Industry adoption of CRC research results: Maximising the uptake of the science

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Introduction

The Cooperative Research Centre (CRC) concept introduced a new approach to the way research was conducted and the way technology was transferred. Most of the on farm research was previously conducted by State Departments of Agriculture and extended to producers by a team of department extension officers. CSIRO and Universities were more involved with off farm research and their methods of technology transfer did not involve extension personnel. Most of this research was funded from internal budgets but there was competition for industry funds. While competition was healthy there was some duplication of research effort and there were differences in approach between CSIRO, Universities and State Departments of Agriculture and there tended to be a divide between researchers and extension officers within State Departments. There was little pressure to measure uptake of new technology in dollar terms.

The CRC concept introduced a completely new approach. Universities, CSIRO and State Departments were forced to work cooperatively on big picture projects with well defined and measurable goals rather than by the number of research publications or field days held.

Industry was not only required to provide significant funding but was also integrally involved in the prioritisation of the research projects. This gave industry ownership and also ensured that the research was targeted at relevant industry issues.

The ability to obtain funding for renewed CRCs was largely dependent on being able to demonstrate good science, transfer of the technology and industry benefit from the existing CRC.

Technology Transfer Methods

The broad industry approach meant that CRCs did research for all levels of the industry from producers to retailers including the lot feeding and processor sectors which are so important in the production of high quality product. These sectors each needed different methods of technology transfer so the CRCs needed to be innovative and flexible in the way they introduced new technology to the industry. The traditional model of scientists publishing their research in scientific publications and expecting a team of departmental extension officers to get it adopted by industry was never going to be adequate. There was also a need to shorten the time lag from design of the research project to adoption by industry. In many case this meant the release of results before scientific papers were written. A wide range of technology transfer methods were utilised by the first two CRCs. (Bindon et.al. 2001)

(i) Commercialisation

A direct method of technology transfer and one promoted by the CRC funding body was the patenting and commercialisation of a research product such as a vaccine. This was sometimes a very long process especially where National Registration Authority approval had to be gained. The Pestigard and Bovilis MH vaccines are shining examples of this method. The Pestigard vaccine was released commercially in 2003 and the Bovilis MH vaccine in 2004. The commercialisation of gene markers was another successful example.

Other examples of commercialisation were the use of existing industry models such as the BREEDPLAN genetic analysis model and the Eating Quality Standards (EQS) model which were extensively used to implement new research results from CRC1. These models had the capacity to be progressively upgraded as soon as new research results became available.

(ii) Scientist to Industry

The progressives in any segment of the beef industry do not wait for science to be filtered through scientific papers or extension people. They want to be at the cutting edge and in direct contact with the researcher. One of the most successful technology transfer methods of the Beef CRCs has been the ability of some of its scientists to communicate directly with industry either through seminars or by direct consultancy.

David Johnston in genetics, John Thompson in meat science and Bernie Bindon on general CRC findings are very good examples of CRC researchers who are highly respected and have been powerful in the transfer of technology.

(iii) Traditional Extension

The first Beef CRC established the position of Coordinator of Meat Industry Education. The aim of this position was to bring together the extension and education resources of the core partners and other training providers, to develop and deliver a cohesive and effective education program. There had been no existing mechanism to facilitate joint education and extension activities across state boundaries or between State Departments of Agriculture and the CSIRO. The Coordinator position was designed to bridge the gap and unite groups who had previously competed for Commonwealth funding and who had largely operated within their own state boundaries. There was now the opportunity for these groups to be involved in technology transfer at a coordinated national level.

The design of the Beef CRC's extension and technology transfer program was reliant upon in-kind contributions from a number of individual extension officers mainly within NSW Agriculture and Queensland Department of Primary Industries (DPI), with up to 50% of their time allocated to CRC dedicated activities. This was generally not very successful because of a general lack of involvement in and ownership of the research project. Some states did not have people on the ground to promote CRC results.

As a generalisation the strongest support from state department extension officers came from those who had a larger time commitment to the project and were Armidale based and therefore felt a closer association with the CRC and ownership of the outcomes. They were involved in the production of sponsors reports, and research reports together with the establishment of group learning situations such as the Feeder Steer Schools at Armidale.

An example of strong involvement of extension officers not based in Armidale was a Queensland DPI led project to deliver CRC outcomes across tropical Australia which delivered 41 field days and workshops in Queensland, NT and the pastoral regions of WA. (Farrel et al. 2005)

(iv) Sponsors Reports and Research Updates

The two CRCs produced 11 Sponsors Progress Reports from 1993 to 2002 under the title "Beef the Future". The Sponsors Reports gave the industry sponsors who had contributed financially to the CRCs first access to research results. Research updates under the title "CRC News" were also published for general distribution. Both publications included direct contributions from the scientists involved in the CRCs which reported the latest (usually unpublished) results from their research which overcame the time lag issue.

The two reports were replaced by a quarterly email newsletter "Stakeholder eNews" in July 2003 which now goes to some 1200 email addresses in Australia and throughout the world and is available from the CRC website.

(v) CRC Research Reports

A publication titled "Producing High Quality Beef from Australian Cattle Herds" edited by Dundon, Sundstrom and Gaden was published in 2000. This 210 page book summarised the CRC research from 1993 to 2000 and listed all scientific and conference papers published to that date. A further publication "Producing Quality Beef" edited by Gaden, which summarised the most industry relevant research results was published in 2004. Using more modern technology two CDs titled "Summary of Genetic Findings and Outcomes of the Beef CRC" edited by Sundstrom and "Nutrition, Meat Science and Health Findings of the beef CRC" edited by Gaden provided an electronic summary of the major research outcomes of CRC1 and CRC2 to 2005.

(vi) Website

A website was established early in the life of the CRCs, but it is only more recently that there have been substantial amounts of CRC research results available including research papers, conference papers and material from the two CRC Outcomes CDs. The most recent addition is the "Livestock Library" developed in conjunction with the Sheep CRC. The Livestock Library currently includes over 17,000 scientific journal articles, conference papers, CRC publications and fact sheets which can be searched by key word, author or title. The number of visits or page hits on the site has not been monitored but it has provided easy access to the CRC research results both from within Australia and internationally.

(vii) Feeder Steer Schools

The Armidale Feeder Steer School, a three day workshop was launched in 1996. The aim was to provide a targeted event, offering scientific and technical information in the morning sessions and hands-on practical application sessions in the afternoons with live cattle.

The school was designed to offer something to all sectors of the industry, including breeders and backgrounders, extension and advisory staff; agribusiness; lot feeders and operational staff at feedlots. A major goal was to assist breeders and producers of feeder cattle to implement optimum breeding, nutritional and marketing techniques to increase their returns. The school was focused on practical understanding and adoption of management strategies to better target the lot fed sector.

The format proved successful and the school has now been running for 11 years in Armidale with the most recent school again being booked out. The program format was also adopted in Victoria, Queensland , WA and the NT, with tailor-made changes to offer participants timely and relevant information. Since the inception of the feeder schools, over 2,000 people have attended the three day program across five states.

(viii) Industry Seminars

In the early period a number of seminars which involved high profile industry identities were organised to give CRC1 some profile. These seminars which covered industry issues such as the declining beef consumption and how to secure and improve our export trade to Japan were generally very well attended with one seminar in Albury attracting 600 people. Later on externally organised seminars such as MLA "Meat for Profit" days and Australian Lot Feeders Association Conferences were utilised to promote CRC results.

(ix) CRC Field Days

Traditional field days at CRC Research sites have been held throughout the two CRCs commencing with a field day at "Duck Ponds", at Emerald in central Queensland, the breeding property for the Northern Cross Breeding Project in 1998.

Field days were also held at the CRC Tullimba feedlot at Armidale in NSW.

(x) Industry Demonstrations

The Regional Combinations Project in CRC2 with sites in NSW, Victoria, Tasmania and Western Australia was designed to discover/demonstrate the role of genetics and nutrition in the production of high quality beef in southern Australia. The project included diverse genetic types of Wagyu, Angus and European breeds. Angus sires with diverse EBVs for marbling and retail beef yield were also used. This project has demonstrated suitable breed combinations for specific markets and also the ability of EBVs to influence the phenotype of the resulting progeny.

(xi) CRC Education Program

A requirement of CRCs was the need to have an integrated education and training program. The CRC brought with it a new structure which formally integrated tertiary institutions with research and provided a much stronger incorporation of postgraduate research with industry initiatives and focus. Masters and PhD students were intrinsically linked to commercial projects and were able to bring real benefits to the cooperating company, industry and the scientific community through new and progressive research into beef quality issues. Around 60 students have completed PhD or Masters qualifications with industry based research projects between 1993 and 2005.

The requirement for each CRC to be attached to a University was a guarantee that research would be better incorporated into postgraduate and undergraduate programs. The University of New England was a core partner for the two Beef CRCs and established several new undergraduate and post graduate subjects and other new initiatives. Subjects in meat science, meat technology and feedlot management were developed and offered to both internal and external students.

(xii) Certificate Courses

As part of the first two CRCs UNE introduced several vocational certificate courses which have traditionally been offered by the TAFE system. A Certificate in Rural Science was offered through the University of New England from 1997 to 2005 in two streams; Feedlot Management and Meat Science and Technology

During the 9 years that the certificate courses were offered, enrolments were very strong in both fields and particularly in Feedlot Management with up to 60 in a class and 283 completing this subject.

Many of the industry students enrolling in the University certificates had existing knowledge and understanding of the "how" procedures and were looking for a much broader understanding of the strategic decision making "why" aspects to compliment their practical skills, without having to study a four year degree.

The Rural Science Certificate provided a lot of the strategic background of how and why animal processes work; how feed is digested and utilised; how different components of animals grow and develop, such as bone, muscle and fat; how diseases operate and are overcome and prevented; factors influencing meat quality and so on. The course provided students with the knowledge, expertise and importantly, the decision making processes required for management level decisions.

The certificates provided a valuable vehicle for the dissemination of CRC research results directly to those working in the industry.

The CRC Coordinator worked closely with Rangers Valley Feedlot to develop a Certificate in Pen Riding which was further progressed and is now offered by NSW TAFE. This certificate was specifically aimed at improving the skills base of personnel working in the animal health section of the lot feeding industry. It is a competency based certificate that assesses both skill and knowledge.

Industry has supported the course by providing a Pen Rider of the Year Award at the biennial ALFA lot feeding conference, sponsored by Pfizer.

Evaluating the Outcomes

It should be recognised that some of the research that came under the umbrella of CRC1 was already underway when the first CRC was funded. This included the CSIRO vaccine research, feed efficiency research at Trangie Research Station, breed comparisons at Grafton Research Station. It is not possible to evaluate all of the outcomes of the two CRCs but some highlights are listed below.

(i) Eating Quality Standards

The impact of the Eating Quality Standards research was outstanding The major breakthrough was the development of the EQS model by CRC researchers, which capitalised on the huge taste test dataset created by the CRC. This model put objective measures on the many factors known to affect the eating quality of beef as perceived by the average Australian consumer. It was world leading research which also had the ability to incorporate ongoing research into factors such as sale yard stress and the effect of Hormone Growth Promotants (HGPs).

The EQS model was used by Meat Standards Australia (MSA) to provide an outcome based grading system initially using MSA employed grading staff. Later MSA became the auditor for company employed grading staff. The promotion of MSA as a brand in it's own right led to it's rejection by the large supermarket chains but the MSA grading system now underpins about 30 branded beef products and the major supermarkets use EQS technology to underpin their eating quality assurance programs. There are currently around 50,000 carcases per month graded under Meat Standards Australia, which represents 25% of cattle slaughtered for the domestic market. While MSA grading is not used as part of our export industry specifications, processor/exporters use much of the EQS technology to improve the eating quality of export product. It is not possible to quantify the impact of this research because of the dynamics of supply and demand but independent research has shown much higher levels of Australian consumer satisfaction with the beef they currently purchase compared to 10 years ago and this appears to have impacted on the steady increase in consumer expenditure on beef over the last five years.

(ii) Quantitative genetics

The BREEDPLAN technology was in place at the start of the CRC, but was in need of data which allowed it to expand the number of traits and validate some others as well as combine direct carcase measurements with the growing number of ultrasound measurements of carcase traits in live animals. The data collected from herds involved in CRC1 provided the data for Animal Genetics and Breeding Unit scientists to calculate the necessary genetic parameters to allow the calculation of Estimated Breeding Values from the two data sources; a world first. This same technology allowed the industry use of measurements of Net Feed Intake (NFI) and later the correlated trait of Insulin-like Growth Hormone (IGF-1). The more cost effective measure of IGF-1 has been pursued by several British breeds with these breeds currently measuring IGF-1 in approximately 6500 animals per year to enable the calculation of EBVs for NFI for seedstock animals. This trait has yet to be rewarded financially by the grass fed or lot feeding industry but will potentially play a major role in increasing the feed efficiency of breeding herds and reducing the methane production of Australia's cattle herd.

(iii) Genetic and nutritional effects on marbling

While marbling is not important in our domestic market it is the single most important trait for beef exported to the high quality end of the Japanese and Korean markets. There has been considerable research on how to genetically and nutritionally manipulate this valuable trait. The effects of pre feedlot growth rates have been well documented by CRC research and the effects of different grains such as corn are better understood.

The genetic parameters and interactions were calculated in the CRC1 project and incorporated into the BREEDPLAN model. Ultrasound scanning of seed stock animals is the primary method of measuring the trait and allowing genetic progress. There has been recognition by feedlots supplying these markets that genetic predisposition is crucial to achieving high levels of marbling. The largest "marbling breed", Angus, has made a small amount of genetic progress over the last five years but industry is questioning whether there is an observable change in the marbling level of cattle destined for the Japanese and Korean markets. It appears that this may be due the time lag from genetic change in the seedstock herd to genetic change in the commercial herd and also the improvements in genetics for growth and back grounding methods, causing cattle to enter feedlots at younger ages and therefore be less mature at the end of the feeding period.

The understanding of the effect of genetics and nutrition on marbling is much better understood as a result of the CRCs and the technology to improve marbling is available.

(iv) Vaccines

Mannheimia haemolytica infection is a major component of Bovine Respiratory Disease (BRD)

in feedlot cattle. A vaccine against Mannheimia haemolytica developed in conjunction with CSIRO Livestock Industries at Geelong has now been commercialised and is being increasingly used by feed lots and backgrounders. BRD is the single most important cause of sickness and death in feedlots so the widespread use of this vaccine has the potential to provide huge savings to the lot feeding industry.

(v) DNA Markers

The most high profile technology and the basis of the CRC3 portfolio is the discovery of DNA markers for production traits of beef cattle. CRC1 provided possibly the best database for the validation of gene markers in beef cattle in the world. A large research effort within the CRC projects has produced only three commercialised gene markers.

The effect of these markers is still unclear but it is likely that they explain only a small part of the genetic variation for marbling and tenderness. It is likely that much of the variation in marbling accounted for by the two gene markers for marbling is already explained in the EBV for marbling for those breeds with extensive scan data.

However there is no phenotypic measure of tenderness in live cattle so the gene markers for tenderness appear to be a useful start even though they are currently not rewarded in the market place. The economic returns from gene marker research and commercialisation is arguably very small at this point in time.

The technology for finding markers is advancing rapidly and the CRC database will continue to provide a valuable resource for discovering a potential plethora of gene markers and especially those for hard to measure traits such as feed efficiency and tenderness.

Traditional Extension

The impact of traditional extension methods including publication of progress results of research, field days, presentations to industry conferences, workshops, and provision of information via the web is difficult to measure as it is so widely targeted. Bindon et al. (2001) reported that reported that traditional technology transfer approaches did not appear to result in high levels of demonstrated change in practices.

However the impact of these traditional extension methods was important to maintain an industry profile for the two CRCs which it appears to have been very successful in doing. It also continually recognised the sponsors of the two CRCs in the public arena.

Conclusion

The CRC concept created a completely new research model requiring cooperation between different research bodies to conduct research on industry relevant projects and the need for more rapid technology transfer methods. The new model which required rapid technology transfer created some tensions between researchers and extension officers with pressure on extension officers to get research results out to industry and researchers sometimes uncomfortable about releasing preliminary results or having extension officers interpret their results.

The most successful examples of technology transfer in the first two CRCs were through the patenting of vaccines and DNA markers and the use of commercialised models of Meat Standards Australia and BREEDPLAN. However the patenting of vaccines was a very slow process and it is too early to asses the industry impact of these vaccines. The commercial impact of the current DNA markers is also very small but that is more to do with the uncertainty about their commercial value rather than the technology transfer methods used.

The industry adoption of MSA grading to improve the eating quality of beef is relatively low as measured by the proportion of carcases being MSA graded but the adoption of the underlying technology by the large supermarket chains and export processors appears to be very significant.

The BREEDPLAN model was able to make the results from quantitative genetics research available to all of the seedstock industry very quickly but the measurement of carcase traits by ultrasound scanning has only been widely adopted by a few breeds. The measurement of net feed intake or the correlated IGF-1 is also limited to a small proportion of the seedstock industry.

The impact of traditional extension methods is impossible to measure but played a major role in creating and maintaining the profile of the CRCs as perceived by sponsors and industry.

The subsequent funding of CRC2 and CRC3 was heavily dependant on being able to demonstrate the implementation of research results by industry in previous CRCs. The high level of technology in CRC3 is likely to see a strong shift away from traditional extension in favour of commercialisation as the preferred method of technology transfer.

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References

Bindon BM, Burrow HM, Kinghorn BP (2001) Communication, education and training strategies to deliver CRC outcomes to beef industry stakeholders. Australian Journal of Experimental Agriculture 41, 1073-1087.

Farrell RA, Edmondston VJ, Bertram JD, Venamore P, Hudson S (2005) Delivering new CRC technologies to the northern beef industry. Proceedings of the Association for the Advancement of Animal Breeding and Genetics 16