**Supplementary material**

*Herd size calculation*

Herd size was indicative of total herd size in order to capture the effect of chance interactions between the breeding herd and other animal groups. Animal identification and movement (AIM) data from the Department of Agriculture, Food and the Marine (DAFM) enabled total herd size to be calculated for years 2013-2015 inclusive (ending 31st Dec each year), with the final herd size predicted from the mean of all three. The next step was to define the 33rd percentile for herd size, which resulted in <72 total animals on farm, below which herds were defined as small, and the 66th percentile, which resulted in >139 animals, above which herds were defined as being in the large category.

*Movement status calculation*

Using similar data from AIM for the years 2013-2015, movement status was defined as the proportion of animals moved into a herd within each year ending the 31st December, in proportion to the total herd size at the beginning of that year. A threshold was agreed that displayed minimal animal introduction into a herd. For this reason the 33rd and the 66th percentile of the grand mean of movements from all three years, provided sensible thresholds. When ranking herds based on this parameter, below 6% (33rd percentile) was considered to be a herd almost practicing a closed herd policy (‘Low move’), and above 18% (66th percentile) was indicative of a herd with a high level of annual purchases ‘High move’ herd.

*Vaccination status calculation*

Each farm participating in the epidemiological study (short title, *BeefCow*), received a brief questionnaire which was used to determine reproductive management strategies carried out on each holding. Each producer outlined their vaccination policy with regards to BHV-1, BVDv, Leptospirosis and *Neospora Caninum*, which subsequently allowed for herds actively vaccinating for BHV-1to be identified.

*Omitted risk factors*

The level of naïve individuals within a herd has a large effect on the disruptive outcome of BHV-1 introduction. Raaperi *et al.* (2012) indicated that a prolonged low level of herd seroprevalence for BHV-1creates a pool of susceptible individuals, which the authors indicated would leave the herd vulnerable to reproductive disorders upon viral introduction. In concurrence with this, Lassen *et al*. (2012) demonstrated how the odds ratio of reproductive failure increased linearly as herd seroprevalence increased. In this study, however, it was not possible to establish whether the virus was in an active or a latent state within individuals, which may ultimately lead to differences in viral outcomes. Herd seroprevalence was therefore identified as a significant contributor to BHV-1 pathogenicity; however the decision was taken to omit herd seroprevalence as a risk factor, in the absence of accurate data on seroprevalence levels of nonbreeding animals within herds.

Stocking rate was also not included as a risk factor. This was due to the unavailability of information regarding the total area farmed for each herd sampled in the epidemiological study.

**Supplementary table 1.** Implications of BHV-1 seropositivity on mean values, SEM( ± ) and *P*-values1, in key performance traits within selected risk factors

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Risk Factor** | **Scenario** | **Sero status**5 | *Calving Interval (days)* | *Live weight gain 0-225 days (g/d)* | *Reappearance rate (%)* | *Calf mortality <28days (%)* | *Calf mortality 28-225 days (%)* |
| Herd Size2 | Large | (-) | 367 ± 1.8 *(0.350)1* | 1096 ± 18 *(0.771)* | 91 ± 1.1 *(0.040)* | 3.5 ± 0.57 *(0.693)* | 1.7 ± 0.38 *(0.460)* |
| Large | (+) | 370 ± 1.8 *(0.350)* | 1090 ± 19 *(0.771)* | 87 ± 1.2 (0.040) | 3.2 ± 0.64 (0.693) | 2.0 ± 0.43 (0.460) |
| Small | (-) | 379 ± 2.3 (0.727) | 1241 ± 23 (0.366) | 79 ± 1.5 (0.153) | 2.5 ± 0.79 (0.697) | 1.7 ± 0.56 (0.254) |
| Small | (+) | 377 ± 3.6 (0.727) | 1210 ± 30 (0.366) | 82 ± 2.1 (0.153) | 3.0 ± 1.24 (0.697) | 0.7 ± 0.82 (0.254) |
| Movement Status3 | High Move | (-) | 372 ± 1.7 (0.461) | 1175 ± 17 (0.757) | 89 ± 1.5 (0.089) | 3.6 ± 0.84 (0.391) | 2.2 ± 0.44 (0.368) |
| High Move | (+) | 374 ± 2.0 (0.461) | 1168 ± 21 (0.757) | 85 ± 1.7 (0.089) | 2.6 ± 0.97 (0.391) | 1.6 ± 0.58 (0.368) |
| Low Move | (-) | 373 ± 2.4 (0.133) | 1210 ± 20 (0.286) | 86 ± 1.6 (0.751) | 2.0 ± 0.79 (0.460) | 2.0 ± 0.61 (0.513) |
| Low Move | (+) | 368 ± 3.2 (0.133) | 1166 ± 30 (0.286) | 87 ± 2.2 (0.751) | 2.9 ± 1.00 (0.460) | 2.7 ± 0.78 (0.513) |
| Vaccination Status4 | Vacc | (-) | 372 ± 2.6 (0.420) | 1170 ± 30 (0.608) | 91 ± 1.6 (0.756) | 5.7 ± 1.00 (0.278) | 1.9 ± 0.50 (0.600) |
| Vacc | (+) | 375 ± 3.7 (0.420) | 1188 ± 38 (0.608) | 91 ± 2.3 (0.756) | 4.0 ± 1.50 (0.278) | 2.6 ± 1.00 (0.600) |
| Non Vacc | (-) | 373 ± 1.3 (0.398) | 1177 ± 13 (0.381) | 90 ± 1.0 (0.090) | 2.9 ± 0.50 (0.561) | 1.1 ± 0.30 (0.379) |
| Non Vacc | (+) | 371 ± 1.5 (0.398) | 1161 ± 15 (0.381) | 88 ± 1.1 (0.090) | 3.3 ± 0.60 (0.561) | 1.6 ± 0.40 (0.379) |

2 Herd size was divided into large herds > 139, small herds <72 total animals within the herd.

3 Movement status was defined by high movement herds >18%, low movement herd < 6% total inward movements per year.

4 Vaccination Status was defined by herds which had an active vaccination protocol and herds which did not have an active vaccination protocol.

5 Sero status refers to the level of seropositivity within the cohort of animals for each scenario, where (-) = 0%, and (+) = 100%.