EFFICIENCY AND COST COMPARISON OF DIFFERENT CLEANING AND DISINFECTING PROCESSES FOR PIG FARMS.

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Introduction

An effective scheme of cleaning and disinfection makes possible to reduce incidence and consequences of numerous diseases. Programs of cleaning and disinfection have been proposed for a long time to pig farmers but the recommendations have been more based on practical experience rather on scientifically established data. In addition, these operations considered as difficult and little gratifying are not always correctly implemented by pig farmers (Corrégé, 2002) and they represent a considerable cost, particularly in terms of working time. The aim of this study is to propose an optimised scheme of cleaning and disinfection for barns.

Materiel and methods

This study was led in the two ITP experimental farms. Various methods, at each principal stage of cleaning and disinfection of the buildings were compared in farrowing, post-weaning and fattening units (table 1). For each test carried out, the method to be tested was compared with a beforehand-defined standard program of cleaning and disinfection. This comparison was made either in the two halves of the same room, or in two identical rooms having contained the same batch. Efficiency of cleaning was approached by measurement of TPA (URL) and quality of disinfection by aerobic colony counts 48 hours after the disinfection(Corrégé et al., 2003), on 15 sites shared out within the room. (De Azevedo Araujo, 2002). Labour times and water and products consumption were recorded for each test in order to calculate the cost of these operations. Statistical analysis, both for TPA and bacterial counts, was carried out with software SAS, by variance analysis (GLM procedure) applied to logarithmic values of bacterial counts and URL.

Results and Discussion

Automatic soaking system (i.e. ramp of steeping with timer) in comparison with manual steeping (flat jet) doesn't lead to any improvement of cleaning and disinfection (table 2). Nevertheless, it reduces considerably costs thanks to a saving of labour time of 30 hours per year for 100 sows. These results don't join those reported by Foucher (1997), which allotted to automatic soaking a better effectiveness considering bacteriological results. Actually, it seems that the better general efficiency of automatic soaking thanks to the sequential water distribution is cancelled by a better local efficiency of manual soaking (the operator is spending more time when surfaces are difficult to wash or very soiled).

The use of a detergent, before or after the phase of pressure wash, allows a significant improvement of the quality of cleaning. On the other hand, disinfection is significantly improved only when the detergent is applied after pressure wash. Using detergent before pressure wash reduces time necessary to this operation, of 1,5 hours in farrowing units, 6,5 hours in post-weaning and 15 hours in fattening (for 100 sows in production). In farrowing units, the economy of time is not sufficient to compensate for the cost of the product. Yet, in post-weaning and fattening, there is a profit of 60 € per year for 100 sows.

The draining and the washing of the slurry pits improve decontamination of the rooms, and more particularly, of the grounds and the high parts of the walls. In the rooms where the slurry pits are emptied then washed, the quantity of alveolar dust (particles of diameter < 1µm) is reduced of more than 50%. Since particles measuring less than 4µm are able to carry bacteria (GUINGAND, 1994), the reduction of their number should limits the recontaminations.

Disinfecting with pulverization in comparison with foam leads to similar results in term of disinfecting efficiency. Thus, the better bacteriological efficiency of foam (in comparison with pulverization) brought back by Mahe (2002) has not been checked. The explanation could that the recommended quantities of disinfecting solution by m² of surface (0.3 l/m²) were scrupulously followed, which is unusual under farms conditions, because of the very large quantities of disinfecting solution required (120 litres / 100 m²). So time needed for pulverization is definitely higher than for foam (annual total over cost of 18.5 € per productive sow).

A second disinfection, either by foam or by thermonebulisation, results in a reduction of the bacterial contamination. Moreover, the thermonebulisation allows to reach inaccessible parts of the barn: the level of contamination of the slurry pits decreases significantly and is similar with the one obtained after the first disinfection of the pits using foam disinfection. In addition, the cost of a second disinfection by thermonebulisation is lower than the double disinfection using foam.

The heating of the room by "thermobile" at the end of disinfection process allows a faster drying of the buildings: heated rooms start to dry from the first day after disinfection and are completely dry at the end of 48 hours (temperature and hygrometry were recorded). On the contrary, in not heated rooms, drying starts later and humidity persists until day sixth after disinfection. In the second day after disinfection, the majority of the heated rooms presents a contamination lower than the not heated ones. Nevertheless, the only really significant reduction (34 observations, $p \leq 0{,}05$) was observed during a repetition carried out whereas the outside temperature was 2°C. Finally, heating seemed a good way to reduce contamination, at least in winter time. Its use 6 months per year represents an annual cost close to 600€.

Incidence of the heating on the level of contamination can be explained by two manners:

- Reduction of the dust level following a faster drying: the dried particles, lighter, can be eliminated more easily by ventilation and the risk of recontamination (by the deposit of this dust) is thus reduced.

- Conditions less favourable to microbial survival: the heating of the rooms allows a faster elimination of water and thus makes the bacterial multiplication more difficult. In the contrary, temperature increase (supporting the bacterial development) is in itself a factor of risk; this is why the complete elimination of water must occur quickly.

The use of a clean downtime of 6 days doesn't seem to be a good alternative to heating: indeed, average bacterial counts on day 6 is significantly higher than on day 2 (both in heated and not heated rooms). A clean downtime under our operating conditions has not allowed to reduce the bacterial contamination. On the contrary, this phase supported the recontamination of the buildings.

Several assumptions can be advanced to explain this recontamination:

- The development of the residual germs (still present after disinfection): the absence of heating, by slowing down drying, could maintain wet conditions supporting the bacterial proliferation,
- The phenomenon of sedimentation of the suspended particles, which can contaminate surfaces concerned,
- Flow of ventilation during the clean down time; being maintained at minima (20% of its maximum capacity), recontaminations could occur, coming from the roofs or of the not disinfected slurry pits. A total stop of ventilation would however not have allowed the drying of the rooms.

These results let suppose that a fast drying of the buildings (immediately after disinfection), during 48 hours at least, is more efficient than a long clean downtime.

Conclusion

The tests implemented to analyse the successive stages of cleaning and disinfection process permit to define the most adequate program regarding efficiency of decontamination; that is to say: the use of a detergent after pressure wash, the draining and the pressure wash of the pits, a double disinfection by thermonebulisation and finally the heating of the room after disinfection. In addition, the installation of an automatic soaking system, the use of a detergent before pressure wash and a foam disinfection reduce clearly the cost of the operations of cleaning and disinfection (mainly by dumping out the requested labour time).

References

CORRÉGÉ I., 2002. Journées : « De la démarche hygiène et biosécurité », ISPAIA-SOGEVAL, Ploufragan.

CORRÉGÉ I., DE AZEVEDO ARAUJO C., LE ROUX A., 2003, Journées Rech. Porcine

DE AZEVEDO ARAUJO C., 2002. Thèse de doctorat vétérinaire, Toulouse.

FOUCHER V., MADEC F., 1997. Journées Rech. Porcine, 29, 7-16.

GUINGAND N., 1994. Les poussières en porcherie. Synthèse bibliographique.

MAHE F., 2002. Journées : « De la démarche hygiène et biosécurité », ISPAIA-SOGEVAL, Ploufragan

Table 1 : Results of the various trials and statistical tests

Trial	Method	Number of data	Means and Anova (1) TPA (URL)	Bacterial counts
Soaking	Automatic	150	960 ns	51 ns
	Manual		885	30
Detergent before washing	With	120	393 *	28 ns
	Without		715	43
Detergent after washing	With	120	162 **	15 *
	Without		395	17
Disinfection	Foam	102	520 ns	101 ns
	Pulverisation		876	112
2éme Disinfection by foam	Before	158	998 ns	61 **
	After		519	28
2éme Disinfection thermonebulisation	Before	136	303 ns	27 *
	After		367	10
Heating	Yes J+2	204	2688 ns	16 a
	No J+2		2596	21 a
	No J+6		1546	35 b
Clean downtime	J+1	279	3223 ns	23 a
	J+3		2010	34 b
	J+6		2837	44 c

(1) : ns :not significant, * : p≤ 0.05, ** : p ≤ 0.001

(a, b,c) indicate groups with a significant difference with p≤ 0.001

Table 2: Annual cost price in € for 100 productive sows

Methods		Labour Hours	Labour Cost	Other costs (1)	Total cost
Soaking	Automatic	0	0	143	143
	Manual	23,6	288	14	302
Detergent		9,3	114	213	327
Disinfection	Foam	9,7	118	877	995
	Pulverisation	88,0	1080	873	1953
2éme Disinfection	Thermonebulisation	9,5	116	553	669
	Foam	9,7	118	11	1000
Heating	Thermobile	0	0	615	615

(1)water, electricity, fuel, products, investment depreciatio