Preventive Veterinary Medicine 111 (2013) 268–277

Contents lists available at SciVerse ScienceDirect

Preventive Veterinary Medicine

journal homepage: www.elsevier.com/locate/prevetmed

Financial implications of installing air filtration systems to prevent PRRSV infection in large sow herds

Carmen Alonso[a], Peter R. Davies[a], Dale D. Polson[b], Scott A. Dee[c], William F. Lazarus[d,*]

[a] *Department of Veterinary Population Medicine, College of Veterinary Medicine, University of Minnesota, Saint Paul, MN, United States*
[b] *Boehringer-Ingelheim, Saint Joseph, MO, United States*
[c] *Pipestone Veterinary Clinic, Pipestone, MN, United States*
[d] *Department of Applied Economics, College of Food Agricultural and Natural Resource Sciences, University of Minnesota, Saint Paul, MN, United States*

ARTICLE INFO

Article history:
Received 9 September 2012
Received in revised form 29 April 2013
Accepted 2 May 2013

Keywords:
PRRS
Virus
Air filtration
Investment
Payback

ABSTRACT

Air filtration systems implemented in large sow herds have been demonstrated to decrease the probability of having a porcine reproductive and respiratory syndrome virus (PRRSV) outbreak. However, implementation of air filtration represents a considerable capital investment, and does not eliminate the risk of new virus introductions. The specific objectives of the study were: 1) to determine productivity differences between a cohort of filtered and non-filtered sow farms; and 2) to employ those productivity differences to model the profitability of filtration system investments in a hypothetical 3000 sow farm. Variables included in the study were production variables (quarterly) from respective herds; air filtration status; number of pig sites within 4.7 km of the farm; occurrence of a PRRSV outbreak in a quarter, and season. For the investment analyses, three Scenarios were compared in a deterministic spreadsheet model of weaned pig cost: (1) control, (2) filtered conventional attic, and (3) filtered tunnel ventilation. Model outputs indicated that a filtered farm produced 5927 more pigs than unfiltered farms. The payback periods for the investments, were estimated to be 5.35 years for Scenario 2 and 7.13 years for Scenario 3 based solely on sow herd productivity. Payback period sensitivity analyses were performed for both biological and financial inputs. The payback period was most influenced by the premium for weaned pig sales price for PRRSV-negative pigs, and the relative proportions of time that filtered vs. unfiltered farms produced PRRSV-negative pigs. A premium of $5 per pig for PRRS-negative weaned pigs reduced the estimated payback periods to 2.1 years for Scenario 2 and 2.8 years for Scenario 3.

1. Introduction

Porcine reproductive and respiratory syndrome virus (PRRSV) infection was first recognized as a novel disease causing reproductive and respiratory disease in U.S. swine in the late 1980s (Keffaber, 1989). Soon after outbreaks of a similar syndrome also occurred in Europe (Wensvoort et al., 1991), and two distinct genotypes of the PRRSV were subsequently identified from these early North American and European cases (Murtaugh et al., 2010). Subsequently PRRSV emerged to be a major pandemic swine disease, now universally regarded as the most significant health problem in the US swine industry (Neumann et al., 2005; Holtkamp et al., 2011). A member of the Arteriviridae, PRRSV is an RNA virus with remarkable capacity for genetic change

* Corresponding author at: 249a Ruttan Hall, 1994 Buford Ave, St. Paul MN 55108, United States.
E-mail address: wlazarus@umn.edu (W.F. Lazarus).

0167-5877/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.prevetmed.2013.05.001

via recombination and mutation, which has contributed greatly to the difficulty experienced in controlling the disease (Murtaugh et al., 1995; Kapur et al., 1996). PRRSV has diverse clinical manifestations in both breeding and growing pigs and can cause dramatic production losses due to reproductive failure (particularly abortions in late gestation), increases in the number of weak live-born pigs and preweaning mortality, severe pneumonia in neonatal and nursery piglets, reductions in growth performance and increased rates of mortality and culled pigs (Zimmerman et al., 2012).

The financial impact of an acute outbreak of PRRSV was estimated to be at $255/sow in breeding herds and between $6.25 and $15.25/pig in the growing phase (Holck and Polson, 2003). However, the financial impact of PRRSV is not confined to the acute phase of the initial outbreak. Prolonged losses can occur due to both diminished reproductive and growing pig performance. Neumann, et al. (2005) estimated the annual financial impact of PRRS for U.S. pork production to be $560 million in 2005, with 45% of losses due to a decline in the average daily gain and feed efficiency in growing pigs; 43% due to mortality in growing pigs, and 12% attributed to reproductive losses (Neumann et al., 2005). A more recent study incorporating updated estimates of disease prevalence and apparently more virulent new PRRS strains estimated the annual cost to be $664 million (approximately 20% higher than the 2005 estimate), and attributed 55% of losses to effects on growing pigs (Holtkamp et al., 2011). Producers have made substantial investments across diverse strategies to control PRRS, including gilt pool management and acclimation (Dee et al., 1995); vaccination programs (Cano et al., 2007); biosecurity interventions including transport and insect control (Otake et al., 2002; Dee et al., 2004), and “herd closure” (Torremorell et al., 2003). As management and biosecurity procedures evolved to address the multiple routes of PRRSV transmission, it has become apparent that much of the residual risk of infection in hog dense regions is associated with airborne transmission (Dee et al., 2012; Alonso et al., 2013 companion paper).

2. Background to the decision to filter

Both field and experimental studies support the likely importance of aerosol transmission of PRRS and the potential for air filtration systems to reduce the risk of new virus introductions (Dee et al., 2010a; Spronk et al., 2010; Alonso et al., 2013 companion paper). In the US midwest, numerous sow farms have implemented air filtration systems in swine dense areas (Dee et al., 2010b; Spronk et al., 2010). The aim of the present study was to assess actual production data in filtered and non-filtered farms to determine potential productivity differences, and use observed differences to model the financial impact of two options for filtration interventions using a partial budget analysis.

3. Capital investment analysis – principles and evaluation criteria

The acquisition of a new technology or the purchase of any new equipment such as a swine barn air filtration system is an example of a capital investment, i.e. additions of new durable assets to business that will generate a cash flow benefit for more than one year. Economists use the terms “capital budgeting” or “discounted cash flow analysis” to describe the general approach recommended for taking accurate account of the time value of money, i.e. that a dollar in the pocket today is worth more than at some point time in the future. The steps recommended in many finance textbooks for doing capital budgeting are; identify potentially profitable investment alternatives to be compared (e.g. PRRSV control programs); collect relevant data on cost, returns and capital outlays; choose an appropriate criterion for choosing one of the alternatives based on the data; evaluate the sensitivity of the results to differences in key variables that may be relatively uncertain; and select one of the alternatives (Olson, 2010). The alternatives may be as few as two (such as to install filtration or do nothing, as in this study) or possibly several strategies in addition to doing nothing.

In this paper the perspective taken is that decision makers making the investment decision are swine operators who have not yet installed air filtration, and the data on costs, returns, and capital outlays is based on the study farms. A number of different investment criteria are discussed in finance textbooks, but given space limitations only two will be mentioned here: net present value (NPV) and payback period.

NPV is often preferred because it considers the cash flows over the entire life of the investment, with future cash flows in each period adjusted by a discount rate that accounts for decision makers’ preferences for timing and risk. However, the calculations are complicated, and perhaps more difficult to interpret than payback period for farmers and their business advisers who may be less familiar with discounting and compounding calculations (Zweig, 2013). Payback period is the criterion chosen for this analysis because the logic of this procedure is very clear and understandable for producers. Furthermore, the considerable volatility in input costs (e.g. feed) and revenue streams (e.g. market hog prices) introduces considerable uncertainty to future cash flows using NPV. In adopting the payback period approach, we recognize the inherent limitations that cash flows beyond the payback period are ignored and that cash flows are not discounted to adjust for the time value of money.

For the purpose of this analysis, a partial budgeting approach is taken that focuses on the incremental cash flows affected and ignores those cash flows that remain unchanged.

4. Methodology

4.1. Description of the study population

Production and descriptive data were collected retrospectively from 21 volunteer single-site farrow-to-wean herds already enrolled in an epidemiologic study for evaluating the efficacy of filtration systems in large sow herds (Alonso et al., 2013 companion paper). The group of farms consisted of a voluntary sub-group from the previous study