



Estimating the Savings to Farmers from Eradicating BVD

Purpose

The purpose of this paper is to illustrate the potential financial savings at farm-level from eradicating BVD, using Farm Business Survey (FBS) data for four farm types. The paper also considers the sector wide impacts of eradicating the disease.

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Executive Summary

- Bovine Viral Diarrhoea (BVD) is a virus that causes a complex of diseases in cattle, negatively affecting the productivity of the herd due to reduced fertility, slower growth rates, susceptibility to other diseases and increased mortality rates.
- The industry-led BVD Eradication Scheme has been operational for just under 10 years and since the introduction of the scheme BVD prevalence has fallen from 40% to 10% of breeding herds in Scotland.
- The average farm would only need to see a one to two per cent increase in their output, depending on farm-type, to cover the costs incurred from eradicating BVD from their farm within a year. Any increases above this, and any sustained improvements from remaining BVD free in future years, would represent additional benefit to farms. This is due to the higher productivity associated with being BVD free.
- The ongoing benefit to an average farm from being BVD free ranges from £2,000 - £14,000 per year, depending on farm type. This is based on an assumed two per cent increase in herd productivity less annual BVD screening costs. This equates to around £20-£70 per head of cattle depending on farm type.
- The upfront costs to an average farm from eradicating BVD range from £2,000 - £6,000 depending on farm type. These costs include all associated costs of testing, tagging, disposal and replacement.
- The net increase to Farm Business Income (FBI) to an average farm from eradicating could be up to £9,000 in the first year for dairy farms and all farms could expect a net financial gain within around a year. Any increases above this, and any sustained improvements from remaining BVD free in future years, would represent additional benefit to farms. Whilst there is a risk of reinfection, this risk continues to fall as BVD prevalence falls.

	<i>Dairy</i>	<i>Less Favoured Area Specialist Cattle</i>	<i>Less Favoured Area Cattle & Sheep</i>	<i>Lowland Cattle & Sheep</i>
<i>Stage 1 - Upfront Costs</i>	6,000	3,000	2,000	2,000
<i>Stage 2 - (1 Year) Ongoing Benefit</i>	14,000	3,000	2,000	4,000
<i>Net Impact After 1-Year</i>	9,000	Break Even	Break Even	2,000
<i>Net Impact After 2-Years</i>	23,000	3,000	2,000	6,000

Figures may not sum due to rounding

- If aggregated across the whole sector, the farm-level benefits of total eradication would equate to a net benefit of around £0.6 million after a year, and around £2.4 million per year thereafter, based on a proportional weighting of BVD across farm types and not accounting for any market responses, or risks of reinfection.

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1. Purpose

The Scottish Government, together with industry, veterinary practitioners and scientific partners, is committed to eradicating bovine viral diarrhoea (BVD) from Scotland. The purpose of this paper is to illustrate the potential financial savings at farm-level from eradicating BVD, based on four Scottish farm types: Dairy, Less-Favoured Area (LFA) Specialist Cattle, LFA Cattle & Sheep, and Lowland Cattle & Sheep. The paper also considers the sector wide impacts of eradicating the disease.

2. Background

BVD virus causes a complex of diseases in cattle, the most important of which can interfere with reproduction, affect the unborn calf and ultimately lead to fatal mucosal disease. BVD infection is also associated with significant suppression of disease resistance, contributing to outbreaks of other disease such as pneumonia or scours (diarrhoea).

The industry-led BVD Eradication Scheme has been operational for just under 10 years since 2010. Costs to Scottish Government over this time are in the region of £1 million for the BVD systems and development, subsidized screening and publications costs. Since the introduction of this scheme the level of BVD exposure has fallen from 40 per cent to 10 per cent of breeding herds in Scotland.

To build on the progress, the future phases of the eradication scheme will particularly focus on keepers who choose to retain Persistently Infected (PI) animals or do not investigate the cause of their "not negative" status.

BVD has a number of negative effects on the productivity of cattle herds, particularly those that have persistently infected animals. Broadly, these negative effects include: slow growth rates and susceptibility to other diseases as a result of immuno-suppression; increased mortality rates (as some affected animals will die); increased costs associated with caring for sick animals and decreased calving rates (by increasing the chance of abortion in pregnant animals, and death of new-born calves).

While this paper does not formally consider the environmental aspects of BVD eradication, there are environmental improvements associated with eradicating BVD. Infected cattle are less productive; a herd with BVD produces less milk and/or meat per unit of greenhouse gas emitted than a healthy herd. If BVD is not present, milk and meat production is more efficient, meaning that there is likely to be an environmental benefit associated with BVD eradication.

3. Sector Information

Across Scotland there are over 9,000 dairy and beef farms, with over 1.4 million cattle in total. The standard output (which gives an estimated farm-gate value of output without taking account of the costs incurred in production) of cattle across the beef and dairy sectors was more than £690 million in 2017.¹

Table One – Beef and Dairy Industry Information

¹ Analysis of data from Scottish Agricultural Census 2017

	<i>Dairy</i>	<i>LFA Cattle</i>	<i>LFA Sheep & Cattle</i>	<i>Lowland Cattle & Sheep</i>
<i>Number of Holdings</i>	670	4870	1500	2450
<i>Total Land Area (ha)</i>	108,000	917,000	723,000	121,000
<i>Number of Cattle</i>	318,000	784,000	137,000	201,000
<i>Cattle Standard Output (£)</i>	273,200,000	288,300,000	41,100,000	89,100,000

The most recent monitoring data from the BVD eradication scheme² shows that there are approximately 600 breeding herds in Scotland whose most recent test result gives them a BVD status of 'Not Negative'.

A 'Not Negative' status either means that the most recent herd test shows that the herd has been exposed to BVD, or that the status has lapsed (which automatically defaults the herd to 'Not Negative'). Of these 'Not Negative' herds, less than 100 are currently 'BVD Positive' (i.e. those where BVD infected animals are known to be present in the herd).

4. Farm-Level Financial Impacts

4.1 Farm-Level Analysis

The analysis in this section uses farm-level data from the 2018 Farm Business Survey (FBS) to provide a baseline for farm business financial performance for four different farm types with significant cattle enterprise (Dairy, Less Favoured Area (LFA) Specialist Beef, LFA Cattle and Sheep, and Lowland Cattle and Sheep).³ A range of assumptions on the costs of eradicating BVD and the benefits from eradication are then applied to this baseline position – to illustrate the potential farm level financial benefits of eradicating BVD.

Table Two – Baseline FBS information for average farm in the sample

	<i>Dairy</i>	<i>LFA Specialist Cattle</i>	<i>LFA Cattle & Sheep</i>	<i>Lowland Cattle & Sheep</i>
<i>Total Output⁴</i>	495,000	206,000	211,000	235,000
<i>Total Input</i>	433,000	176,000	169,000	202,000
<i>Farm Business Income</i>	62,000	30,000	42,000	33,000

To illustrate the potential impact that the eradication of BVD could have on farm level profitability, two stages are presented in this paper:

² Scottish Government Data for November 2018

³ The Farm Business Survey is a sample survey of approximately 500 farm businesses, all of which are classified as having 'considerable economic activity' (above 25,000 Euros output per year) and are above the 0.5 Standard Labour Requirement. Full information of the Farm Business Survey methodology can be found at <https://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/Publications/FASmethod/16-17FBSMETHOD>

⁴ Throughout this paper, output includes Diversification Income.

Table Three – Stages of Analysis and Key Assumptions

Stage One Overview – Upfront Costs	A farm discovers the BVD virus is present and, as a result decides to eradicate it from their herd. The costs associated with action to eradicate the disease are incurred upfront, and the benefits associated with BVD eradication are not present.
Stage One Assumptions	<ul style="list-style-type: none"> • After receiving the ‘non-negative’ result from the compulsory anti-body screening test of 20 cattle, individual blood tests are done on all cattle. • 1% of the adult cattle and 2.5% of calves in the herd are found to be BVD positive, and will all be destroyed. • Disposal costs are incurred on 80% of BVD positive adults and on all BVD positive calves (because evidence shows that, on average, 20% of BVD positive cattle are in good enough health to be sent to the abattoir). • Adjustments for the aforementioned benefits from BVD eradication are not applied to any farms, because it is widely accepted that the benefits of removing BVD come only as a result of full eradication.
Stage Two Overview – Ongoing Impacts	BVD is no longer present in the herd and, as a result, the only costs incurred are those of the initial screening test, while all of the benefits associated with BVD eradication are realised.
Stage Two Assumptions	<ul style="list-style-type: none"> • An antibody screening test of 20 cattle is undertaken – but indicates no BVD presence in any herd. • No further costs are incurred • All of the benefits are of eradication (through increased productivity, increased fertility and decreased mortality) are realised.

As a baseline, we assume average farms of each farm type are BVD-positive, but do not know it yet. Stage One shows the costs of testing and replacing cattle once a screening test indicates a BVD-positive herd, while Stage Two shows the production benefits to that farm compared to production with a BVD-positive herd (as well as ongoing screening costs).

Once the results from these two stages have been calculated, it is possible to illustrate the financial impacts to the average farm in each farm type over a single year in each stage. Note that there is no reason for Stage Two to end after just one year – the farm will experience additional production benefits for the duration they remain BVD-negative and screen their cattle.

Throughout this analysis, the assumptions relating to costs from tackling BVD and benefits associated with the BVD negative status have been applied to individual farm-level financial data from the FBS. These individual results have then been averaged (using a simple arithmetic mean) to provide an average impact for each farm type. Throughout this analysis the assumptions on testing costs and the prevalence of BVD have been applied to the number of suckler cows in a herd (and calves, where explicitly mentioned), as these animals are often considered to be central to the future of the herd.

Table Four – Summary of Costs used in Analysis⁵

Cost Type	Assumption
Screening Test (20 animals per herd)	It is assumed the screening tests of 20 animals in a herd costs £80.
Individual Blood Test (on every animal in a BVD positive herd)	It is assumed that individual blood tests for the whole suckler herd cost £5 per head.
Calf Tag Testing	It is assumed that a tag test is applied to every calf in the herd, at a cost of £5 per tag. To determine the number of calves expected in a herd each year, the number of heifers in calf listed in the FBS data is added to the number of female cows aged over 2 years (making the assumption that they will be expected to provide one calf each year).
Lab Testing (inc. Courier/Postage)	For the combined costs of courier/postage of the samples to the lab, and the costs of the lab testing – a figure of £6.50 per test has been assumed.
Disposal	Disposal costs for calves are assumed to be £35 per animal, while for adult cattle this is assumed to be £95 per animal ⁶ .
Replacement	Based on the SAC Farm Management Handbook 2017/18, replacements costs are assumed to be: <ul style="list-style-type: none"> • £700 per head (hill suckler) • £900 per head (lowland enterprises) • £1,600 per head (dairy)

Table Five – Assumed Impact on Cattle Output from BVD Eradication

Benefit	Assumed Impact on Output
Productivity Benefit	BVD Eradication will increase the efficiency of cattle output, because there will be a reduction sickness and weight-loss. It is assumed that this increased in productivity will increase cattle output by 1%.
Fertility Benefit	BVD eradication will increase fertility in herds – as a BVD non-negative status is known to adversely impact on fertility rates. It is assumed that this increased fertility will increase cattle output by 1%.
Mortality Benefit	BVD eradication will decrease the mortality rate in herds. It is assumed that this will decrease mortality by 50% - feeding through to an increase in cattle output of 2%.

4.2 Farm-Level Results

This section presents summaries of the impact which the two stages have on the Farm Business Income (FBI) of an average farm from each of the four farm types in 2018, accompanied by discussion of the overall implications.

⁵ Unless the source of these assumptions is specifically stated, these figures are drawn from Scottish Government animal health professionals discussions with market contacts (farmers, vets, abattoirs etc).

⁶ Based on charges from the National Fallen Stock Scheme.

Table Six – Stage One Impact of Upfront Costs on Farm Business Income

	Dairy	Less Favoured Area Specialist Cattle	Less Favoured Area Cattle & Sheep	Lowland Cattle & Sheep
Total Increased Costs	6,000	3,000	2,000	2,000
Vet Testing Costs	1,000	600	500	500
Tagging Costs	100	60	30	60
Disposal Costs	200	200	60	70
Adult Replacement Costs	2,000	700	440	600
Lab Testing and Courier Costs	2,000	2,000	1,000	1,000
Total Output	495,000	206,000	211,000	235,000
Total Input (New)	439,000	180,000	171,000	205,000
Farm Business Income	57,000	27,000	40,000	30,000
Change in FBI	-6,000	-3,000	-2,000	-2,000
Change in FBI (%)	-9%	-11%	-5%	-7%

As shown by table six above, an average farm of any farm type would be expected to experience a reduction in their farm business income as a result of the increased costs assumed in stage one, where the farm is taking action to eradicate BVD.

The average LFA Specialist Cattle farm is predicted to experience the largest, relative, fall in percentage terms in their farm business income, experiencing a reduction in FBI of around £3,000, or 11 per cent of FBI, as a result of the costs of tackling BVD. The average Dairy farm is predicted to experience the largest, absolute, fall in pounds in their FBI: £6,000, or 9 per cent. This is predominantly due to relatively large average herd size in the dairy industry, as well as high replacement costs for dairy cows.

Table Seven – Stage Two Ongoing Impacts on Farm Business Income

	Dairy	Less Favoured Area Specialist Cattle	Less Favoured Area Cattle & Sheep	Lowland Cattle & Sheep
Total Increased Costs	600	600	600	600
Testing Costs	80	80	80	80
Lab and Courier Costs	500	500	500	500
Total Increased Output	15,000	4,000	3,000	5,000
Production Benefit	4,000	1,000	1,000	1,000
Fertility Benefit	4,000	1,000	1,000	1,000
Mortality Benefit	8,000	2,000	1,000	2,000
Total Output (New)	510,000	210,000	214,000	240,000
Total Input (New)	434,000	177,000	170,000	203,000
Farm Business Income	77,000	33,000	44,000	37,000
Change in FBI	14,000	3,000	2,000	4,000
Change in FBI (%)	23%	10%	5%	13%

Table seven shows the average 12-month financial benefit that the average farm from each farm type may experience after having eradicated BVD. As shown in the above table, an average farm from the dairy industry is predicted to see the largest benefit from the eradication of BVD – with a 23 per cent increase in FBI under scenario two, when compared to the baseline. This is due to the high levels of output from the Dairy sector in the baseline.

All other farm types also see large increases in FBI (ranging from 5 to 13 per cent depending on farm type).

Table seven also shows that by eradicating BVD from their herd, an average farm could save thousands of pounds. The size of this saving varies by type of farm – with an average dairy farm seeing a saving of £14,000 compared to between £2,000 and £4,000 for the other farm types. Much of this difference is due to the large and relatively high output of the average dairy herd.

Table Eight – Financial Impact of Eradicating BVD Per Head of Cattle

	<i>Dairy</i>	<i>Less Favoured Area Specialist Cattle</i>	<i>Less Favoured Area Cattle & Sheep</i>	<i>Lowland Cattle & Sheep</i>
<i>Gain in FBI from eradicating BVD (£)</i>	14,000	3,000	2,000	4,000
<i>Gain in FBI per cattle (£)</i>	70	30	20	40

In order to put these figures into more context, table eight includes a figure for the increase in FBI for each cow in an average herd. This shows that an average farm might expect to save between £20 and £70 per cow if they moved from having BVD infection present to complete eradication.

4.3 Farm-Level Financial Conclusions

Overall, while there are upfront costs of eradicating BVD, once the virus is no longer present, the farm would continue to see financial benefits over coming years and, as the financial benefits from eradicating BVD accrue every year the herd is BVD free. This could significantly outweigh the initial costs of eradication, which are only incurred at the outset.

An average farm may experience one-off costs between £2,000 and £6,000, depending on farm type, whilst taking action to eradicating BVD. However, once BVD has been eradicated an average farm would expect to experience an annual financial gain of between £2,000 and £14,000 meaning many farms could see a financial gain. As shown in table 9 below this could be potentially up to £9,000, in the just first year of being BVD free and, based on the FBS data, all farms could expect a net financial gain within around a year. Moreover, this financial gain would continue each year provided that the herd maintained the BVD free status, meaning that the benefits would outweigh the costs substantially after just a few years of being BVD free. Whilst there is a risk of reinfection, this risk continues to fall as overall prevalence of BVD falls in the national herd.

Table Nine – Net Farm-Level Benefit of Eradicating BVD

	Dairy	Less Favoured Area Specialist Cattle	Less Favoured Area Cattle & Sheep	Lowland Cattle & Sheep
<i>Stage 1 - Upfront Costs</i>	6,000	3,000	2,000	2,000
<i>Stage 2 - (1 Year) Ongoing Benefit</i>	14,000	3,000	2,000	4,000
<i>Net Impact After 1-Year</i>	9,000	Break Even	Break Even	2,000
<i>Net Impact After 2-Years</i>	23,000	3,000	2,000	6,000

Figures may not sum due to rounding

5. Sector-Level Financial Impacts

In order to indicate the possible scale of benefits for the whole cattle sector, we can consider the farm-level benefits, as shown in the table above, in relation to the number of farms with a BVD status of ‘not-negative’. As at June 2019 there were approximately 600 farms in Scotland with a ‘not-negative’ test result. Using the financial benefit figures from table seven, and assuming that these farms are split proportionally⁷ across the four farm-types considered in this paper. Total eradication would equate to a net benefit of around £0.6 million after a year, accounting for upfront costs, and ongoing net benefits, not accounting for any market responses or risk of reinfection, of around an extra £2.4 million each year overall financial benefit, not accounting for any market responses, when summed across all farms. Scottish Government BVD monitoring data suggests prevalence is higher amongst dairy herds by a factor of around two. As tables nine and seven suggest that dairy farms stand to benefit the most from removing BVD from their farm, then overall benefits across the sector would be higher as well.

6. Threshold Analysis

The analysis in Section 4 of this report relies on a number of assumptions around the size of output benefits which a farm may experience as a result of eradicating BVD. The assumptions on the size of these benefits are best-estimates based on limited data, in particular in terms of certainty around the size of the productivity benefits – so may not reflect the reality for many farms. Therefore, in order to account for potential uncertainties, it is prudent to consider the possible financial impacts using a different approach.

By considering ‘threshold analysis’, we are able to establish the minimum level of increase in outputs, due to productivity increases, which farms would need to experience in order to just cover the costs of taking action to eradicate the virus. i.e. we are able to show how much the

⁷ This means that the proportion of ‘not-negative’ farms of each farm type is the same as the overall split of farms as shown in table one. A proportional split has been used because information of the farm type of each of the 600 farms with ‘not-negative’ status is not available.

farm's output would need to increase by in order for taking action against BVD to have been financially worthwhile within just one year.

Using all of the same assumptions on cost, prevalence and farm action as used in the previous section, the increase in output needed for the average farm of each farm type to break-even are shown in table ten below.

Table Ten – % increase in outputs required to cover costs of eradicating BVD for each farm type

	<i>Dairy</i>	<i>Less Favoured Area Specialist Cattle</i>	<i>Less Favoured Area Cattle & Sheep</i>	<i>Lowland Cattle & Sheep</i>
<i>Eradication Costs as a Percentage of Outputs</i>	1%	2%	1%	1%

As shown in table ten, the average farm would only need to see an increase in output of between 1 or 2 per cent within a year in order to be able to cover the costs which they incurred from taking action to eradicate BVD from their herd. Any increases above the amounts shown in table ten would represent pure financial benefit to the farm, and any subsequent, related increases to output in future years would be additional benefit.

7. Additional Considerations

The results in this paper provide indicative savings which a typical farm of each farm type may see if it moved from having BVD present in the herd to complete BVD eradication. These results are based on assumptions about the prevalence of BVD in cattle herds and the efficacy of the BVD eradication programme. In reality these will vary between farm businesses, which implies the impacts of the eradication programme will also be variable – even among businesses of the same type or size.

For example, businesses that are currently BVD free may incur only very small increases in costs and may not observe any increases in income due to the eradication programme. On the other hand, businesses that have high incidences of BVD in their herds will most likely incur high level of costs and will also derive the largest benefits from the eradication programme. RESAS is therefore in the process of developing an interactive tool to enable estimates more relevant to farms, based on some key information. This tool should be available for farmers, academics, advisors and others to use later in 2019.

It is also important to consider how farm businesses may react to the eradication of BVD. Broadly, economic theory would suggest that increased productivity in production systems will provide businesses an incentive to further increase supply as they change production choices. In cattle production systems, this may mean an increase in herd sizes in the long run, especially relative to the baseline with low levels of herd productivity due to, for instance, BVD prevalence. In reality, however, such additional impacts and their sizes will depend on many factors, including farmer attitude, the sizes of productivity increases relative to baseline, farm size, etc.

Economic theory would also suggest that increases to productivity in a sector would feed through to lower consumer prices. However, whether or not this happened in practice would depend on the level of competition in the sector and the responsiveness of consumers to changes in prices. The potential consumer price impacts of BVD eradication have not been considered as part of this work.

Finally, even with complete eradication of BVD within Scottish herds, there remains a risk of reinfection presented by the movement of livestock to and from other UK and European countries. It is for this reason that continued testing of animals in Scotland is vital. The implications of this potential risk of re-infection were not included in the analysis presented in this paper.

8. Conclusion

At present there are approximately 600 farms in Scotland with a 'not-negative' BVD test result. There are substantial financial benefits to farmers associated with eradicating the disease and this paper has sought to estimate these.

Based on farm-level financial data and assumptions on the size of potential benefits, an average farm may stand to achieve an increase in Farm Business Income (FBI) of between £2,000 and £14,000 depending on farm type. These impacts are largest for Dairy farms, predominantly because of the larger average size of Dairy herds. This represents an overall increase in FBI of between 5 to 23 per cent - which is an increase in FBI of approximately £20-£70 per cow, depending on farm-type.

When these farm level savings are aggregated across the industry, the total benefits to FBI could be around £2.4 million if all farms with a BVD 'not-negative' status completely eradicated the disease from their farms. Furthermore, due to uncertainties around the exact size of benefits from eradication, this paper set out break-even analysis which demonstrated that the average farm would only need to experience a resultant increase in output of one to two per cent in order to cover the costs of eradication. Any increase above this amount would purely be financial benefit, and any increase in output after the first year, which is when the majority of costs are incurred would be a financial benefit from eradication.