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Increasing the relevance of applied bio-physical research: A case study into beef breeding cow twinning technology

T.G. PARMINTER AND D.C. SMEATON

AgResearch, Ruakura Research Centre, Private Bag 3123, Hamilton

ABSTRACT

Science funders need to know that their investment in technology will be relevant and useful. Pre-trial social research and the involvement of potential users in project management, enables scientists to ensure that these conditions are addressed. This paper examines the development of twinning technology for beef breeding cows as an example. Preliminary social research in 1995 showed that users wanted information about the technology and its interactions with sheep production and lamb finishing. They also wanted to know the labour requirements, and new skills needed for producing successful results. A systems trial examining these issues commenced at Whatawhata Research Centre later that year.

A mentor group was initiated at the start of the trial with farmers, scientists, funders, and a vet included. This group was involved in trial management over the three-year period of the trial. The trial has shown that it may be profitable for farmers to produce twin calves and grow them out to 18 months of age or older, providing that they can manage calving. Twinning cows were shown to be complimentary to sheep breeding and lamb finishing.

The role of the mentor group was evaluated in a survey of group members in 1997. The group was shown to be of high value to the individuals involved, and to the livestock industry, through providing greater opportunities for farmers and scientists to learn from each other. However, there was some concern that the mentor group process could increase the costs of carrying out research.

Keywords: social research; systems trial; mentor groups; breeding cows; twinning.

INTRODUCTION

Twinning Technology

New technologies that had been developed to improve the reproductive efficiency in beef breeding herds provided an opportunity to test the application of a collaborative social and biophysical programme. One of these was twinning technology (McMillan *et al.*, 1996).

Preliminary work had shown that beef breeding cows could be impregnated with two embryos that were carried to full term, born naturally, and reared successfully. An opportunity for New Zealand beef farmers to greatly improve the productivity of their beef herds was possible (Farquharson and Griffith, 1991).

Beliefs, Attitudes and Technology Adoption

The value of new technology to likely users will be enhanced when it takes into account their aspirations and needs(Chambers *et al.*, 1989). Parminter (1994) and Parminter *et al.,* (1993) reported that the beliefs and attitudes of individual farmers towards technologies provided better estimators of their actual adoption decisions than other farm and farmer variables. Beliefs and attitudes about technologies were considered to result from farmers' perceptions of how the technologies interacted within the systems in which they were to be used and then the overall benefit that was likely to be produced.

If farmers' perceptions are to be of any value in the design and development of new technologies then they need to be able to be identified before the technologies have been fully developed. Those characteristics most likely to influence user behaviour need to be described.

To provide the type of information that could be directly applied by farmers within their farming systems the authors considered that the field experiments would need to be:

a) at an appropriate spatial scale
b) measured in relevant units familiar to and being used by farmers
c) at a level of system complexity that farmers were used to
d) over a sufficient time period to include natural temporal variation (e.g. due to climate)

As an example, the effect of breeding cows rearing twins in a mixed livestock farm could not be determined without combining sheep with cattle in a paddock grazing study that continued for a number of years.

Mentor Groups

Mentor groups are an application of the "local group" concept outlined by Pretty and Chambers (1994). The absence of mentor groups associated with current research activities reflects a neglected relationship between scientists and their clients. This is due to scientists focussing on developing new technologies rather than on the development of organisations or communities.

Some of the common functions (adapted from Pretty and Chambers 1994, Bebbington 1994) of mentor groups involved in research are to:

- provide indigenous knowledge
- provide vertical technology and development links between scientists, extensionists, and farmers
- provide vertical economic links between scientists, farmers, processors, and markets
- mobilise resources to assist the research
- assist other groups gain access to the research results

- provide an information development infrastructure
- improve the access of rural people to information
- improve social cohesion
- provide a framework for co-operative action
- help to organise people so that they can use their own knowledge and research experiences to advocate for further or future research within institutional research organisations

METHODS

1. Farmers were invited to workshops where they were asked to describe the farming systems within which they would apply the new twinning technology. A total of six workshops were held in three regions (Northland, King Country, and Poverty Bay) attended by 140 farmers. The farmers identified those traits that would most affect the value of the technology in their farming systems. They were also surveyed to measure the strength of their beliefs and attitudes and how these could affect their use of the technology.

2. A field trial was begun in 1995 to address farmer concerns. The trial was established at Whatawhata Research to test the benefits and problems of using twinning cow technology in an interactive farm system (Smeaton and Clayton, 1998). The trial was carried out by:

- comparing calf output of single verses twin rearing beef cows run with breeding ewes in replicated farmlets over three years
- monitoring specific requirements of twinning cows such as extra supplements, to make the system feasible
- determining its profitability
- designing a management package for successful extension of the technology on to farms.

The trial used four balanced farmlets of which two carried cows bearing twins, and on the other two, carried cows bearing single calves. All farmlets had a stocking rate of 16 su/ha comprising 50% cow, and 50% sheep stock units. Each farm carried 20 cows and 120 breeding ewes.

The trial followed best management practice routines used by farmers on mixed livestock farms. This recognised that most farmers initially trying out new technology would be looking for marginal improvements to their existing system.

The experiment used two integrative indicators to capture differences between the farmlets. Differences in biological results were made to appear as differences in feed levels. Labour and skill requirements were measured and finally, profitability was then calculated.

3. A mentor group was established to guide the trial. The group consisted of eight industry people, mostly farmers, but also included a veterinary surgeon, and a system scientist as well as the funding manager. The mentor group was intended to provide guidance with:

- the establishment of typical farm decision making protocols
- specifications for the type of research information being produced
- how the research information could be presented to farmers

After 2 years, the members of the mentor group were surveyed to evaluate how effective the mentor group had been at satisfying their objectives, and the value to them of their participation. The survey was sent to mentor group members associated with this trial and also to others familiar with the mentor group process. The survey used Lickert (1932) scales and open questions to measure the attitudes of group members.

RESULTS AND DISCUSSION

Preliminary social research

One quarter of the farmers in the regional workshops were likely to use the twinning technology if it became commercially available ($p<0.001$) providing the technology was capable of producing over 60% of twin calving cows, and cost them less than half the market price of weaner calves to use. Additional users would result if the technology could also provide improved beef genetics, improve the quality of their young stock, and better integrate their beef production system with sheep breeding and lamb finishing.

The farmers identified a number of ways in which they expected the twinning technology to interact within their existing beef systems (Parminter and Smeaton, 1997) to make marginal gains or losses. They expected that the technology might increase their herd's productivity and profitability, make more efficient use of their pasture, and require less work for them than fostering calves. However, the technology might also be unsuitable for their existing cows and farm requiring costly improvements to be made. Additional farm work might be required at times, and subsequent animal growth rates and fertility levels might negate the benefits of producing the extra calves.

Field trial

In the first two years of the trial the following results have been observed (Smeaton and Clayton, 1998):

- pregnancy rates from embryo transfer have been variable (from 35%-70%). in the first year, 15% of the cows subject to embryo transfer had twin pregnancies, in the second year, 21%
- twin calves were 83% of the weaning weight of single calves
- 80% of twin born calves survived rearing compared to 95% of single born calves
- twin-rearing cows reared 65% more calf weight than single calf rearing cows
- an extra 250 kg dm/year (as silage) has had to be fed in the twin calving systems to keep similar live weight profiles and pasture cover
- the extra labour required (mainly at calving) was 5.7 hours per cow greater than with single cows
- rebreeding of cows appears to have been unaffected by farmlet treatments given the use of CIDR's for embryo transfer
- sheep production has been unaffected by differences between the two breeding cow enterprises.

Mentor group

There were fourteen completed surveys for analyses from the sixteen sent out. Five were from scientists, two from research funders, six from farmers, and one other.

In all cases the advantages from mentor groups were considered to outweigh their disadvantages.

Table 1 shows the most important perceived advantages and disadvantages of the mentor group in descending order with the most important (based upon it's average score) at the top. The greatest advantages of the group appeared to be the learning resulting from the stimulation and interaction that occurred between scientists and farmers. The disadvantages were not as strongly scored as the advantages, and only three were scored with consistency. The greatest disadvantages were that the mentor group seemed to increase research costs and require extra research time.

Table 1: Evaluation of Mentor Groups

Mentor Group Advantages	Mentor Group Disadvantages
Scientists learn things of value from farmer input (experience)	Mentor groups cost extra money and time
Greater stimulation for farmers from being involved in research	Less freedom for scientists to try out new ideas
Scientists have increased contact with farmers	Less pure research is carried out
More farmer involvement in research	
Greater general farmer awareness of research	

The greatest variability in scoring, (ranging from strongly disagreeing to strongly agreeing) was for statements describing the possible disadvantages of Mentor Groups. Most of the group agreed that the Groups "cost extra time and money", but that they were not "a waste of time". For each of the statements in Table 1 describing the possible disadvantages of mentor groups there were 2-3 people who agreed strongly with the statements, and another 2-3 people who disagreed equally strongly, the scores of the other group members determined the final overall score. Such variability could make it very hard for the group to decide upon future changes to make to improve the group's performance. One person stated that "Your questionnaire addresses many of the apparent pitfalls which may be laid at the feet of this [Mentor Group] approach". In contrast, another person summed up their own comments about the benefits of Mentor Groups by saying, "The Mentor Group has put some practical rigour into this project".

In answer to the question about how the Mentor Group had assisted the trial, most described practical tips that had been given. For instance "Good practical advice which has helped and allowed the trial to be modified (e.g. around calving time) so that the animals survived and the trial to continue and produce results." Other responses focussed upon the Group helping with the presentation of the trial's results in a form useful to other farmers. For instance "By bringing together farmers, veterinarians and scientists from different areas of expertise to get practical science results to take to the industry." And "The overall financial profit/loss aspect of the trial is always to the fore in farmer's minds".

Members found their involvement in the group "exciting" and "positive", and "stimulating" for their own "learning". However one person still had "real reservations about this as a way of transferring technology to the industries concerned". To be successful, each group needed a "scientist with a good understanding of farming systems and farmers. Also a scientist with good interpersonal skills and a willingness to listen and involve the whole group in the issues." The role taken by the farmer members was also considered important by some, best summed up by one farmer "I'm constantly asking myself, 'Would I be prepared to do it this way at home?'".

CONCLUSIONS

1. Preliminary social research enabled the field trial to be established with confidence that it would be both studying issues relevant to farmers, and providing results likely be applied in practical farm decisions.

2. The field trial is quantifying the strengths and limitations of twinning technology in mixed livestock farm systems. It has also identified priorities for future component and systems research.

3. There was a concern expressed by some group members that the Mentor Group process could stifle scientific creativity in order to find common ground in decision making. Skill in facilitation would be needed to manage this.

4. The Mentor Group has been shown to be of value to the individuals involved, and potentially to the livestock industry. The greatest value being the practical suggestions made by farmers about running the trial.

5. We recommend that all applied research programmes should involve research collaboration with endusers. This can be efficiently achieved in a multidisciplinary programme that also involves social and biophysical researchers to establish relevant technical specifications, and research protocols.

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