THE UNDERWOOD LECTURE FOR 1994

WHITHER THE BEEF INDUSTRY AND ITS RESEARCH AND EDUCATION COMPONENTS

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Ladies and gentlemen, it is a privilege and a great honour to be invited to present the Underwood Lecture for 1994. My sequence of emotions on being invited to present the lecture ran through those of pleasure, being flattered and finally being frightened! The latter emotion remains with me. Whilst I have been a member of the Society for over 30 years, most of my working life has been spent in remote and not so remote areas of north Queensland which has limited my capacity to contribute to Australian Society of Animal Production (ASAP) affairs other than at a local level. Hence, whilst it is a great honour to be asked to present this prestigious lecture, I am sure that there are other more worthy invitees who have contributed more to ASAP than I.

I feel very privileged to be in the company of previous Underwood lecturers of the calibre of Reg Moir, Ian MacDonald and Hector Lee amongst others, who were his contemporaries and who knew and worked with Eric Underwood. In contrast, I am of a younger generation, and my working life has largely been spent on the diagonal side of the continent from Underwood’s main activities. Despite that geographical separation and despite our disciplinary areas being largely different, somewhat surprisingly Underwood, his work and his publications had an influence on me at different stages of my career.

As an undergraduate, I recall being fascinated by some of the trace element work Underwood was reporting, and particularly I recall my introduction to Underwood’s early publication, “Trace Elements in Human and Animal Nutrition”, by Dr Bill Pryor, then a lecturer in nutrition at the University of Queensland. Coincidentally, I was grateful for that early introduction when several years later, as a recent graduate working in the Gulf country of north west Queensland, I and several colleagues were investigating a wasting disease syndrome in sheep in the region.

One of the avenues of assistance I sought was from Eric Underwood, who graciously replied making some suggestions, which proved to be very helpful. The problem was subsequently identified as a selenium toxicity problem associated with ingestion of a native plant, *Neptunia amplificaulis*, which has the unfortunate capacity to selectively take up selenium to extremely high levels. Some 30 years after we had made that diagnosis, and a long while after I had changed my sheep hat for a cattle hat, I was asked to look at some cattle from this area with hoof abnormalities. Perhaps not surprisingly, selenium toxicity had again raised its head, and for the same reasons, since once again *Neptunia* was fairly common after some rare good seasons. After a long absence, Eric Underwood’s name again came to mind.

So much for my brief associations with Eric Underwood. Apart from a passing introduction at an ASAP conference, my contacts were through his writings which, as I’ve shown, were of great assistance to me on several occasions. Several previous Underwood lecturers have covered the outstanding scientific achievements of Eric Underwood and his contributions to the Australian agricultural research scene. As a reproductive physiologist, not familiar with the trace element field I can add little other than the anecdotal recollections I have referred to.

The issues I would like to address here are several, which reflect a personal perspective of Australian agriculture and in particular the beef cattle industry. Others are of a more philosophical nature, particularly in relation to beef cattle research, its directions, its funding and its future. Having recently moved from an active research career, I’ve been in a position of standing aside for a year or so and looking somewhat at a distance at research, with some resultant changes in my perspectives.

Firstly though the beef industry, an industry where even in my short lifetime there have been enormous changes in some areas but surprisingly very little in other areas. As a youngster on relatives’ properties in south east Queensland in the mid 1950s I can recall earnest debate about the phenotypic qualities of British breeds of cattle needed to supply the frozen beef trade to the United Kingdom, then our principal market. I also recall the tacit acceptance that cattle tick control involved dipping in arsenical based dips at 5-6 weekly intervals, and have strong recollections of all the mustering involved in that activity.
Contrast this with the debate today where more and more we are identifying a range of niche markets each of which require cattle of different specifications in terms of genotype, age, weight, fat cover, marbling, etc. Similarly, tick control has moved towards biological control using resistant *Bos indicus* cattle, while more latterly, the prospects of tick and tick fever vaccines hold out promise for effective control procedures. Both approaches recognise the growing consumer demand for "clean healthy food", uncontaminated by chemicals.

A very minor component of the beef market in the 50’s and 60’s was the live cattle export trade. Contrast the situation today where more than 300,000 live cattle are exported from northern ports primarily to south east Asian markets, and the enormous financial benefits and management implications this has had for many sections of the northern beef industry.

On a related issue of cattle breeding, there has been in northern Australia a significant genetic revolution in a relatively short period. The early years of the introduction of *Bos indicus* genotypes into northern herds were marked by controversy and ridicule of the Brahman. The pendulum then swung in the reverse direction when the outstanding adaptive traits of the Brahman and its derivative breeds, played a very significant part in the reinvigoration of the northern beef industry. Whilst these genotypes will, for the foreseeable future, continue to remain the dominant breeds for the north, there is now greater emphasis on crossbreeding with *Bos taurus* sires in order to source cattle into emerging enterprises such as the feedlot industry supplying specialised markets. A prime example of how the market drives the production end and, indirectly, a prime example of how market trends may drive research directions. For example, a major activity of the Cattle and Beef Industry Cooperative Research Centre northern research program is the assessment of the significance of genetic contributions in terms of purebred and crossbred *Bos indicus* cattle to a range of meat quality parameters.

Before moving to research and educational issues, I would like to briefly discuss some selected issues in relation to the Australian beef industry. I am sure that many of you will not disagree with the statement that until very recently the northern and southern beef industries could almost be regarded as quite separate entities. The northern industry based on about 1-12 million cattle, about half of the Australian cattle population, was primarily a low cost breeding, and in some areas a fattening operation, a vast majority of the product being manufacturing beef destined for export. An inherently low input system, where, until recent times, disease constraints were significant, and where low levels of productively were counterbalanced by the scale of operations, has been transformed in recent years through a series of market, economic and technological initiatives.

Recent developments, the pace of which has been somewhat curtailed by recent severe climatic constraints, have included the more widespread use of adapted *Bos indicus* genotypes, a greatly increased level of live cattle exports for fattening, or for breeding, to south east Asia and a trend towards production of younger age cattle to meet specific and often specialised markets such as the Japanese Ox and Korean trades. The recent rapid expansion of feedlotting capacity in southern grain growing areas of eastern Australia has resulted in an increasing proportion of male turn-off cattle from northern herds being sold as feeder steers rather than being grown out for the production of older and heavier slaughter cattle for the traditional United States (US) manufacturing beef trade. A consequence of these production shifts is the increasing north-south trends in cattle movements, particularly for grass or grain finishing. However, one potentially undesirable consequence of these shifts is the demand by some sections of the feedlot industry for a reduction in the Brahman content of feeder steers; a difficult decision for many northern breeders relying on the inherent superiority of these genotypes for production in harsh environments.

Similarly, increased turn off rates of younger male cattle have put increasing pressures on northern producers to improve reproductive rates and also caused a shift in herd dynamics with a higher proportion of breeders in the herd. Both of these factors may influence breeder herd survival rates and can thus change the level of risk management associated with cattle production in a harsh and uncertain environment.

Whilst these shifts have been very obvious in eastern Australia, similar trends have also occurred in the west with the movement of northern steers to the south west for finishing and an increasing reliance on the south east Asian boat trade for export of steers. Again, these trends have seen marked changes in profitability and an increasing emphasis on the need to achieve higher productive and reproductive levels in northern herds.

In contrast, the southern Australian industry, based on a larger share of the domestic market, less dependent on a single manufacturing beef market in the US, still primarily based on the use of *Bos taurus* breeds, and having a wider array of production options including significant lot feeding capacity, has a more extensive range of potential markets. The southern Australian industry may, in fact, become...
progressively more dependent on the northern sector for provision of finishing cattle. Hence the barriers and apparent differences that existed between northern and southern segments are no longer so strong and for the foreseeable future there will be greater interdependence of the 2 segments, perhaps the south being more dependent than previously on supply of finishing cattle from northern regions. However, whether the south becomes primarily a finishing area and the north primarily a breeding area, as suggested by some, is dependent on an array of individual producer judgements combined with market, seasonal and economic factors impossible to predict in the medium to long term.

What of the future of the Australian beef industry? Whilst I am neither economist, nor marketer, nor accurate crystal ball gazer, in my assessment the future is bright. Expanding markets in south east and north Asia, an increasingly environmental conscious Europe concerned with, amongst other things, environmental pollution from ruminants and, I believe, a US industry heading down similar pathways, will give us a more competitive advantage on world beef markets. However, the on-farm segment of the industry continues to be plagued by the narrowing margin between production costs and returns.

Recent cattle price increases in eastern Australia, spurred in part by the break in the Queensland drought and above average seasonal conditions in the south, have seen a reduction in numbers of cattle going to slaughter, with consequent higher prices. Whilst some are concerned at the proliferation of the feedlot industry, and I am one of them, one benefit of this new production segment has been a floor in the market for store cattle and the creation of another sale option for many producers. Increased consumer preferences for lean meat and the successful promotional activities of the Australian Meat and Livestock Corporation for domestic beef consumption has resulted in more emphasis on meat quality. These trends have flowed back to producers who no longer are concerned with their product only to the farm gate. The environmental and genetic factors influencing meat quality are now influencing many producers’ attitudes to their breeding and management programs and there is increasing awareness of the need for follow-through of product to the consumer’s plate. These attitudes will have significant and long term positive benefits on the on-farm segment of the industry.

In the off-farm segment of the industry, significant cost savings are achievable in converting livestock into meat and meat products. The current 5 year research and development programs of the Meat Research Corporation (MRC), concentrating efforts on the processing sector, clearly recognise the potential for these gains.

Development of new technologies such as Fututech, an automated beef slaughtering process, offer opportunities for significant processing cost reductions of up to 30% and enhanced efficiency in the processing sector of the industry. Commercial evaluation of this technology in the Kilcoy works is now underway and associated research is directed towards a fully integrated slaughter, boning and offal handling process which has the potential for enormous cost savings in the Australian processing industry. An important consideration, however, is that this technology is not prematurely lost to overseas interests before the Australian industry has the opportunity to capitalise on the research investment in the technology.

I would like to move now to some issues of agricultural research relevant to the beef industry. I hope I will be forgiven in making an obvious statement to this audience of the enormous changes which have occurred in Australian agricultural research in the past decade. I believe these changes have had both negative and positive effects. As an optimist I would like to concentrate on what I see as some of the positive benefits, but before doing so it would be remiss not to briefly comment on what I see as 2 of the downsides of these changes.

Firstly, there is no doubt that the absolute extent of agricultural research effort in Australia has declined in the past decade. A significant component of this decline in our research capability has been the erosion of our research manpower capacity. In 1991 I did an informal survey of personnel involved in the animal component of beef cattle production research in northern Australia. While I was aware of reductions which had occurred in research personnel in the area I was not aware of the extent, and was surprised to find that I was a member of half a cricket team servicing the research needs of the northern beef industry.
My other concern, and that of many other commentators, is that there has been a significant redistribution of research effort away from a balance of basic, strategic and applied research combined with shorter term developmental research, to a situation where more and more funds are directed towards outcome-oriented research. I have no problems whatsoever with outcome-oriented research which focuses the mind and the activities on real-world problems requiring solutions. However, in terms of the assessment procedures for funding applications for outcome-oriented research I do have some problems. I believe that unless our processes are very stringent, there is a real danger of putting the cart before the horse by having to do the research (funding source?), analysing and interpreting the data, doing an economic analysis, then preparing a submission with appropriate economic justifications for your hypothesis and, finally, hopefully receiving the research funding (to report the research?). In other words, we must guard against a situation which requires that we have prior knowledge of the answers to the questions the research is attempting to address.

Our current outcome-oriented research is the product of a combination of basic and strategic research undertaken over the past 10–15 years. We have reduced our capacity to provide the building blocks for applied research and technological activities for the next generation. I believe this balance needs to be redressed.

Turning to a more positive view of research, I concede that many recent changes in research funding strategies have been beneficial rather than purely inhibitory. Research structures have become more flexible to facilitate cooperation and collaboration. The Cooperative Research Centre (CRC) program is one example, and, for the beef industry, the Meat Quality CRC program involving collaboration across State, institutional and disciplinary boundaries, and with strong industry links, offers opportunities for inter-disciplinary research which would otherwise not be possible under budgetary pressures of recent years. I made reference earlier to the imbalance in the research mix due to funding body preferences for outcome-oriented research. For the beef industry, the CRC offers an opportunity to maintain what I believe is a necessary mix of basic, strategic and applied research that is directed towards industry problems, needed for our future competitiveness in world beef and meat markets.

Priorities for research have also been changed by continuing concerns on a range of environmental issues including sustainable development and the production of clean wholesome foodstuffs. Product, market and consumer issues are now more important driving forces in the research quantum than previously. As researchers, some of us have been guilty of not recognising the importance of these factors in reshaping research efforts. I believe we need to now place more importance on the development of a research strategy for Australian agriculture that will help us to achieve a long term vision for Australian agriculture and ensure that we can improve the international competitiveness of our rural industries.

However, a key element in this strategy must be that while targeting applied research and technological developments to national economic needs we must maintain the fundamental core of basic and strategic research to provide for developments into the future. It is these latter parts of the research profile now in greatest need of support in Australian agricultural research. Some investment now will ensure we do not become net importers of the research and development efforts of others in the future.

Others more qualified and experienced have debated the pros and cons of the various methodologies for assessing the economic returns from agricultural research. Alan Lloyd and others have drawn attention to the “under-investment” hypothesis in agricultural research which is that though lags in returns to investment in research are long, the returns have been high, and that research spending should be expanded, not contracted. Supporting this general viewpoint, for example, is the MRC evaluation of benefit cost ratios from several projects partly funded by the Corporation during the first 5 year plan. These ratios range from 6 to 70, indicating a highly variable but nonetheless average high return on investment in research.

Studies of economic benefits are useful in making a case for research funding. They can also help in research planning to assist managers and planners to identify the best directions for research and can aid decision making in the best allocation of research resources. It does not follow, however, that these processes should be the sole criteria for deciding on resource allocation. They are a valuable part of planning procedures but we must ensure that rigid application of these principles does not stultify creativity, imagination and research judgement. Put simply, benefit/cost analysis or any other form of economic analysis should be only one of a set of criteria on which research programs are evaluated.

Finally, I want to make some very brief comments on agricultural education. Alan Robson, in a previous Underwood lecture, presented some thought provoking ideas on the future of Australian education. The McColl report examined these issues further but unfortunately in my view failed to come...
to grips with some of the outstanding issues, particularly in relation to education in the animal related areas.

There is no doubt that whilst efficiency in Australian agriculture is high, our education system at all levels is still not well equipped to help producers meet the challenges of the future, including the expanding range of skill bases required if most producers are to stay in business. The need for greater awareness of all factors affecting profitability will require better educational skills for rural managers of the future.

Australian farmers have the lowest participation rate in tertiary education of any Organisation for Economic Cooperation and Development (OECD) country and this is reflected in the current problems of many tertiary institutions teaching agriculture which have low enrolments, very often cannot fill their quotas and have had to accept students with lower entry rates than for other courses. An additional problem is the small size and hence politically weak status of many agricultural faculties in Australian universities. In my view there is a need for some rationalisation of tertiary educational capacity and in particular a need to look critically at funding of several key national centres for agricultural education. Such an approach would complement the small number of special research centres in agriculture and would also be in line with the educational responsibilities of the CRCs. In fact, funds injected into the CRCs could provide the process whereby such national centres could be supported in part.

We now have a battery of new technology, including video conferencing techniques which can be applied to distance education delivery. There is an increasing demand for adult life-time education programs, partly driven through a reduction of State departmental extension activities, and from a demand from many rural communities for better educational opportunities. These demands can be coupled with an emerging technological capacity in order to provide high quality distance education to end users in remote communities. Current processes and the ways we think about agricultural education need to be modified to provide for the needs of all levels of Australian agriculture into the future.

Exports are the name of the game for most rural industries, and rural education is no exception. We need to further explore and develop opportunities for delivery of Australian agricultural education overseas. We have a good reputation for development and delivery of relevant programs of agricultural education and the capacity to modify these for different circumstances. Whilst many educators have been active in several geographical regions, particularly south east Asia, I believe we have only scratched the surface of overseas educational opportunities which are a potentially large export market for the future.

In conclusion, I believe there is a sound long term future for the industry provided we can respond with the appropriate products to supply market niches. There is now increasing flexibility within the on-farm sector to do this, but improvements in processing efficiency will enhance our world competitiveness. Australia had a strong basic and strategic research base to support technological research and development programs critical to our competitiveness. There has been an erosion of this capacity through a change in the balance of the research profile combined with reduced research manpower capacity which may well limit new technological developments in the next 2 decades. I believe we need to redress these issues, or like many other Australian industries we may be forced to import our technology from our competitors.