VIRTUAL HERDING RESEARCH UPDATE

TECHNOTE 9: BREAK EVEN COST ANALYSIS OF THE IMPLEMENTATION OF VIRTUAL HERDING TECHNOLOGY IN THE LIVESTOCK INDUSTRIES

Background

Virtual herding (VH) technology has the potential to move livestock with less labour and improve grazing management. Feed and labour are significant costs on beef, sheep and dairy farms and VH technology offers potential for improved efficiency in both areas. This project investigated the break-even cost that farm businesses could invest in VH technology based on anticipated benefits.

Three case studies were investigated:

• pasture-based dairy farm in West Gippsland, Victoria;

• mixed sheep-beef production in western Victoria; and

• extensive beef production in central western Queensland.

Approach

The price of VH technology has yet to be established, so the approach taken in this study was to calculate the break-even cost per animal for the technology based on the anticipated benefits and the cost of current traditional farming infrastructure and operating methods. Three case study farms were selected from leading livestock producers who had an interest in VH technology. The farm owners were interviewed to identify key practical VH technology applications on their own farms. The potential benefits were estimated using farm data and published literature. The applications were investigated as individual options and in combination where the applications could be combined on the farm.

The 'break-even' capital cost of VH technology was estimated for a range of applications on each case study farm. A partial discounted net cash flow budget over 10 years was used assuming a 15 per cent internal rate of return (nominal) was required to justify investing in VH technology. The capital cost included livestock neckbands and associated infrastructure but not on-going registration fees. A 5-year lifespan of the VH neckbands was assumed unless otherwise indicated.

The applications of VH technology and the potential benefits will vary for individual farms. The results presented are specific to the case study farms and our current understanding of the potential value propositions that may be achieved through the use of the technology and key details of the assumptions made are provided. The potential benefits could be larger or smaller than those estimated in this study. There may be additional benefits not considered in this paper which would potentially impact the break-even cost values that have been calculated.

Pasture-based dairy

The dairy farm was in West Gippsland with long-term annual rainfall of approximately 1,000 mm. The milking area had approximately 192 ha available for grazing with a milking herd of 680 cows. Cows calved between late July and late September. Annual milk production was approximately 430 kg milk solids/cow. In addition to grazed pasture, cows were fed 1.2 to 1.8 t DM/yr of a concentrate supplement as well as conserved fodder as required.

The benefits assumed for each application and the break-even cost of the technology is summarised in Table 1. These results indicate that if the VH technology is only used in a very limited capacity to fetch cows then the break-even cost is approximately $77 per cow. However, if labour savings and production benefits (e.g. increased milk production) are combined, then the break-even cost could be more than $300 per cow.

production), then the investment could be more than $300 per cow.

Table 1 Applications of VH technology on a pasture-based dairy, the potential benefits and break-even cost ($/cow) to achieve a 15 per cent return on investment over a 10-year period.

Application of VHtechnology	Potential benefit	Break-even cost
1 Fetching cows for milking to save labour and ATV use	• Labour savings of 1 hour/day for 330 days/year • Vehicle fuel, repairs and maintenance savings of $3,000/year	$77/cow
2 Splitting pasture allocation to enable later milked cows to have access to a greater quantity and higher quality of pasture	One third of cows in the herd has: • Increase in milk production of 0.075 kg milk solids/cow/day [A] • Improved reproduction to extend the life of cows from 4 to 5 lactations	$238/cow
3 Applications 1 and 2 combined	• As above	$319/cow
4 Flexible grazing in wet conditions to avoid pugging and pasture damage	• 1.5 t DM/ha of pasture saved on 30% of the milking area every second year	$77/cow

[A] without compromising the production of earlier milked cows.

Sheep-beef farm

The sheep/beef farm was in western Victoria with long-term annual rainfall of 550 mm. The home farm comprised approximately 2,800 ha with 320 ha of this being leased. There were two out-blocks that are primarily grazed by cattle. A block of approximately 480 ha was located about 40 km north of the home farm and another of approximately 440 ha was located about 100 km south.

There were approximately 7,500 mature merino ewes, 500 rams, and 2,500 replacement ewes. Between 33-50 per cent of the ewes were joined to prime lamb sires and the rest were joined to merino rams to ensure enough replacement ewes. There are approximately 2,300 mature beef cattle (cows and bulls) and approximately 1,700 calves.

Both, calving and lambing was predominantly in early spring. The two out-blocks were grazed by 880 of the mature cows.

Approximately 60 per cent of the home farm was undulating to steep with several gullies running through the property. The cattle complement the sheep by grazing more of the slopes and gullies on the home farm whereas the sheep tend to overgraze the pasture on the hills, which impacts on pasture production and persistence.

The potential benefits and break-even cost of the technology is summarised in Table 2. Investment in VH technology on out-blocks to manage beef cattle appeared to be worthwhile, but it does not appear to be for the sheep enterprise considered in this case study, even when multiple benefits are combined.

Table 2 Applications of VH technology on a mixed sheep-beef farm in western Victoria, the potential benefits and break even cost ($/head) to achieve a 15 per cent return on investment over a 10-year period

Application of VHtechnology	Potential benefit	Break-even cost
1 Use on beef herd on the two out-blocks that are distant to the home farm to save labour and control grazing management	• Reduced labour by 1.5 days per week on each block • Increased pasture utilisation by 10%	$408/cow
2 Use on sheep to improve pasture utilisation and persistence on home farm by grazing on the hills and gullies	• More silage conserved (0.3 t DM/ha) and less hay purchased • Improved reproduction to extend the life of cows from 4 to 5 lactations	$55/head sheep
3 Application 2 plus manage riparian zones without spending more on permanent fencing	• Capital expenditure on 30 km fencing avoided	$74/head sheep
4 Application 3 plus increasing lamb survival by running smaller mobs at lambing	• Increased survival rate of twin lambs from 140% to 160% by reducing paddock size from 15 ha to 4 ha	$103/head sheep

Extensive beef farm

The beef case study farm was a breeder operation on forest country in central, western Queensland. The climate has a summer dominant rainfall pattern that is highly variable (mean annual rainfall approx. 430 mm with range 107 to 1026 mm). The region has a short and highly variable growing season of approximately 2 to 3 months.

The property was 7,000 ha and typically carries a herd of 400 breeders (F1 Wagyu/Angus) and calves until weaning. A controlled mating program was implemented on the property with bulls introduced to the herd in late January and removed in April. Typical weaning percentage achieved was 80 per cent. Mustering occurs for branding in March, weaning/pregnancy testing in June/July, with an additional mustering to remove the bulls in April.

The property was divided into eight paddocks which allows some control of grazing management. The cows are divided into two herds and each herd was rotated through a simple four paddock rotation. Grazing management incorporates periodic wet season spelling to maintain the condition of the grasslands.

The potential benefits and break-even cost of the VH technology is summarised in Table 3. Labour savings for mustering combined with increased carrying capacity had the highest break-even cost. The increased weaning weight and weaning percentage application had moderate break-even costs. It was not considered possible to achieve multiple production benefits in the same application due to the short growing season at this property.

Table 3 Applications of VH technology on an extensive beef production system in central, western Queensland, the potential benefits and break even cost ($/head) to achieve a 15 per cent return on investment over a 10-year period.

Application of VHtechnology	Potential benefit	Break-even cost
1 Partial mustering of herd for branding and weaning	• Labour, helicopter hire, fuel savings of $1000/muster, or $2000/year	$35/cow
2 Application 1 plus improved carrying capacity from greater control of grazing management	• Herd size increased by 20% (80 cows)	$255/cow
3 Application 1 plus increased weaning weight by 10 kg supported by grazing higher quality pastures	• Weaning weight increased from 170 to 180 kg live weight	$138/cow
4 Application 1 plus increased weaning percentage by 5%, supported by grazing higher quality pastures	• Additional 20 weaners valued at sale price at weaning	$140/cow

Sensitivity of break-even costs to key assumptions

Limited information was available to assess the overall farm production gains that could be achieved through the use of VH technology as well as indicate the lifespan of the neckbands under commercial conditions. The sensitivity of break-even cost to assumptions about production gains and lifespan were assessed using the dairy case study farm.

The break-even cost was sensitive to the assumptions relating to the amount of extra milked produced if the latter milked cows were preferentially allocated pasture (Table 4). For example, if 0.150 kg milk solids/cow/day extra milk production was achieved on one third of the herd, the resulting break-even cost was $429/cow. But if the extra milk production from those cows was only 0.038 kg milk solids/cow/day, then the break-even cost of VH technology would be reduced to $143/cow.

Table 4 Sensitivity analysis to extra milk production from using VH technology to feed later milked cows better on the case study dairy farm (Table 1, Application 2). (Note that benefits in reproductive performance were kept constant)

	Amount of extra milk production from one third of the herd for 300 days		
	0.038 kg MS/cow/day (~0.5 L/cow/day)	0.075 kg MS/cow/day (~1 L/cow/day)	0.150 kg MS/cow/day (~2 L/cow/day)
Break-even cost ($/cow)	$143	$238	$429

The applications of VH technology were also sensitive to the lifetime of the neckbands (Table 5). As would be expected, doubling the lifetime of the neckbands resulted in about a 50 per cent increase in the break-even cost for all the applications analysed.

Table 5 Sensitivity to neckband lifetime of using VH technology on the case study dairy farm in a range of scenarios.

Application of VH technology	5-year lifespan	10-year lifespan
1 Fetching cows for milking to save labour and ATV use	$77	$116
2 Splitting pasture allocation to enable later milked cows to have access to a greater quantity and higher quality of pasture	$238	$370
3 Applications 1 and 2 combined	$319	$499

KEY FINDINGS

These case studies have shown that for dairy and beef production systems break-even costs in the range $255 to 408/cow could be achieved. These costs are within the range of comparable activity devices.

In the dairy and beef case studies, pasture or livestock production gains were essential to achieving break-even costs in the price range of other comparable activity devices. Labour savings alone were often not enough to achieve break-even costs in this range. Furthermore the break-even cost is sensitive to the level of production increases achieved and lifetime of the technology.

VH technology for sheep results in lower break-even costs due to the large number of neckbands required in these production systems. However, if the same benefits could be achieved by having neckbands on approximately half of the ewes then the implementation of the technology for sheep may be economic.

There are opportunities for improved environmental outcomes, for example through better management of treed and riparian areas without need for permanent fencing, in addition to the production benefits identified here.

The case study farmers identified that having other functions integrated with VH technology, such as heat detection and animal health monitoring, may increase the likelihood of adoption.

Results for this study are specific to the properties investigated. The applications and benefits will vary for individual properties, so the break-even cost needs to be assessed for each farm business.

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