BIOSECURITY, HEALTH CONTROL, FARMING CONCEPTION AND MANAGEMENT FACTORS : IMPACT ON TECHNICAL AND ECONOMIC PERFORMANCES

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SUMMARY

This study is based on an analysis of relationships between the characteristics of farms with a regard to biosecurity, health control, farming conception, management factors and technical and economic performances. Questionnaires were used to gather information about farming characteristics and practices. Seven techno-economic indices from the technical and economic database (GTE) have been identified: sow productivity, average daily gain, feed conversion ratio, mortality rate, medication costs, lean meat percentage and percentage of pigs within optimum carcass weight range. A standardized margin was defined in order to summarize the economic effect.

The influence of some farming practices and characteristics on the technical and economic performances was demonstrated: the technical and economic results were lowered by diseases with clinical signs. Good building conception, strict management with a rigorous batch farrowing, a complete protocol of cleaning and disinfection and correct sanitary practices were linked to good technical and economic performances. The difference of the margin between farms with and without favourable practices is estimated at around 180 €/sow/year.

INTRODUCTION

Numerous recommendations concerning biosecurity, hygiene and management factors are given to farmers through the Good Hygiene Practices Guide or other improvement initiatives. In a difficult economic environment, these advances may appear as additional obligations that require investments or changes in practices without necessarily favourable effects on technical and economic performances of farm.

The purpose of this study is to analyze the relationships between the characteristics of farms with regard to biosecurity, conception and management and their technical and economic performances.

MATERIAL AND METHODS

In 166 farrow-to-finish pig herds, questionnaires were used to gather information on farming characteristics and practices. The questionnaire, with a little over 400 points, focused on biosecurity, quarantine, feed and farming management, types of rooms for each physiological stage, health control, protocol of cleaning and disinfection [2].
The following seven techno-economic indices from the French technical and economic database (GTE) were selected:

- sow productivity: number of pigs produced per present sow and per year (Productivity),
- average daily gain (8-115kg), in g per day (ADG),
- feed conversion ratio (8-115kg), in kg of feed consumed per kg of growth (FCR),
- mortality, from weaning to sale, in percentage (Death rate),
- medication costs, in € for 100kg of carcass weight (Health cost),
- lean meat percentage (carcass leanness),
- percentage of pigs within optimum carcass weight range (% of range).

The standardized margin (in €/present sow/year) was calculated to have an economical estimation [2].

Standardized margin = product – feed cost – replacement cost With: the technical indices are those of GTE results from each farm. The economical indices (pork and feed prices) are the average values over 5 years.

In a first step, the 8 technical and economic indices have each been submitted to a statistical analysis independent from the others. The relationship between farming practices (descriptive and explicative variables) and each of the 8 technical and economic indices (quantitative variables that we want to explain) has been studied in 2 stages: an ANOVA with one factor followed by a multivarious analysis with a multiple linear regression model (GLM-SAS).

In a second step, the impact of good practices on technical and economic performances was assessed. For each variable included in the 8 multivariate models, a score of 10 is attributed to farms complying with the favourable modality of this variable. By adding these individual scores, a global index is calculated by farm. The farms are grouped in 3 profiles (Profile 1: unfavourable practices, Index ≤ 150 - Profile 2: average practices, 150 < Index ≤ 200 - Profile 3: favourable practices, Index >

200) and the impact of these profiles on the 8 technical and economic indices is analyzed (GLM -SAS).

RESULTS

Farming characteristics linked to technical and economic performances

For each 8 technical and economic indices, the results of analysis of variance with one factor and multiple linear regression models are presented in Table 1. The number of significant variables at 5% of the univariate analysis varies from one variable to another: some explanatory variables are linked to medication costs and percentage of pigs within optimum carcass weight range, respectively 14 and 18. On the contrary, for the daily gain and the standardized margin, respectively 47 and 53 variables are emphasized.

Table 1: Results of statistical analysis

	Sow Productivity	ADG (g/d)	FCR (kg/kg)	Death Rate (%)	Health cost (€/100 kg)	Carcass leanness	% of range	Margin (€/ sow/ Year)
Univariate analysis: N*	41	47	37	38	14	34	18	53
Regression model : N	8	6	6	5	5	4	5	6
Regression model : R^2	0,33	0,32	0,24	0,20	0,21	0,20	0,16	0,31
* number of significant variables								

The regression models emphasize four to eight variables related to each indice. Practices which have a positive effect for each of these 8 models are:

- **sow productivity:** age of weaning at 21 days, no change of pens and presence of large rooms in post-weaning, over 50% of partition walls between the pens in the fattening unit, on farm mixed-diet, antibiotic treatment in fattening, footbath in front of rooms and in corridors.
- **average daily gain**: farm geographical localization, over 80% of slatted floors in fattening, all in-all out management in fattening, no clinical PMWS in post-weaning, manure spreading equipment in common, correct protocol of cleaning/disinfection in farrowing units.
- **feed conversion ratio**: dead animals stocked in a closed container, systematic disinfection in post-weaning unit; in fattening unit, all in-all out management, less than 24 pigs per pen, no clinical PRRS and use of a detergent.
- **mortality**: dead animals stocked in a closed container, no change of pens in post-weaning; in fattening, less than 24 pigs per pen, no clinical PRRS and systematic disinfection.
- **medication costs**: no ileitis vaccination and no antibiotic treatment in post-weaning, correct management of manure, automatic soaking in farrowing units, Cleandown time more than 48 hours in post-weaning units.
- **lean meat percentage:** farm geographical localization, no heat-treated feed, washing pits in farrowing unit and corridors cleaning and disinfection.
- **percentage of pigs within optimum carcass weight range:** low rate of piglets adoption, no pre-fattening unit, no clinical signs in farrowing unit and cleaning and disinfection of the loading area.
- **standardized margin:** more than 20% of piglets adoption, no change of pens and presence of large rooms in post-weaning unit, over 50% of partition walls between the pens in fattening, no clinical PRRS in pregnant sows and a favorable salmonella serological status.

Impact of farming conditions and practices on technical and economic performances

Apart from the medication costs and the percentage of pigs within optimum carcass weight range, there is an effect of the farming profile on technical and economic indices (Table 2). For the standardized margin, the 3 profiles are significantly different from each other, with values of profile 1, linked to unfavourable practices, lower than those of profile 2, itself lower than those of profile 3. For the productivity, results of profile 3 farms (with favourable practices) are significantly higher than those of profiles 1 and 2. For other indices, the averages of farms in profile 1 are lower than those of profiles 2 and 3 which are not significantly different. Finally, difference of technical performances between these 3 profiles are important, concerning productivity, average daily gain, feed conversion ratio and mortality. The economic impact, estimated from the standardized margin, shows a difference in margin of 83 €/present sow/year between profiles 1 and 2 and 85 € between profiles 2 and 3. This difference reaches 182 €/present sow/year in favor of farms with favourable practices (profile 3) compared to farms with unfavourable practices (profile 1).

Table 2: Average results of farms from the 3 profiles

Technical and economic indices	p	Practices			△ Profile 3 – profile 1
		Unfavourable Profile 1	Average Profile 2	Favourable Profile 3	
Number of farms		43	90	33	
Sow Productivity	<0.001	20.3 a*	21.0 a	22.2 b	+1.9
ADG (g/d)	<0,005	654 a	676 b	682 b	+ 28
FCR (kg/kg)	<0,0001	2.73 a	2.61 b	2.59 b	– 0.14
Death Rate (%)	<0,001	7.94 a	6.64 b	5.73 b	– 2.21
Health cost (€/100 kg)	ns	6.33	6.20	6.61	nc
Carcass leanness	<0,005	61.35 a	61.76 b	61.89 b	+ 0.54
% of range	ns	84.0	84.0	84.6	nc
Standardized margin (€/sow/year)	<0,0001	863 a	960 b	1045 c	+ 182

* Different letters in a row mean a significant difference at 5% level, ns not significant, nc not calculated

DISCUSSION

The epidemiological questionnaire used was developed for a risk-factors study of the contamination of pigs by salmonella and not especially for this analysis [2]. Also, some variables that could have an impact on technical and economical performances were not taken into account: for example, some information on the health status, on the use of drugs or even on the feed and the reproduction management. This can be why, only a low part of the variation of technical and economic indices (R^2 from 0.16 to 0.33) is explained by the models obtained. Despite this, this study allows us to show the influence of health control, some biosecurity measures and farm management on technical and economic performances.

In this study, although the medication costs are not linked to the farm profile, some farm practices are linked to drugs cost and also previous studies have demonstrated the relationship between this cost and the sanitary status of farms and some farm conditions such as the respect of all in- all out management, of density or of some measures of bio-security [4].

The calculation of index which describes practices may be questionable: it doesn't consider all farming practices which influence performances and it doesn't prioritize them. It shows however an aspect of the bio-security level and health as well as conception and farming management. It also emphasizes important differences in farming performances.

As we know, considering the number of farms taken in account as well as the methodology applied, this is the first study of that size used to estimate technical and economic consequences of good farming practices.

Indeed, few studies have examined the relationships between performances and farming practices. Cariolet et al. [1] used an evaluation grid of health to highlight differences between sow productivity and feed efficiency. Laanen et al. [3] also underline a relationship between the level of external biosecurity and the average daily gain, but not between internal biosecurity and the average daily gain, neither between biosecurity levels and mortalities. These different studies are based on index calculation to characterize farms, but the lack of harmonization between them makes hard results comparison.

CONCLUSION

An important number of factors influencing technical and economic performances are highlighted. These results help to argue in favour of respect of recommendations with regard to biosecurity, health control, conception and farming management. Farms implementing favourable practices have a higher margin. This should motivate farmers to apply strict policies of health control but also to think about modifications in practice or in farming conceptions which make for an optimization of technical and economic results. This study constitutes also a strong argument to the implementation of the Good Hygiene Practice Guide in pig farms.

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