**Supplementary Table S1.** Herd management variables associated (*P* < 0.05) with dairy cow mortality by univariable analysis of data from 459 operations

in 17 states.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Variable Description** | **Level** | **Herds (%)** | **Model Predicted Mortality %** | **Incidence Rate Ratio** | **Standard Error** | ***Χ*2 P- value** |
|
| **Dairy Herd Information and Management Practices** |  |  |  |  |  |  |
| The number of dairy cows, whether dry or in milk, on this operation on January 1st, 2007. (Including dairy heifers that had calved.) | ≥500 | 6.4 | 7.2 | 1.2725 | 0.0889 | 0.0015 |
| 100 - 499 | 24.8 | 6.1 | 1.0754 | 0.0708 |
| 30 - 99 | 68.9 | 5.7 | Referent1 | |
| The dairy operation's practices are best described as conventional (as opposed to grazing, a combination of conventional and grazing, or organic) | yes | 68.6 | 6.5 | 1.1649 | 0.0782 | 0.0238 |
| no | 31.4 | 5.6 | Referent | |
| The number of cows per employee (i.e. paid and unpaid people, including owners and family members, assigned duties directly related to operation of the dairy) | >56 | 10.8 | 7.1 | 1.3008 | 0.1043 | 0.0026 |
| 24 - 56 | 45.2 | 6.1 | 1.1253 | 0.0852 |
| ≤23 | 44.1 | 5.5 | Referent | |
| The individual primarily responsible for balancing feed rations fed to dairy cows | Independent or Feed company nutritionist | 67.0 | 6.6 | 1.2165 | 0.0814 | 0.0037 |
| Employee (nonveterinarian), Veterinarian, Operator/Owner | 34.0 | 5.4 | Referent | |
| Forage test results were used to balance feed rations | yes | 86.6 | 6.5 | 1.3908 | 0.1473 | 0.0020 |
| no | 13.4 | 4.7 | Referent | |
| This operation fed a total mixed ration | yes | 59.9 | 6.7 | 1.4561 | 0.1073 | <0.0001 |
| no | 40.1 | 4.6 | Referent | |
| MUN (milk urea nitrogen) was used to determine ration composition | yes | 49.8 | 6.7 | 1.1751 | 0.0662 | 0.0045 |
| no | 50.2 | 5.7 | Referent | |
| This operation relies on pasture during the growing season to provide part of the forage component of the ration | yes | 52.9 | 5.7 | 0.8423 | 0.0469 | 0.0022 |
| no | 47.1 | 6.7 | Referent | |
| Lactating dairy cows received bST (bovine Somatotropin) | yes | 21.6 | 7.5 | 1.3388 | 0.0718 | <0.0001 |
| no | 78.4 | 5.6 | Referent | |
| Average calving interval, in months, for dairy cows during 2006 | >14.0 | 12.9 | 7.8 | 1.3353 | 0.1106 | 0.0013 |
| 13.1 - 14.0 | 28.3 | 6.6 | 1.1170 | 0.0651 |
| ≤13.0 | 58.9 | 5.9 | Referent | |
| The proportion of dairy cows permanently removed from the herd (excluding cows that died) during 2006 | | | | 1.0060 | 0.0024 | 0.0130 |
| Percent of permanently removed cows (excluding those that died) between 50 and 199 days in milk (mid-lactation) during 2006 | | | | 0.9972 | 0.0014 | 0.0428 |
| The proportion of permanently removed dairy cows (excluding those that died) that were removed primarily because of lameness or injury during 2006 | | | | 1.0057 | 0.0016 | 0.0003 |
| The proportion of permanently removed dairy cows (excluding those that died) that were removed primarily because of diseases other than lameness or injury, udder or mastitis problems, or reproductive problems during 2006 | | | | 1.0075 | 0.0031 | 0.0140 |
| **Milk Quality and Milking Procedures** |  |  |  |  |  |  |
| Average bulk tank somatic cell count for milk shipped during the last 12 months | >300 000 cells/ml | 29.1 | 7.1 | 1.2884 | 0.0898 | 0.0012 |
| 200-299 000 cells/ml | 40.3 | 6.5 | 1.1736 | 0.0745 |
| <200 000 cells/ml | 30.7 | 5.5 | Referent | |
| Somatic cell count from a bulk tank milk sample taken during the time of survey administration | >365 500 cells/ml | 28.0 | 6.8 | 1.2539 | 0.1016 | 0.0042 |
| 188-365 500 cells/ml | 48.0 | 6.7 | 1.2395 | 0.0850 |
| ≤187 000 cells/ml | 24.1 | 5.4 | Referent | |
| Individual(s) primarily responsible for milking the majority of cows | Hired worker(s) (non-family member) | 24.6 | 7.0 | 1.3058 | 0.0788 | <0.0001 |
| Family member(s) of owner | 15.6 | 5.7 | 1.0717 | 0.1097 |
| Owner/operator | 59.8 | 5.3 | Referent | |
| Fresh cows were milked less than 3 times per day | yes | 92.3 | 6.0 | 0.8396 | 0.0502 | 0.0032 |
| no | 7.7 | 7.2 | Referent | |
| The majority of cows were milked less than 3 times per day | yes | 93.0 | 5.8 | 0.7490 | 0.0441 | <0.0001 |
| no | 7.0 | 7.7 | Referent | |
| Frequency of milker training | Trained 1 or more times per year | 18.4 | 6.7 | 1.2438 | 0.0901 | 0.0070 |
| Trained as new employees only | 35.6 | 6.5 | 1.2127 | 0.0870 |
| No milker training | 46.0 | 5.4 | Referent | |
| **Health Management** |  |  |  |  |  |  |
| Heifers were vaccinated against at least one of the following: BVD, IBR, PI3, BRSV, *H. somnus*, Lepto, *Salmonella*, *E. coli* mastitis, or Clostridia | yes | 89.0 | 6.2 | 0.7513 | 0.0767 | 0.0046 |
| no | 11.0 | 8.2 | Referent | |
| Heifers were normally vaccinated against BVD | yes | 85.1 | 6.2 | 0.8381 | 0.0740 | 0.0438 |
| no | 14.9 | 7.4 | Referent | |
| Heifers were normally vaccinated against *E. coli* mastitis | yes | 24.7 | 6.8 | 1.1314 | 0.0619 | 0.0240 |
| no | 75.3 | 6.0 | Referent | |
| Heifers were normally vaccinated against leptospirosis | yes | 77.4 | 6.1 | 0.8533 | 0.0613 | 0.0264 |
| no | 22.6 | 7.2 | Referent | |
| Lactating cows were normally given ionophores in feed | yes | 34.2 | 7.0 | 1.2229 | 0.0654 | 0.0002 |
| no | 65.8 | 5.7 | Referent | |
| Lactating cows were normally given selenium in feed | yes | 83.1 | 6.5 | 1.1972 | 0.0876 | 0.0151 |
| no | 16.9 | 5.5 | Referent | |
| **Births, Illness, and Deaths** |  |  |  |  |  |  |
| Obstetrical gloves are worn during calving interventions | yes | 67.6 | 6.6 | 1.1904 | 0.0819 | 0.0121 |
| no | 32.4 | 5.6 | Referent | |
| This operation has a system for scoring calving difficulty | yes | 38.7 | 6.7 | 1.1261 | 0.0648 | 0.0394 |
| no | 61.3 | 6.0 | Referent | |
| Percent of dairy cows with respiratory problems during 2006 | >5.0% | 23.9 | 7.4 | 1.4301 | 0.1289 | 0.0004 |
| 0.6 – 5.0% | 38.4 | 6.4 | 1.2393 | 0.0975 |
| ≤0.5% | 37.7 | 5.2 | Referent | |
| Percent of dairy cows treated with antibiotics for respiratory disease | >3.9% | 28.0 | 7.1 | 1.3498 | 0.1002 | 0.0001 |
| 0.1 - 3.9% | 28.6 | 6.6 | 1.2519 | 0.0826 |
| 0% | 43.5 | 5.2 | Referent | |
| Percent of dairy cows with diarrhea for more than 48 hours during 2006 | >2.5% | 24.6 | 7.0 | 1.2488 | 0.0836 | 0.0005 |
| 0.1 - 2.5% | 16.5 | 6.9 | 1.2294 | 0.0783 |
| 0% | 58.9 | 5.6 | Referent | |
| Percent of dairy cows affected with mastitis in the last 12 months | >24.6% | 26.0 | 7.2 | 1.2666 | 0.0970 | 0.0064 |
| 9.0 - 24.6% | 49.4 | 6.2 | 1.0864 | 0.0733 |
| ≤8.9% | 24.6 | 5.7 | Referent | |
| Some dairy cows had neurologic problems during 2006 | yes | 15.0 | 7.6 | 1.2797 | 0.0822 | 0.0001 |
| no | 85.0 | 6.0 | Referent | |
| This operation has had cows with signs consistent with hemorrhagic bowel syndrome within the last 5 years | yes | 19.6 | 7.2 | 1.2258 | 0.0725 | 0.0006 |
| no | 80.4 | 5.8 | Referent | |
| Necropsy was used to determine the cause of death for some proportion of dairy cows that died or were euthanized during 2006 | yes | 18.6 | 7.5 | 1.2445 | 0.0669 | <0.0001 |
| no | 81.4 | 6.1 | Referent | |
| The proportion of dairy heifers and cows that aborted during 2006 | | | | 1.0290 | 0.0068 | <0.0001 |
| The proportion of dairy cows with clinical mastitis (presence of abnormal milk and/or inflamed udder) during 2006 | | | | 1.0084 | 0.0020 | <0.0001 |
| The proportion of dairy cows with clinical mastitis (presence of abnormal milk and/or inflamed udder) that was treated with antibiotics | | | | 1.0053 | 0.0019 | 0.0038 |
| The proportion of dairy cows with lameness during 2006 | | | | 1.0082 | 0.0016 | <0.0001 |
| The proportion of dairy cows with a retained placenta (more than 24 hours after delivery) during 2006 | | | | 1.0195 | 0.0036 | <0.0001 |
| The proportion of dairy cows with infertility problems (not pregnant 150 days after calving) during 2006 | | | | 1.0144 | 0.0021 | <0.0001 |
| The proportion of dairy cows with reproductive problems (e.g., dystocia, metritis) during 2006 | | | | 1.0103 | 0.0026 | <0.0001 |
| The proportion of dairy cows with a displaced abomasum during 2006 | | | | 1.0226 | 0.0070 | 0.0009 |
| **Disease Confirmation** |  |  |  |  |  |  |
| Laboratory testing during the last 12 months confirmed Salmonella from cattle on the operation | yes | 8.1 | 7.5 | 1.2222 | 0.0910 | 0.0063 |
| no | 91.9 | 6.1 | Referent | |
| Laboratory testing during the last 12 months confirmed Johne's disease (*Mycobacterium paratuberculosis*) from cattle on the operation | yes | 22.7 | 7.0 | 1.1681 | 0.0670 | 0.0066 |
| no | 77.3 | 6.0 | Referent | |
| A bulk tank milk sample taken during the time of survey administration tested ELISA positive for Bovine Leukosis Virus | yes | 83.9 | 6.6 | 1.4324 | 0.1357 | 0.0002 |
| no | 16.1 | 4.6 | Referent | |
| **Housing** |  |  |  |  |  |  |
| The primary housing facility/outside area for lactating dairy cows was a freestall during 2006 | yes | 37.7 | 6.8 | 1.2157 | 0.0688 | 0.0006 |
| no | 62.3 | 5.6 | Referent | |
| The primary housing facility/outside area for lactating dairy cows was a tie stall or stanchion during 2006 | yes | 45.3 | 5.4 | 0.8358 | 0.0610 | 0.0142 |
| no | 54.7 | 6.5 | Referent | |
| The primary housing facility/outside area for lactating dairy cows was pasture during 2006 | yes | 9.3 | 4.7 | 0.7239 | 0.0804 | 0.0040 |
| no | 90.7 | 6.5 | Referent | |
| The primary housing facility/outside area for dry (nonlactating) cows was a freestall during 2006 | yes | 27.4 | 7.0 | 1.1827 | 0.0653 | 0.0023 |
| no | 72.6 | 5.9 | Referent | |
| The primary housing facility/outside area for dry (nonlactating) cows was pasture during 2006 | yes | 16.8 | 5.4 | 0.8280 | 0.0623 | 0.0130 |
| no | 83.2 | 6.5 | Referent | |
| Concrete is the predominant flooring type that lactating cows stand or walk on when not being milked | yes | 57.1 | 6.7 | 1.1615 | 0.0710 | 0.0149 |
| no | 42.9 | 5.8 | Referent | |
| The ground or flooring that lactating cows stand on most of the time during the summer is usually dry | yes | 60.3 | 5.8 | 0.8615 | 0.0472 | 0.0067 |
| no | 39.7 | 6.7 | Referent | |
| **Biosecurity** |  |  |  |  |  |  |
| Cattle (calves, heifers, cows, or bulls) were brought onto the operation during 2006 | yes | 44.3 | 6.8 | 1.1533 | 0.0618 | 0.0079 |
| no | 55.7 | 5.9 | Referent | |
| Some dairy cow replacements that entered the milking herd in 2006 were raised off of the operation or were born off of the operation. | yes | 24.1 | 7.1 | 1.2096 | 0.0674 | 0.0006 |
| no | 75.9 | 5.9 | Referent | |
| During the last 12 months, this operation controlled access to cattle feed by other livestock and wildlife, such as elk, deer, and raccoons | yes | 48.5 | 6.7 | 1.1476 | 0.0627 | 0.0123 |
| no | 51.5 | 5.8 | Referent | |
| During the last 12 months, some cows drank from a lake, pond, stream, river, etc. | yes | 33.4 | 5.6 | 0.8553 | 0.0519 | 0.0104 |
| no | 66.6 | 6.6 | Referent | |
| Rodent control (such as cats, traps, chemical/bait, etc.) was used in the last 12 months | yes | 94.4 | 6.2 | 0.7163 | 0.0726 | 0.0007 |
| no | 5.6 | 8.6 | Referent | |
| During an average week, the number of visits by people who came onto the operation, including employees, veterinarians, neighbors, nutritionists, milk haulers, etc. | >54 | 10.4 | 7.0 | 1.1769 | 0.0871 | 0.0321 |
| 11 - 54 | 45.9 | 6.1 | 1.0170 | 0.0701 |
| ≤10 | 43.8 | 6.0 | Referent | |
| During an average week, the number of visits made to the operation by people (including employees, veterinarians, neighbors, nutritionists, milk haulers, etc.) that involved contact with animals | | | | 1.0018 | 0.0005 | 0.0005 |

1Reference category.