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PRESIDENTIAL ADDRESS

Exploitation of the sheep's genes — the Government contribution

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Exploit is defined by Macquarie as 'to turn to practical account; utilise for profit, especially natural resources'.

To turn sheep genes into profitable, exportable products is the challenge to be met by our sheep industry.

I will address myself to this exploitation and the support required from Government for the ram breeders to meet their part of the challenge. I will discuss 'Exploitation of the sheep's genes — the Government contribution'.

The desired end products of the ram breeding sector are animals to parent the next sheep generation that are genetically superior in economically important traits. The increasingly diverse range of such traits will require an equally increasingly diverse range of genotypes.

Like any production line, the sheep breeder is dependent on having access to the raw material and tools appropriate to his trade. As for any company management, incentives to produce must exist and the climate be right to encourage change, if change is appropriate.

My discussion will cover these three aspects (the raw material, tools of trade, and incentives to produce) generally. Then I will focus on how Government through research and development and extension support can meet its share of the responsibility to improve the genetic merit of our national flock.

THE RAW MATERIAL

Productivity not production: an improved product from the same or less input is where economic forces have shifted the emphasis to in New Zealand sheep farming today. Access to the appropriate raw material to work with is essential if ram breeders and through them the commercial sheep producers, are to meet this challenge.

There is the need to ensure a wide spectrum of genes is available for economically important traits so that industry can respond when economics signal some specialisation or diversification is appropriate.

Any barrier which prevents the ram breeding industry from responding fully to these signals needs to be examined (Rae, 1984).

Access to the genetic merit contained within some strains and flocks needs to be unrestricted by

such things as ownership, registration status or breed purity of the sheep. The Lands and Survey Department's Waihora large scale Romney group breeding scheme has clearly demonstrated that superior genetic merit can be found and concentrated through a progressive breeding programme unrelated to the animal's ownership, except insofar as this ownership did enable the selection for performance to be ruthlessly pursued.

Likewise genetic merit is dependent more on the selection decisions of the flockmaster than on the ram's single-entry status with his breed society.

The Scandinavian concept of gene pools with specific productive attributes rather than maintaining breed purity has enormous potential for us. One of our progressive breed societies has had some discussion on providing an umbrella organisation for breeders with a common breeding objective rather than a common breed. For the first time, the 1985 Sheeplan membership lists 42 flocks under separate "cross" categories.

The degree of impedence to utilising superior genes, irrespective of source or purity varies greatly between breeds, breed societies and breeding groups. It behoves all breeders to work positively towards the removal of barriers to genetic improvement, by ensuring the economically important genes can be fully exploited at the breeder level. Many of these good genes are moving into just one commercial flock where their potential is dissipated after just one generation.

Genes for prolificacy, milking ability, growth rate, fleece weight, carcass quality, resistance or tolerance to economically significant diseases are the most important ones to increase the frequency of in the national flock. Some of these traits are exhibited at quite satisfactory levels in our present breeds and some occur very strongly in breeds suited to New Zealand but currently not farmed here (Clarke, 1984).

Much useful genetic variation appears to be available overseas to support New Zealand's national future in sheep production. No one overseas breed has all the attributes sought. In our long-term interests we therefore require on-going opportunities from genotypes which are currently available or are being developed overseas. For maximum genetic flexibility and speed of incorporation into the New

Zealand flock, breeders should concentrate upon breeds of extreme performance in the attributes they seek to improve, especially if these benefits seem likely to reduce the costs of production per unit of product available for sale. For example the Finnish Landrace.

The comparative trials in New Zealand between 1972 and 1978 showed that Finn x Romneys were the best breed or crossbreed for hogget mating, had highest ovulation rates at all ages, achieved highest percentage conceptions, exhibited lowest embryonic mortality, and recorded proportionately the fewest perinatal lamb deaths. Further, they produced the largest litters, had the lowest percentage of barrenness among ewes, and demonstrated appreciably the best mothering abilities among the breeds and crossbreeds compared. Certainly an outlier in superior reproductive performance. Given the raw material, what tools of trade then does the ram breeder need?

THE TOOLS OF TRADE

The ram breeder's business is to produce for sale rams to sire the next sheep generation. The ram breeder's responsibility is to ensure that each succeeding generation of sheep are, on average, capable of being more productive and more profitable than the preceding generation. This involves selecting the parents of the next generation on the basis of performance information.

Selection is threefold, namely:

- (i) Measuring or assessing traits of economic importance on individual animals;
- (ii) Predicting the breeding value of the individual for the trait, or traits which are to be improved;
- (iii) Assuming structural soundness, deciding on the basis of the breeding value whether the animal should be kept or culled and then taking the appropriate action.

All three steps are critical in bringing about genetic improvement.

The ultimate selection decisions are in the hands of the breeder. However, a recording service can provide the vehicle for the breeder to measure and record, can process data to produce breeding values and can present the records in a way to assist the breeder and buyer of his rams to make effective selection decisions. A recording service is therefore an essential tool for the breeder serious about his trade of generating genetic progress (Daniell and Callow, 1980).

A national flock recording service has been a feature of New Zealand's ram breeding industry since 1967. Following on from the first National Flock Recording Scheme (NFRS), a modified and expanded service (Sheeplan) was introduced in 1976. Like its predecessor, Sheeplan is aimed at within-

flock genetic rankings of animals. Sheeplan predicts the breeding value of the individual for economically important traits and combinations of those traits.

The cost of collecting field records is high. Sophisticated processing systems to achieve maximum accuracy in the genetic rankings is therefore justified. Schemes servicing many members can provide such accurate processing systems. Advisory support and formats of outputs common to all flocks which encourage understanding by ram buyers are further advantages of a national scheme.

From the genetic viewpoint artificial insemination is a tool to be used to facilitate sire proving; sire referencing; dissemination of superior genes; and dissemination and evaluation of scarce genes. These enable greater genetic gains through improved intensity of selection; more accurate selection decisions; reduced generation intervals between each round of selection; and more rapid dissemination of genetic gains. Such gains are substantial and have been well quantified by others.

An integral component of a successful AI programme is a recording system. In fact, the benefits that have been identified for AI are basically non-existent unless the sheep AI industry is supported by a high level national flock recording scheme — a scheme that will provide the level and degree of within-flock and across-flock analyses required.

Sheeplan was designed to provide within-flock breeding value rankings. The current processing methodology does not exploit the cross-flock links that exist now in the Sheeplan records. The methodology required for the recording scheme supporting AI is Best Linear Unbiased Prediction (BLUP). BLUP is now being routinely applied in dairy cattle and increasingly in beef cattle breeding. It is used in the beef cattle sire-referencing scheme in New Zealand. The framework exists with Sheeplan but substantial restructuring and reprogramming will be necessary to incorporate BLUP.

Ovum and embryo transfer are tools offering comparable benefits to AI. The technology of OT, ET and AI is developed to the level where practical application is appropriate. However, currently the sheep industry does not have an organisation to offer a widespread and continuing service. Such a service needs to be structured to ensure that research requirements can be identified and research and development are achievable.

Genetic progress is more rapid when higher selection pressures can be exerted. More fecund breeds and AI facilitate these as does the use of fertility drugs. Immunisation of the breeding ewe is therefore a further tool at the disposal of the ram breeder. The use of this tool needs to be viewed positively by breeders and their breed societies if the potential of our sheep industry is to be exploited.

INCENTIVES TO PRODUCE

What influences the breeder to turn to practical account? What motivates the breeder to either maintain momentum in a given direction or change direction?

Certainly financial incentives are crucial. But information and advice and assistance with interpretation of this information; demonstration that targets are realistic and achievable; the traditions and attitudes of the industry the breeder operates in; and the commitment of agencies such as MAF and Producer Boards to supporting the breeder's objectives and sharing the risk, has a profound and often overriding influence on whether or not the breeder recognises that the signals apply to him and whether or not he responds positively to them.

Information and Advice

The volume and sources of information to which sheep farmers are exposed is multiplying. Because of the welter of information becoming available, access to it has to be more precise (Anon., 1982). Breeders only have time for information that is pertinent to their needs.

New generation systems will utilise more fully the information storage and organisation capacity of computers. The volume of information available will be immense and retrieval almost immediate. However, the new technology will not take over the management of the sheep breeding enterprise. On the contrary it will increase the number of decisions that the breeder has to make.

The recording scheme is simply a tool to assist the decision-making process, and unless the records are actually used (rather than just collected) nothing has been achieved. Sheepplan offers a variety of recording options and this places pressure on breeders to clearly define their breeding objectives and then choose the most suitable breeding plan and associated combination of inputs and processing to give records appropriate to their objective. People skilled in interpretation with technical competence in animal breeding, and with communication skills can have a profound influence on bridging the gap between recording as an end in itself and selection based on recording.

The problem of choice is one the breeder is continually confronted with and the more comprehensive, flexible and varied the tools of trade the more stressful the choice and decision-making process. Progress is impeded in a stressful environment without access to trained extension workers.

The animal breeding adviser's role is one of creating understanding rather than one of direction. The emphasis is increasingly on making farmers better able to help themselves. An inter-active

relationship between farmers, researchers, advisers and the media is evolving.

Demonstration

That response to selection is slow, for the economically important sheep traits such as fertility, is now better appreciated and acknowledged by the industry with its increasing understanding of population genetics theory. That it exists though has been demonstrated to the satisfaction of large sectors of the sheep industry. Some of the most convincing New Zealand evidence comes from a research study at Ruakura of the effectiveness of selecting on the basis of twinning in Romney ewes; and, more recently under commercial farming conditions, in the Waihora breeding programme.

The confidence of the sheep industry must be maintained in the areas of change promoted by proof that targets are biologically realistic and achievable. Demonstration through research and monitoring through collective analysis of Sheepplan data will support this.

Such an example is the recent analysis that showed selection on the Sheepplan two-tooth selection index for dual-purpose breeds improved lean — a point that needed demonstration as many breeders were reluctant to use an index without a direct carcass lean measure. That weight-for-age was a useful correlated trait was not accepted by a large number of breeders.

Industry Attitudes

The Breed Society umbrella covers 80% (3500 flocks) of the ram breeders in New Zealand. The Federation of Livestock Breeding Groups represents the interests of a further 10%, with the majority of the remainder breeding rams only for their own use. Breed societies therefore continue to have a major influence on breeders' attitudes. One major breed, the Coopworth, has made performance recording (more specifically membership of Sheepplan) mandatory for breed society registration. Other breeds do now recognise to a varying degree the impact of Sheepplan to their mutual benefit. Sheepplan's development of recording services for breed societies will further enhance this co-operation.

The New Zealand Sheepplan Council (NZSC), comprising Sheepplan member representatives and sheep industry representatives advises the Minister of Agriculture and Fisheries on policy matters relating to Sheepplan and sheep improvement programmes. The significant breed society forces are represented on NZSC. This broad spectrum representation further enhances Sheepplan's acceptance to a diverse industry.

One of the most powerful forces driving the breeder towards objective performance selection

criteria is the purchasing power of the commercial producer (Callow and Binnie, 1982). Advisers have put considerable emphasis on promoting the philosophy of performance recording amongst ram buyers. Sheeplan assists advisers with this by provision of educational/promotional material. Further, the design of Sheeplan computer outputs recognises that buyers and their agents as well as breeders will be wanting to read them. A high proportion of ram buyers now demand that the rams they buy come from performance recorded flocks on the one hand and secondly that the records be made available to them to assist confirm their choice of breeder and assist in their choice of ram.

GOVERNMENT CONTRIBUTION

Substantial Government resources are allocated through the education vote to ensure succeeding generations of New Zealanders are better equipped to handle the ever-changing social and economic climate. Our education system is a blend of public and private enterprise. The benefits of choice and competition are capitalised on with minimum real division or fragmentation.

With human populations we have to make the best of what we're given (no selective mating, culling or importations here), whereas with sheep populations we can take steps to exploit the better bets.

What are the avenues for Government to contribute to, to ensure that succeeding generations of sheep are better equipped to respond to the ever-changing market signals?

Research

Economists would agree that it is the primary role of the public sector to create an economic and institutional setting which gives those who gain from research the incentive to invest at an appropriate level. In addition the public sector might conduct this type of research, together with that which generates widely applicable new knowledge about practices rather than processes or markets. Where it does conduct such research on behalf of large sectors of the agricultural community, more debate is needed over the appropriate sharing of the costs between the taxpayer at large and the direct beneficiaries of the research (Scobie, 1984).

Government researchers have identified important opportunities for exploiting the sheep's genes through extending the gene pool available to the sheep industry. This extension has been both through release to the industry of Government-bred Romneys and the importation of Finnish Landrace, Texel and Oxford Down embryos. Until such time as comparable genetic merit is concentrated in industry sources, programmes such as Waihora need to be

continued. Surplus breeding stock from other Government sheep programmes should likewise be available provided always they meet the criteria of adding to the superiority or diversity of the current gene pool. Government should take an active role in promoting the concept of gene pools rather than breed purity. The collaborative Lands and Survey Department Wiremu project is an example of this. Development of a new gene pool incorporating the attributes of heavy, lean lamb production is being undertaken at Wiremu.

Research now needs to be undertaken to evaluate the imported breeds under New Zealand conditions. Opposition from many sectors to the importation supports the contention it is a government role to import and evaluate. Release of the exotics, if appropriate, to the industry needs to be followed up with monitoring under commercial conditions. Effective dissemination of these genes and on-farm evaluation needs an AI service and an upgraded national performance recording scheme, supported by an informed animal breeding extension service.

A good base of research information on factors interacting to affect conception rate from AI in sheep has been established (Jury, 1984). The finding from a recent AI seminar was that a major requirement for future research is to define systems to suit farmer requirements and to devote efforts to achieving good results within an appropriate framework. Such research is a shared responsibility of Government and the organisation providing the AI service. Without a Government input under-investment is likely to occur.

Individuals within the same industry group benefitting from the restructuring of Sheeplan could be expected to fund the associated research and development of Sheeplan. Accurate definition of that group is required. Consider not just restructuring to handle AI but the wider aspects supporting the upgrading of Sheeplan (STG Subcommittee, 1985) to maintain its effectiveness both as a tool in the hands of the breeder and as a positive influence on the industry in which he operates.

Improved methodology such as BLUP offers the opportunities for Sheeplan to more accurately predict individual's breeding values within the flock and to link animals across flocks and across years. Restructuring would facilitate the incorporation of BLUP.

It would also improve operational flexibility and efficiency; accommodate electronic developments for data collection and transmission and facilitate the provision of recording services to the breed societies and breeding groups. The restructuring would provide easy access to the database for research analyses involving several flocks and generations of

animals simultaneously. An important industry shortfall in the current system is Sheepplan's inability to meet the challenge of expansion of the database to cater for the increasing market-led diversification of sheep production through selection and breed development through crossbreeding. Both on-farm and off-farm data must be accommodated for sheep; the requirements of other species could also be considered. The country's national flock recording scheme must provide a diverse portfolio of options to enable the ram breeder to meet the challenges of the ever-changing market place.

Who then is the industry group to benefit from the restructuring of Sheepplan? Detailed consideration of these areas just listed will show the widespread benefits to most groups within the sheep industry and some outside.

The success of the sheep industry as an export generator in the future depends on an integrated industry approach. An industry-wide data base needs serious consideration of which Sheepplan would be the cornerstone. Sheepplan restructuring could be a tool in establishing industry-wide links, in which case the group to benefit would include all of the sheep industry.

Government should conduct the research and development associated with the upgrading of its national flock recording scheme. It should provide the resources, particularly the people resources, and it should negotiate an equitable funding arrangement with the groups that will benefit. In the absence of a structure to levy those groups, Government should make the necessary funds available. No photographer can operate without a camera, little meaningful exploitation of the sheep's genes can occur without an appropriate recording service.

Advice

Earlier the limitations of information without interpretation support and advice were identified. I want now to discuss the Government contribution to the extension aspects of gene exploitation. The Government, through its Ministry of Agriculture and Fisheries, operates an effective farm advisory service. Within its ranks, it has specialist animal breeding extension personnel as well as a number of generalist farm advisers with an understanding of animal breeding principles and the application of Sheepplan to the industry.

The opportunities offered to the country through realising the potential contained within the sheep's genes justifies the extension input and if Government resource allocation was put on a time scale more meaningful for animal breeding activities, the potential waiting to be realised would justify an increased allocation to sheep breeding extension activities. Sheepplan advice would be enhanced by more documentation as much of the initial

interpretation and application of Sheepplan to both the ram breeder and his client could be handled in written form. Adviser-breeder contact on a one-to-one or at least a group basis is essential though when breeding objectives are being defined and breeding plans are being formulated. The successful incorporation of exotic genes into the national flock will be highly dependent on such contact.

If there is a one-way flow of information from the adviser to the sheep farmer and the information goes no further than this falls into the theoretical definition of 'paid advice' (McArthur, 1982). However the most effective advice is that which convinces the farmer that the decisions made are entirely his own, and which better equips him for future decision-making. Consequently, the value of such advice is not likely to be fully perceived and the sector is likely to undervalue the benefits from extension effort of this type.

Many benefits derived from animal breeding extension programmes are realised over a relatively long period. If this period exceeds the sheep farmer's planning horizon, he may be reluctant to pay, although the longer time preference of the nation may mean that the investment is justified on the national basis (Chudleigh *et al.*, 1984).

Much of the advice given on breeding to the sheep industry falls into the multi-way flow category rather than the one-way flow. Advise a Coopworth council member and you influence a breed society. Advise a stock and station agency and you may motivate many hundreds of commercial ram buyers. This type of advice then is a public good — its use is not restricted to those who 'buy' it. The problem with public goods when you make the user pay, is that too little of the nation's resources gets devoted to them. One breeder may not get sufficient benefit from a consultation to pay the bill for that consultation. But New Zealand may benefit sufficiently to pay the bill many times over — that is, by the time the information has been disseminated to an entire breed society.

Sheep breeding advice to the breeder and the industry he influences and who influences him is an essential and integral component of any serious effort to exploit the sheep's genes for the benefit of the New Zealand economy. It may well be the limiting factor. It is an obvious function for Government. Government funding of sheep breeding extension and a substantial part of the research and development areas I have discussed is justified as these represent areas of market failure in the agricultural sector.

Allocation of resources has a cost. But failure to allocate also has a cost — the opportunity cost. With the time frame that animal breeding works within, the allocators of the resources must recognise that evaluation, adoption and resulting progress will take

several sheep generations. Failure to allocate now will extend this time frame and will only be justified if technology supersedes the original proposition. Is this a risk an agriculturally dependent economy can afford to take?

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