# The on-farm impact of beef production technologies

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## ABSTRACT

Three beef breeding cow technologies (heifer mating, dairy cross cows, and exotic terminal sire bulls) have the potential to increase cattle gross margins by 48% and increase output from the national beef herd significantly. However, on a whole farm basis where the extra feeding levels required to implement these technologies are taken into account individual farm surpluses increase by only 21%.

Samples of farmers from the Taihape/Hunterville and coastal Hawkes Bay regions were all aware of the technologies but had chosen not to use the new technologies for rational reasons. The most frequently stated reason was that the technologies were not suitable for harsh farming environments. Other reasons stated by farmers related to the farmer not being able to provide the breeding cow herd the preferential feeding required for these technologies to express their potential.

**Keywords:** Farmer First Research; on-farm change; beef production technologies.

## INTRODUCTION

The adoption of technology and changes to some components of a farming system often appear to have the potential to substantially increase production on a district or industry basis when calculated across all farms. The national beef cow herd,for example is claimed to have the potential to increase output by 450,000 cattle, representing a 35% increase over current yield levels, if farmers changed their beef cow management practices (Nicol 1990). The New Zealand Beef Council estimated that in 1990 New Zealand beef farmers could have obtained an additional $70.5m gross income through the wider adoption of three beef breeding cow technologies: first mating heifers as yearlings, crossbred cows (including dairy cross) and terminal sire bulls (Power *et al* 1992).

These three technologies have been the focus of considerable research and extension over the last twenty years (eg. Carter and Cox 1973, McMillan and McCall 1991, Morris 1982, and Thomson 1990). Extension workers have used gross margin analyses to show that significant gains in cattle income can be made by implementing these technologies (Thomson 1989). However, industry statistics indicate that these technologies have been adopted only by a small proportion of the population (Nicol 1990).

A survey of King Country farmers (Parminter 1993) found that farmers' beliefs about their breeding cow enterprises were closely associated with their adoption decisions. This finding provokes the important question: why do some farmers have beliefs which are compatible with the adoption of these technologies and other farmers have beliefs that are incompatible with the adoption of these technologies?

This paper illustrates how the case for the wider adoption of breeding cow technologies might be made from a national perspective, evaluates the on-farm impact of these technologies and discusses the reasons farmers have given for not adopting these technologies.

## FARMER FIRST RESEARCH

The Farmer First Research (FFR) programme, initiated at Massey University, aims to develop a research methodology that complements traditional research work by formally researching farmers' circumstances, constraints to change, and involving farmers in the research process (McRae *et al* 1993). Phase one involves working closely with farmers to establish farmers circumstances, including their goals, and their constraints to change. Phase two is concerned with the design and evaluation of appropriate strategies expected to improve farmer well-being. During phase two the active involvement of farmers continues along with collaboration from disciplinary specialists and members of the agricultural servicing industries.

Two samples of 30 sheep and beef farmers were drawn at random from two climatically distinct regions of New Zealand North Island hill country; summer moist Taihape/ Hunterville and summer dry coastal Hawkes Bay. The only requirement to qualify for inclusion in the sample was that the farm was a minimum of 200 hectares. The sample represents approximately 10% of the population of each region.

Two research officers, one in each region, have completed phase one of the research programme. Three semi-structured personal interviews (Rhoades 1985) were carried out over a twelve month period. Historical, physical, financial, and personal data were gathered and analysed to develop a better understanding of how the farmers goals had changed over time and to provide empirical data to quantify circumstances (McRae 1993).

Specific information regarding the use of beef production technologies was collected. This included whether or not farmers were aware of the three breeding cow technologies, had they used the technologies in the past, were they currently using the technologies, and did they intend to use them in the future. The reasons why they had or had not adopted the technologies were also discussed.

## CURRENT USAGE OF BREEDING COW TECHNOLOGIES

Seventy percent of farmers in the Taihape/Hunterville sample and seventy five percent of farmers in the Hawkes Bay sample were operating a breeding cow herd. The numbers of farmers in each of the samples who were using the breeding cow technologies are summarised in Table 1. Farmers producing exotic cross animals for sale or slaughter were mating either all, or part of their cow herd to an exotic sire. One farmer in the Hawkes Bay sample was operating a Charolais stud and is not included because these animals were being sold for breeding rather than for slaughter. Farmers using all three technologies are also counted in the individual technology categories.

The proportions of farmers using the breeding cow technologies in the Taihape/Hunterville were similar to those found in the King Country (Power 1992) which also has a reliable summer rainfall.

**TABLE 1:** Use of breeding cow technologies by samples of farmers located in the Taihape/Hunterville and Hawkes Bay areas.

| Technology | Taihape/Hunterville n = 21 | Hawkes Bay n = 23 | Total n = 44 |
|---|---|---|---|
| Dairy Cross Cows | 7 (33%) | 4 (17%) | 11 (25%) |
| Heifer Mating | 7 (33%) | 3 (13%) | 10 (23%) |
| Exotic Cross Progeny | 8 (40%) | 16 (69%) | 24 (55%) |
| Package of 3 technologies | 3 (14%) | 2 (9%) | 5 (11%) |

## THE IMPACT OF BREEDING COW TECHNOLOGIES

The impact of breeding cow technologies are investigated in this paper at two levels. The first involves an incremental change within an existing breeding cow herd where heifers are first mated at 15 months instead of 27 months (referred to as 'Heifer mating'). The second involves a package of three technologies where dairy cross cows are first mated at 15 months (to an Angus bull) and an exotic terminal sire bull used across all cows after first calving (referred to as 'Dairy-Exotic cross').

The impact of adopting these technologies is first evaluated from a national perspective where the potential increase in beef output from the national herd is estimated. The on-farm impact of these technologies is then evaluated using a Gross Margin analysis and a Whole Farm analysis.

### National Beef Output.

Data reported in Table 1 are used to illustrate how the case for the wider adoption of breeding cow technologies could be justified from a national perspective (a similar approach was used by the NZ Beef Council). The purpose of this illustration is not to accurately predict the impact of breeding cow technologies, but more to set the scene for the on-farm evaluation.

To determine the base situation the proportion of sample farmers (Table 1) using each of the technologies is extrapolated across the national herd. The potential impact of the technologies is estimated by calculating the increase in beef output if all farmers adopted heifer mating and/or dairy-exotic cross technologies.

The impact of heifer mating will be reflected in an increase in the number of calves produced each year and subsequent cattle offered for slaughter. The impact of dairy-exotic cross technologies will also be reflected in extra calves produced each year and an increase in the number of exotic cross cattle offered for slaughter. Exotic cross animals are estimated to achieve 15% higher carcass weights at a given age than traditional breeds (Hogg 1990). The number of farmers using exotic sires was 55% (table 1) however the proportion of the cow herd mated to these sires was around half so the proportion of the national herd mated to exotic sires is estimated to be 27%.

If the rates of adoption were increased from 25% to 100% for heifer mating and from 11% to 100% for dairy-exotic cross national beef output is estimated to increase by 44,000 tonnes (8 %) and 84,000 tonnes (16 %) respectively. This increase in output equates to an increase of $110m and $210m in farmers' cattle income (Table 2).

**TABLE 2:** The impact on national beef output from increased usage of breeding cow technologies.

| | Current Output | Heifer Mating | Dairy-Exotic Cross |
|---|---|---|---|
| Total Volume (t) | 530,000 | 44,000 | 84,000 |
| Value to Farmers ($m) | 1,325 | 110 | 210 |
| Percentage Increase | | 8 | 16 |

### On-Farm Impact

Gross Margin analyses and Whole Farm analyses for Heifer mating and Dairy-exotic cross systems are compared with a base situation of a traditional breeding cow herd (Angus/Hereford) where heifers are first mated at 27 months.

#### Gross Margin Analysis

The Gross Margins presented in Table 3 are based on a 100 cow herd with a 25% replacement rate. All stock surplus to replacement requirements are sold at weaning for $2.00/kg liveweight.

**TABLE 3:** Gross margin and whole farm analysis for alternative breeding cow policies.

| | Traditional 27 months | Heifer Mating | Dairy-Exotic Cross |
|---|---|---|---|
| Gross margin ($/su) | 33.23 | 40.16 | 49.08 |
| Increased Gross margin (%) | | 21 | 48 |
| Farm Surplus ($) | 39,875 | 44,850 | 48,225 |
| Increased farm surplus (%) | | 12 | 21 |

Superficially, cattle gross margins show an increase from $33.23/su to $40.16/su (21%) by first mating heifers at 15 months instead of 27 months and to $49.08/su (48%) by using the dairy-exotic cross system (Table 3). However, these

increased performance levels will not be achieved without changes to the farm management system and increased feeding levels allocated to the cattle enterprise. The extra feed must be supplied either by increasing the total supply of feed or by reducing the amount of feed allocated to other stock enterprises. The impact on the whole farm system needs to be considered before the real gains in productivity and profitability can be assessed.

### Whole Farm Analysis

The whole farm analysis is based on a farm of 400 ha carrying 3000 sheep stock units and 1000 cattle stock units. The cattle system is the same as that described for the gross margin analysis.

To assess the whole farm impact it is assumed the extra feeding levels required to implement the heifer mating and dairy-exotic cross technologies is supplied by reducing sheep numbers. Feed budgets have been calculated to determine the number of ewes that must be removed from the system to achieve the same pasture consumption patterns.

When the loss of revenue from sheep is taken into account the farm surplus is calculated to increase from $39,875 to $44,850 (12%) by using heifer mating and to $48,225 (21%) by using the dairy-exotic cross system.

## FARMERS REASONS FOR NOT ADOPTING BREEDING COW TECHNOLOGIES.

Research findings presented in this section relate to the Taihape/Hunterville sample only. Information from the Hawkes Bay sample is not available in this form. However, early discussions with these farmers suggest that the inappropriateness of these technologies under harsh conditions and their affect on the longevity of the breeding cow are the main reasons Hawkes Bay farmers are not using the technologies.

All farmers in the Taihape/Hunterville sample were aware of the technologies and those farmers not using the technologies were able to articulate reasons for choosing not to use them.

**TABLE 4:** Reasons given for not adopting the heifer mating and dairy-exotic cross technologies.

| Reason | Number of farmers (n = 21) |
|---|---|
| Unsuitable for harsh environment | 7 |
| Undergoing farm development | 5 |
| Small herd size | 5 |
| Low priority stock class | 3 |
| Market considerations | 1 |

The most frequently stated reason for not using heifer mating and dairy-exotic cross technologies was that they were not suitable for harsh farming environments. These farmers stated during the interviews that they were not prepared to make the on-farm changes required to ensure the cows received higher feeding levels because the costs and the risks were believed to be too high. The costs include lower performance in some other stock classes (eg. ewe flock or finishing cattle) and extra labour required to implement a more intensive system. Risks associated with these technologies included high losses, calving difficulties and re-mating problems.

Farmers on less developed farms chose not to use the breeding cow technologies because they believed they did not have the resources to allow more intensive management (especially subdivision and stock handling facilities). In these situations the breeding cows were being used as a development tool and dairy-exotic cross technologies were considered inappropriate.

Farmers with smaller herds (less than 60 cows) believed they were unable to implement the breeding cow technologies effectively because it required too many bulls and created too many small mobs of cattle requiring specific management.

Fifteen farmers (70%) in the Taihape/Hunterville sample who had a breeding cow herd also had a proportion of finishing cattle. These farmers considered finishing cattle a higher priority for quality feed than the breeding operation. Five farmers believed that mating heifers was in direct conflict with finishing cattle. In these situations heifers are not mated and the preferred policy was to purchase mature cows as replacements.

One farmer in the sample considered the market prospects for Angus cattle to be better than for dairy-exotic cross types.

## DISCUSSION

The whole farm analysis helps to put the impact of the breeding cow technologies in context and demonstrates that their impact is not as significant as would be concluded from a simple gross margin analysis. If the farmer had to forego a more profitable stock class than sheep (eg. finishing cattle) to accommodate the change the increase in farm surplus would be less.

Increases in farm surpluses of $5000-8500 were found for the farm modelled when breeding cow technologies were introduced. Given that FFR has found that most farmers want to increase their cash surpluses (Reid 1993) it may seem surprising more farmers have not used the technologies to achieve these gains. On paper it is a simple process to change breeding cow technologies and reallocate extra feed to the cattle enterprise and less to the sheep enterprise. In practice, however, it is somewhat more complicated and requires considerable on-farm change. Farmers compare the potential gains against the required on-farm changes necessary to implement the technology and decide whether the technology is appropriate to their circumstances. Farmers attitudes to risk and the availability of labour are likely to be important factors affecting the decision to implement the technology.

The use of breeding cow technologies requires considerable on-farm change and their success is dependent on more intensive management systems such as setting feeding priorities, liveweight monitoring, and greater calving husbandry (McMillan 1990). Intensive management systems are likely to be more sensitive to adverse events that affect the availability of feed and are therefore inherently more risky (McArthur and Dillon 1971). The FFR sample data suggest that the use of heifer mating and dairy-exotic cross technologies was less widespread in the Hawkes Bay than in the Taihape/Hunterville area (Table 1). The Hawkes Bay region is prone to summer droughts and is considered a more risky farming environment. These findings relate to small samples and require validation, however, the higher risk of adverse

climatic events may help explain the lower use of the breeding cow technologies in the Hawkes Bay compared to Taihape/Hunterville.

The dairy-exotic cross technology involves the introduction of cattle breeds with greater genetic potential to achieve high growth rates. These breeds also need a favourable environment to express this potential (Hogg 1990). Similarly, heifer mating requires replacement heifers to be fed preferentially to achieve target mating weights. Examples from the Taihape/Hunterville sample where the breeding cow enterprise is not fed preferentially include farmers undergoing farm development, small herds, and where sheep are more profitable than cattle. Farmers undergoing farm development do not have the appropriate resources and feed management systems for the successful implementation of heifer mating and dairy-exotic cross technologies. The objective of their breeding cow management is likely to be farm development rather than productivity. Farmers who have small herds believe they can not implement heifer mating and dairy-exotic cross technologies because it would create too many classes of cattle in small numbers which require specific management. Farmers agreed that while cattle are more profitable than sheep the breeding cows should be a higher priority stock class than sheep. However, if the relative profitabilities of sheep and cattle reverse then the cows would become a low priority stock class and farmers are concerned these genotypes would not perform as well as traditional breeds in unfavourable conditions.

## CONCLUSIONS

It has been suggested that significant gains in beef productivity and profitability are available nationally if greater use was made of heifer mating and dairy-exotic cross technologies. However, increases in productivity and gross income calculated on a national basis are of little relevance to individual farmers because they are concerned about how these technologies will impact on their own whole farm situation.

Farmer First Research findings suggest that farmers beliefs about breeding cow technologies are the product of their circumstances and the breeding cow technologies are simply inappropriate for some farmers circumstances. However, FFR samples are small and validation of this hypothesis is required.

All farmers in the sample were aware of the technologies but had chosen not to use the new technologies for rational reasons. Sample farmers with circumstances appropriate for, but not using, the heifer mating and dairy-exotic cross technologies believe the potential increases in farm surpluses are insufficient to justify the costs associated with the change (eg. risk, labour, and opportunity cost of feed). It is unlikely that these farmers will adopt exotic-dairy cross technology unless the on-farm returns from these technologies are increased or the costs reduced. Where sample farmers have circumstances inappropriate for heifer mating and dairy-cross technologies the challenge for researchers is to develop technologies more appropriate to these circumstances.

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