown individually and cumulatively to induce raised cortisol levels, whether measured in plasma or saliva.[13]

6.15 The Australian Wool Corporation estimates that, as of 1 January 1989, the total cost of shearing and crutching the Australian sheep flock, including classing and pressing the wool, amounted to $652 million. The contract shearing rate, per sheep, was $3.14.[14] Apart from the costs involved, the problem of labour is worrying the industry. The number of young shearers is dropping, a fact which may accentuate the problems for farmers of obtaining shearing teams at the time they would like to shear. In 1988 the Australian Wool Corporation spent $635,000 on training shearers and shed staff[15] in an effort both to maintain the supply of shearers and to ensure that those shearers are trained in the proper techniques of handling and shearing sheep.

6.16 Apart from addressing the training needs of shearers, the industry has not been unmindful of the other improvements that can be made to the traditional shearing process. Yard and shed design can be improved, in the light of recent research into sheep behaviour. While it would be unrealistic to expect farmers to pull down their old sheds and construct new ones more attuned to the needs of the sheep, at least those starting from scratch will be able, with advice from their local department of agriculture, to erect a structure which will obviate some of the problems of the old sheds. Inexpensive modifications can also be

made, including front-fill catching pens, slide-swing, lift-swing and tip-swing gates, and distance ramps rather than chutes by which the sheep can exit. Improvements such as raised shearing boards, Fawcett shearing mats, self-pinning presses and rotating circular wool tables are of little direct assistance to the sheep, but by improving the work flow and working conditions in the shed, they may bring with them indirect benefits from relaxed, less-pressured shearers and shed hands.[16]

6.17 Other areas in which the traditional shearing process can be improved for both sheep and shearer are in the design of the handpiece, and in support devices. Wide combs, which are now generally accepted despite the acrimonious industrial disputes of the early 1980s, speed up the shearing at least a little.[17] Work is in progress to make handpieces lighter, cooler, quieter, more manoeuverable and to vibrate less.[18] The Australian Wool Corporation (AWC) is currently supporting four research projects worth in total $A152,344 to "develop and evaluate novel and conventional manual shearing concepts".[19]

Alternatives to conventional shearing

6.18 The extent to which the present and predicted future problems associated with shearing dominate industry thinking is reflected in the priorities accorded to research into alternatives to conventional shearing by the AWC and other funding bodies. Almost two million dollars of the AWC budget of six and a quarter million dollars for research and development to improve the health and welfare of sheep are devoted to projects which are investigating biological wool harvesting or robotic shearing. Both approaches offer considerable potential to improve the welfare of sheep.

Biological wool harvesting

6.19 The CSIRO has been researching skin and fleece biology for many years and has been engaged in the search for a chemical alternative to shearing for 15 years. Recently the Division of Animal Production patented a new process of harvesting wool, using a naturally occurring protein, epidermal growth factor (EGF). A small dose of the EGF (that is, between 100-130 ug/kg body weight) is given in a single, subcutaneous injection. This results in a weakening of the wool fibres temporarily, with normal growth resuming in a matter of days. The weakened zone is then carried above the skin and the fleece is protected by a retention system for four to six weeks, at which time the fleece may be removed by hand.[20] Commercial quantities of EGF are now able to be produced in co-operation with Coopers Animal Health Australia Ltd, using genetic engineering techniques.

6.20 In their evidence to the Committee, CSIRO officers stressed that the then fleece retention system (a nylon net) was a prototype, with design work continuing in that area.[21] More recently, they have begun using a full lightweight body jacket which "breathes" and which is fastened with Velcro strips. The upended sheep is clipped in by its legs to a sheep "train" for its EGF shot, a pre-shearing clean-up and jacket fitting, all of which takes about one minute. Wool harvesting is still by hand, about six weeks later, with the harvester running his fingers down under the fleece much in the way a shearer does, to remove the fleece in one piece.[22]

6.21 Preliminary trials of the technology have been conducted in the field and, according to Dr Trevor Scott, then Divisional chief, were "extremely well-received".[23] The CSIRO is aiming to have a first generation biological wool harvesting technology available commercially by 1991.[24] Current project aims are to

refine the dose rate and variation in response across strains; to ascertain the optimum treatment period; to define the wool retention and removal system; to carry out large-scale field trials; and to ascertain cost-benefits.[25]

6.22 According to the CSIRO officers, biological wool harvesting has many advantages over conventional shearing. Initial problems with cold stress or sunburn of the sheep's bare skin have been overcome by allowing sufficient wool regrowth before the fleece is harvested. As the fleece becomes loose after six weeks, no pain is experienced by the sheep when its wool is removed and it suffers no cuts or bruises in the process. There is also less danger of infection. If crutching were carried out at the time of the EGF injection, there would be the added advantage for the sheep of less yarding and handling, and for the owner, a cleaner clip.[26]

6.23 The critics of biological wool harvesting have pointed to a few areas in which they believe the process to be deficient. Professor Setchell, Professor of Animal Sciences at the University of Adelaide, observed that the threshold between an effective dose of EGF and a lethal dose was very narrow.[27] To this, Dr Scott replied:

> During the past 4 years we have administered EGF to approximately 1000 sheep at dose rates in the range of 30-600ug/Kg/body weight and no deaths have occurred.[28]

In its submission to the Committee, ANZFAS pointed out that sheep show wide variations in response to EGF and therefore a standard dose could not be administered to the flock to achieve the same effect on every animal.[29]

6.24 Another area in which concerns have been expressed is that of the effects of EGF on the sheep's reproductive characteristics. In rams, CSIRO research has shown that, while their sexual activity was not influenced by EGF, temporary

impairment in spermatogenesis does occur for up to nine weeks after treatment with depilatory doses of EGF (that is, doses of > 100 ug/kg body weight). In ewes, dosing in early or mid cycle may lead to slightly delayed oestrus and normal to increased fecundity, while dosing late in the cycle results in approximately twice the length of interval between cycles but unimpaired fecundity.[30] If further research confirms these findings on a larger population, then in welfare terms, EGF could not be said to be harmful in terms of its effects on reproduction.

6.25 Questions have been raised about the effects of residual EGF on humans, were they to consume a dosed sheep. While detectable amounts of EGF and its metabolites do remain in muscle, fat, liver and kidneys, it is presumed that these residues would be broken down by intestinal enzymes in the human gut.[31]

6.26 While wool growth and wool quality are not significant welfare issues, they are of vital concern to the industry. Research is currently in progress to determine the long-term qualitative and quantitative effects of EGF on wool.

6.27 Not all animal welfare organisations were enthusiastic about the prospects of biological wool harvesting. ANZFAS, for example, declared that it was "a project before its time",[32] that it had run for 15 years with little to show for the money expended and that there were more worthy research areas with a greater likelihood of timely solutions.

6.28 While not denying the existence of other sheep welfare problems, the Committee believes that research into biological wool harvesting should be continued until the long-term effects of the application of depilatory doses of EGF have been fully examined; the stresses, if any, of the harvesting process compared with those caused by other shearing methods; and its economic viability assessed.

Robotic shearing

6.29 An alternative method of harvesting wool has been developing in competition with biological wool harvesting, namely automated or robotic shearing. Projects are underway in both Adelaide and Perth, using different methods of animal restraint and different sensing mechanisms.

6.30 The Perth project has been conducted by the Department of Mechanical Engineering of the University of Western Australia since 1978 and is supported financially by the Australian Wool Corporation. It relies on an automatic manipulator which moves the sheep from one shearing position to another, and stretches its neck and legs. A blindfold helps keep the sheep extremely still. The shearing robot, consisting of a mechanical arm powered by hydraulic actuators, has sensors in the cutting mechanism which measure the distance between the cutter and the sheep's skin. Force sensors and overload projection devices are fitted to prevent injury to the sheep in the event of uncontrolled actuator movement.

6.31 The project, when fully developed, hopes to achieve fully automated shearing of the whole sheep in four minutes, a time comparable with manual shearing; software development which will allow for the biological variability of sheep; compact units able to be easily transported; and allow for automated or manual capturing of the sheep.[33] By February 1989 it had reached the stage where a sheep could be fully shorn in twenty minutes and major changes were being made to the restraint mechanisms which would significantly improve the comfort of the sheep during the operation.

6.32 The Adelaide project has been undertaken by a private company, Merino Wool Harvesting Pty Ltd, with initial financial support from the Australian Wool Corporation until 1987-88, the Industrial Research and Incentives Scheme and other sources. Its

present funding comes from Elders IXL, which has committed $5.4 million to see the research and development phase throught to its completion. It differs from its Western Australian counterpart in that it relies on electro-immobilisation as its method of restraining the sheep, which is then shorn upright rather than rotated.[34] It also differs from the Perth project in that it leaves the awkward wool (for example around the legs) to be removed by hand, by shearers. The rationale for this is that shearers will retain their skills and indeed perhaps develop other skills, such as classing, while the heavier, more back-breaking job of fleece removal is done robotically. It will also allow for faster throughput of sheep, with each party doing the job most suited to him.

6.33 By the end of 1988, the Adelaide project had reached the stage where the robot performed its part of the shearing process in 100 seconds. Questions which remained to be answered were the methods of getting the sheep to the robots and the order in which the manual and the robotic parts of the process were performed. Goals of the project now are to attain a complete throughput time of 105 seconds with a prototype in the field by December 1990 for twelve months of field trials.

6.34 Electro-immobilisation has been considered in more detail in Chapter 5. In the case of robotic shearing, its application certainly provides an immobile animal around which the robot can work with little to no danger of mishaps. However, serious questions are still being voiced about this procedure and the extent to which sheep find it aversive. Before advocating any robotic shearing device which depended for its operation on an electro-immobilised subject, the Committee would wish to see the results of a controlled aversion trial comparing conventional manual shearing, robotic shearing using the Western Australian restraints and robotic shearing using electro-immobilisation.

6.35 In the opinion of the Committee, alternative shearing techniques must be pursued with vigour. There is a move away from all forms of heavy manual labour, such as traditional shearing represents, in our society.[35] Traditional shearing costs can be expected to continue to increase faster than wool prices,[36] particularly in respect of the compensation component, which is already approaching $1 million per annum in Western Australia alone.[37] There is an urgent need to ensure that widely-based research continues into efficient methods of harvesting wool.

6.36 Concerns have nevertheless been expressed about robotic shearing in its present state of development. It is only fair to say that many of these concerns have been recognised by the developers themselves and will be or are already being addressed.

6.37 Firstly, there is concern about the safety of the process for both sheep and operator. One sheep died in the Perth trials when a robot moved inadvertently through the rib cage, an accident which brought the programme to a halt for six months until automatic measures were built into the equipment to ensure that such a horrific event would not recur.[38] Other more minor injuries, such as cuts, have been sustained by the Perth sheep. A final product will have to demonstrate a proven safety record before it is acceptable.

6.38 The method of sheep restraint is also a cause for concern. Any process which involves involuntary rotation has been shown to be stressful to sheep. The studies referred to in Chapter 5 show that sheep find the process of electro-immobilisation more aversive than traditional shearing, although it must be recognised that preference studies can only demonstrate relative and not absolute values.

6.39 Thirdly, there are the practical concerns about the transportability of sensitive electronic and other equipment, its maintenance and general robustness in remote and climatically intemperate locations, and the industrial sensitivities of the introduction of such technology.[39]

6.40 Finally, the economic viability of robotic shearing has yet to be demonstrated. While this is not strictly speaking a welfare matter, it does have welfare implications. If robotic shearing can be shown to produce a clean, uncut and unstressed sheep in a relaxed environment, it will encourage productivity increases which may offset additional costs of the technique.

The future of shearing

6.41 Most wool industry representatives were in agreement with Mr Alan Bowman, a representative of the Wool Council of Australia, who expressed the opinion that both biological wool harvesting and robotic shearing had a long way to go before they could be considered viable options.[40]

6.42 The Committee commends the Australian Wool Corporation, Elders IXL, the CSIRO and other organisations which have had the foresight to fund the investigation of alternatives to traditional shearing practices. The Committee **recommends** that research be continued into alternatives to conventional shearing, and particularly into the sheep welfare aspects of all alternative methods of wool harvesting. As an interim measure, pending the likely future introduction of alternative methods of wool harvesting, the Committee **recommends** that research be continued into improvements to manual shearing.