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SIMULATION OF THE EVOLUTION OF PORCINE REPRODUCTIVE AND RESPIRATORY SYNDROME INFECTION IN ENDEMIC FARMS

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Nous présentons une simulation sur l'évolution de l'infection par le virus du syndrome reproductif et respiratoire du porc dans une ferme à cycle complet. Le programme a été élaboré à l'aide du Quickbasic v 4.5. comme un modèle stochastique et dynamique basé sur le méthode de MonteCarlo. Un total de 50 variables ont été considérées. Quatre groupes ont été distingués: truies, porcelets, post-sevrage et engraissement. Quand l'infection arrive pour la première fois dans une ferme, on observe une croissance subite de l'épidémie jusqu'aux 6-8 semaines après l'introduction du virus. Après, la maladie décroît chez les femelles et réapparaît 30 semaines plus tard si on n'applique pas des mesures de contrôle et l'entrée de jeunes truies susceptibles continue. Une fois que la maladie est endémique, on peut l'éradiquer si on cesse d'introduire des truies susceptibles et on vide les modules de post-sevrage.

Since the first porcine reproductive and respiratory syndrome (PRRS) description in Europe in the early 90s, several strategies to control the infection have been proposed. Most of them rely on single or combined measures as partial depopulation, gilt management and vaccine programs. We present a simulation model exploring, on a theoretical basis, these strategies for the control or eradication of PRRS.

The model has been written using Quickbasic v.4.5, and designed as a stochastic and dinamic simulation based on the Monte Carlo method. The program simulates conventional farrow-to-finish farms allowing different options from farms where PRRS infection is endemic and stabilized to farms where the virus enters for the first time. Five types of modifiable variables have been included: productive parameters (10 variables), initial prevalences of infection and antibodies (6 variables), duration of infection and antibodies (10 variables including means and standard deviations), probabilities of infection (12 variables) and other variables related to the control strategies (vaccination, depopulation, etc.,12 variables). The simulation runs on a weekly basis considering the farm population divided in females (sows and gilts) and pigs from unweaned to finishers. Four possible stages of infection have been considered: uninfected, viraemic, viraemic and seropositive (only for young animals) and non susceptible seropositive animals. Three variables are recorded for each animal: 1) time from last farrow date or the age of the animal (depending if they are sows or growing pigs), 2) the stage of disease and 3) its duration. Results of the simulation indicate that when infection appears for the first time in a fully susceptible herd, an epidemic peak in sow population is observed around 6-8 weeks after the primary cases (Table I). Then, the infection shows a trend to lower in the short term but, after some 30 weeks, a new epidemic could occur. It is assumed that no action is taken to cut the flow of susceptible gilts into the sow population and a virus feedback from weaned pigs to their mothers exists. For nurseries, the epidemic peaks four weeks later than in sows becoming endemically infected as long as the simulation was run, assuming that no control measures were implemented. For growers, PRRS evolution was quite similar to that of the nurseries.
Simulating a farm where PRRS is endemic, infection can be controlled in sows either stopping introduction of susceptible gilts or vaccinating (Table II). If partial depopulations are carried out in nurseries or weaned are vaccinated, there is a huge probability to be succesful in eradication of the disease in all stages of production.

Table I
Percentages of viraemic animals distributed by stages of production and weeks. In this case, no control actions were considered in the simulation

Weeks	sows	unweaned	nursery	growers
0	0	0	0	0
8	50	2.5	35	28
16	1.6	0	28	23
24	1.2	0	23.5	18
32	3.4	0	13.6	16
40	11.2	1	23	18
48	18	1	45	25

Table II
Percentages of viraemic animals distributed by stages of production and weeks. In this case the simulation was run implementing control measures

Weeks	sows	unweaned	nursery	growers
1	15	0	33	33
8	6	0	14	18
16	3.4	0	32	19
24	12	1	36	22
32	10	0	18	18
40	3.4	0	0	0
48	0	0	0	0

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