Inquiry into Primary Producer Access to Gene Technology

House of Reps Standing Committee on Primary Industries and Regional Services

Submission from the Cooperative Research Centre for Premium Quality Wool
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GENE TECHNOLOGY AND LIVESTOCK

The term gene technology can denote conventional breeding techniques for the enhancement of favourable animal production traits, including the use of marker genes that may be linked to desirable production traits. Such techniques continue to be researched and practised in Australia but are not the subject of this submission. The focus below is on the newer methods of transferring specific genes to livestock genomes called transgenesis. The comments in relation to the terms of reference are made with emphasis on their relevance to the future of the wool industry.

THE FUTURE VALUE AND IMPORTANCE OF GENETICALLY MODIFIED LIVESTOCK

(i) **Production of animal products with greater efficiency and/or with improved quality**

To the present time, the investigation of introducing novel genes by transgenesis into the genomes of livestock animals to effect improvements, has been restricted to the technique of microinjection of selected genes into single cell embryos, first used in 1984.

The transgenesis route has not yet given rise to a commercially viable improvement in the quality of an animal product. However, the technology has been employed by the Roslin Institute in Edinburgh (of "Dolly" fame) and its associated company PPL, to insert genes into sheep enabling them to manufacture in sheep milk, human protein products for therapeutic use. For livestock production, intensive research worldwide (especially in the US) is focused, for example, on increasing muscle mass in cattle and sheep and changing the composition of milk for large niche markets.

Over the past 5 years, a group of Australian Scientists (Adelaide University, SA Research and Development Institute and CSIRO Animal Production) within the structure of the CRC for Premium Quality Wool, has initiated investigations into the possibility of altering the properties of wool to improve its processing and textile performance.

It is the only group worldwide doing this kind of research. The aims of the research at present are primarily directed to altering the material nature (proteins) of wool in order to increase the strength of finer wools and to make wool less likely to shrink, obviating the use of environmentally undesirable chemicals.

(ii) **Increasing the efficiency of transgenesis**

Rapid advances are being made in developing the techniques of nuclear transfer and cloning of animals since the first successful cloning of sheep at the Roslin Institute and at Agresearch in New Zealand. Attention has now turned to the utilisation of nuclear transfer for making transgenesis more efficient, less costly and capable of accurate targeting of specific genes to specific sites in the sheep genome. Much work has yet to be done and the research is continuing in Australia within reproductive biology groups such as at the South Australian R&D Institute (SARDI), CSIRO and Monash University.

Resources for sheep cloning research remain limited because of the lack of industrial support, particularly since the withdrawal of funding by the Wool Research and Promotion Organisation (AWRAP). However, several major sheep studs and woolgrowers have indicated their strong interest in the development of cloning techniques for the breeding and preservation of the genomes of elite animals.

(iii) **The importance of R&D skills in this area and potential outcomes**

The few groups in Australia involved in this research are in a central position to effectively compete with overseas laboratories for introducing genes into livestock animals, particularly with respect to sheep because there is less interest in sheep in the Northern Hemisphere. It is vital that their expertise is supported and maintained because the risk is high that without adequate support the highly specialised skills will be lost to overseas laboratories or will shift to other research disciplines. In addition, livestock industries will be in a weaker position to gain access to the new biotechnological advances that are certain to be made in the next five to ten years.

At the present stage of technology development and testing of gene insertions, it is impossible to estimate the dollar value of future commercial opportunities. Indeed, radical changes to wool's characteristics as a textile fibre, for example, could be the catalyst in reviving the long-term commercial viability of the wool industry.

THE ABILITY FOR PRODUCERS TO COMPETE USING TRADITIONALLY AVAILABLE VARIETIES

Wool is gradually losing its market share in the global fibre market and profitability within all sectors of the wool industry has been unacceptably low for most of the 1990's. The potential of gene technology to correct this slide needs to be investigated on a broad front. Genetic gains for wool have been constant but slow for the past several decades through traditional selective breeding techniques. These techniques are being refined to improve the precision of breeding for particular production traits. However, traditional breeding can use only existing genes whereas transgenesis can introduce novel genes, not normally available, to achieve a desired change. Moreover, unlike traditional breeding, transgenesis enables disadvantageous genes to be excluded from a gene transfer.

Sheep transgenic research can be likened to the research conducted by the synthetic fibre industry to constantly modify production techniques and fibre performance. Thus, the gene transfer methods for sheep may be aimed at improving the efficiency of wool production as well as wool products with completely new performance characteristics. That is, the potential benefits can be for both producers and consumers depending on the genes inserted. For example,

- Woolgrowers could gain from the development of efficient cloning techniques and from transgenic sheep genes which improve nutrition efficiency or enhance resistance to parasites.
- Wool processors and manufacturers along the processing/manufacturing pipeline could gain from increased fibre strength and/or elasticity, from altered dyeing properties and from the development of wool with less propensity to shrink.

It is extremely important that these avenues of research are pursued if wool producers are to compete successfully in the textile fibre market.

THE COMMERCIALISATION AND MARKETING OF AGRICULTURAL AND LIVESTOCK PRODUCTION VARIETIES

Formal alliances with stud breeders and woolgrowers in these R&D ventures is being sought. When a genetic procedure is established that can be commercialised, the access to it would be via licensing arrangements and could force changes in the structure and operation of the stud breeding industry.

The Wool CRC has also explored the potential to raise funding from major corporate bodies, particularly in terms of possible interest in using sheep/animal transgenesis for pharmaceutical or other therapeutic purposes (known as 'biofarming'). Such sources could generate the magnitude of funding necessary to make more rapid gains in livestock transgenic research. However, such alliances need to be approached cautiously in view of experiences in transgenic plant research, in which commercial sources of transgenic seed, for example, became owned by large international corporations. That is, corporate ownership of research outcomes could lead to exploitation of the technology to the benefit of the company rather than the livestock industry.

THE COST TO PRODUCERS OF NEW VARIETIES

The R&D resources required to develop a successful transgenic sheep will undoubtedly be several million dollars. How the cost of that research will be translated into costs to wool growers in gaining access to the improved sheep, will be determined by market conditions. For example, a quantum change in the type of wool produced or productivity of an animal will be reflected initially in a major shift in demand from stud breeders and, later, from commercial wool growers. Prices for animals carrying the novel genes should gradually contract as commercial supplies become more general.

As noted above, however, there is the potential for the commercialisation of highly valued transgenic sheep to be controlled by major companies. For example, if they secure intellectual property associated with, say, a wool gene (as distinct from a biomedical property), are in a position to maintain control over the distribution of the genetic gains.

OTHER IMPEDIMENTS TO THE UTILISATION OF NEW VARIETIES BY SMALL PRODUCERS

Experience within the Australian wool industry has shown that, for a combination of reasons, woolgrowers are often slow to adopt new technologies. This is particularly true for small producers who often carry sheep as part of a multi-product enterprise. In other words, their interest in and/or ability to appreciate technological developments within the wool industry may be determined by a different set of priorities.

In addition, many sheep enterprises have a dual interest in both wool production and sheepmeat production. Novel genes that offer substantial gains for wool production may carry less attraction if there are no benefits for the meat side of the enterprise.

ASSISTANCE TO SMALL PRODUCERS TO DEVELOP NEW VARIETIES AND THE PROTECTION OF THE RIGHTS OF INDEPENDENT BREEDERS, IN RELATION TO GENETICALLY MODIFIED ORGANISMS

There is already a strong argument which advocates a significant increase in the average size of commercial wool growing enterprises. The successful adoption of new technologies emerging from sheep transgenesis research may lead to a reorganisation of the culture of the wool grower community in which smaller producers collaborate amongst themselves or with larger enterprises.

THE APPROPRIATENESS OF CURRENT VARIETY PROTECTION RIGHTS ADMINISTRATIVE ARRANGEMENTS AND LEGISLATION IN RELATION TO GENETICALLY MODIFIED ORGANISMS

Currently, Federal legislation allows the patenting of a gene construct which provides a basis for subsequent commercialisation. However, the acceptability of gene technology in sheep does not rest solely with the producers, but also with the general public. The hostile critics of gene manipulation appear to be having a major impact on acceptance by the general public so far as foods are concerned. The situation with wool should not attract such a degree of adverse reaction because the end-use of the genetically modified product is to be worn (or walked on!) not eaten. However, that situation could change if an introduced gene would be present in edible organs. That could occur, for example, if a novel gene is introduced to improve the performance of the sheep itself.

OPPORTUNITIES TO EDUCATE THE COMMUNITY OF THE BENEFITS OF GENE TECHNOLOGY

The current adverse attitude to genetically modified organisms must be directly and strongly addressed by open and informed education programs. Elements of such programs must include:

- Livestock are already genetically engineered by natural selection. Transgenesis offers a more planned and targeted approach.
- The new technologies are more precise
- Improved production is needed to provide for population growth
- Gene research on wool could lead to significant environmental benefits such as less sheep to produce a given amount of wool, lower methane emissions, reduced use of chemicals by producers, less industrial effluent in processing.

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