

# PNEUMONIA AND EFFICIENCY OF PIG PRODUCTION

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## INTRODUCTION

As pneumonia continues to be a very common disease of pigs, its cost to pig producers is an important question. Published estimates of the effects of this disease as summarized in Table I are conflicting, and indicate the need for further work. Previous studies, except those made by Huhn (7), were based on the presence or absence of lung consolidation and not on the actual extent of consolidation in individual pigs. This study was undertaken to determine if there was an underlying relationship between the proportion of consolidated tissue in the lung and the various performance data available for pigs from a Pig Testing Station (MLC), Stotfold, England. The effect on production of clinical pneumonia requiring treatment was also investigated.

## MATERIALS AND METHODS

Animals for the test were a hog/gilt pair and a pair of boars from the same litter. These pairs were maintained under two different husbandry systems. Hog/gilt pairs were reared in a controlled environment house and were held in concrete pens (9' x 7'), 100 such units constituting one self-contained wing with a common air space. The house was heated in an attempt to maintain an average temperature of 65°F, but temperatures as low as 54°F were occasionally recorded. A ventilation rate of up to 10,000 c.f.m. could be provided and a high standard of general hygiene was maintained.

The time taken to fill a wing (200 pigs) depended on the availability of pigs for test and in the period under review was approximately 18 days (differences in time of entry were not likely to alter the results). The pigs arrived at about 45 lbs live weight and were

slaughtered when the pair reached a combined weight of 400 lbs.

The other husbandry system housed litter-mate boar-pairs in 20 shelters with runs, under an umbrella-type roof which was sufficiently open at the eaves to provide ventilation. Each boar-pair had an exercise run 4' x 8' adjoining the shelter.

For all pigs food consumption was measured accurately and live weights were recorded weekly. Records were kept of all medications given to pigs while on the station. Animals were treated for respiratory disease when shallow rapid respirations were first noticed, as these were taken as being indicative of clinical signs of pneumonia. These animals have been designated as "treated pigs" in this paper, treatments for other symptoms being ignored. Animals used in this study were two consecutive throughputs of one controlled environment wing. Pigs born between April and June were tested during the summer and completed test between September and November. Pigs born between May and July were tested during the winter and completed test between November and January. Their litter-mate boar pairs were kept in the open environment. Conditions at two different times of year were therefore represented. These two groups were called summer and winter groups respectively.

### *Performance Parameters*

The following observations were recorded to judge the performance of animals on test:

1. Days on test = number of days to grow from 60 to 200 lb body weight for a boar and from 120 to 400 lb body weight of a hog/gilt pair (combined weights) from one pen.
2. Food conversion = food consumed during the test period divided by the weight gain. This was measured separately for each of the boars but a combined figure is given for the hog/gilt pairs.

### *Lung Examination*

The lungs of all animals in the study were examined at the local bacon factory. A standard card which depicted the limits of the bronchopulmonary segments of the dorsal and ventral aspects of the pig lung as described by Talanti (8), was used for each pig. The amount of visible macroscopic consolidation was recorded by shading on each card. Any

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TABLE I

ECONOMIC ESTIMATES OF THE EFFECT OF PNEUMONIA IN PIGS—SURVEY OF PUBLISHED DATA

Data	Authors	Method	Calculated effects of pneumonia on production
1953	Betts & Beveridge (1)	Pigs inoculated with macerated pneumonic lung, compared with controls	25% depression in weight gain
1955	Betts, Whittlestone, Beveridge, Taylor, Campbell (2)	Control pigs injected with normal lung tissue compared with pigs injected with pneumonic tissue	16% depression in growth rate 22% depression in food conversion efficiency in pigs between 40–200 lbs
1963	Goodwin (6)	3 consecutive general financial assessments comparing two years, when pneumonia incidence was low, with one where it was high	Reduced profit of £1.7 per pig
1964	Englert and Eisenack (5)	2 groups of pigs were used. Each group was placed in contact with 1 clinically pneumonic pig	“Enzootic pneumonia causes economic losses in pigs even if the hygienic, feeding and housing conditions are free from objection”. The lowered weight gains in pneumonic pigs were not statistically significant from non-pneumonic pigs
1965	Eikmeier and Mayer (4)	Farm survey—pneumonic pigs were compared with unaffected pigs	No difference in daily gain and food conversion for animals with or without pneumonia
1965	Björklund and Henricson (3)	Pig Progeny Testing Station	No difference in daily gain for animals with or without lung or nasal changes or both together
1970	Huhn, R. G. (7)	Pigs fattened under similar experimental conditions. Post mortem classifications of severity of lung lesions compared with performance	Moderate to severe pneumonia significantly affected the average daily body weight gain

consolidated tissue not visible on the surface of the lung was therefore not recorded. A quantitative assessment of the amount of consolidation was obtained by determining the percentage of squares of a standard transparent grid which covered the shading on the diagram. This method reflected the extent of externally visible consolidation in any lung, irrespective of the location of the pneumonic tissue. Pigs were allocated to one of four groups showing no consolidation, 0–5% consolidation, 5–10% consolidation, and greater than 10% consolidation respectively. No attempt was made to age the pneumonic lesions or to assess the severity of the inflammation.

*Statistical Analysis*

All statistical comparisons were done by using simple “t” tests and also analysis of variance. In order to determine how changes in the proportion of pneumonic lung tissue affect

values of the various performance criteria, linear regressions were applied to the data for the hog/gilt pairs and boars for the summer and winter groups. A hog/gilt pair was regarded as one experimental unit. Comparisons were made between treated and non-treated animals for boars and hog/gilt pairs, and in the case of hog/gilt pairs also with pens where one animal was treated and one not treated. Differences in growth rate (average days on test – D.O.T.) and average food conversion efficiency (F.C.E.) of treated animals were expressed as a percentage of the values for the D.O.T. and F.C.E. of untreated animals (% depression in Table III).

RESULTS

*The effect of season and housing on the extent of pneumonia*

Overall, boar-pairs housed in naturally ven-

TABLE II  
THE EXTENT OF PNEUMONIA IN THE VARIOUS GROUPS OF PIGS EXAMINED

	Total number of pigs examined	Percentage treated for pneumonia	Treated Pigs		Untreated Pigs	
			Percentage with consolidation in the lungs	Mean extent of consolidation in affected pigs	Percentage of pigs with consolidation in the lungs	Mean extent of consolidation in affected pigs
<i>Summer</i>						
Hogs/Gilts	135	28	50	13.4%	66	9.4%
Boars	49	27	54	6.8%	42	7.4%
<i>Winter</i>						
Hogs/Gilts	172	26	64	12.4%	56	9.8%
Boars	76	33	56	9.4%	49	8.2%

tilated shelters had a lower percentage of lungs showing consolidation than did hog/gilt pairs housed in a controlled environment and the extent of this consolidation was considerably less in animals from the naturally ventilated kennels (see Table II). Comparison between treated and untreated groups revealed the proportion of pigs with pneumonic lungs and the extent of the consolidation tended to be greater in the treated group.

#### *The effect of treatment for pneumonia on performance*

Pigs treated for pneumonia performed less well than pigs which were not treated (Table III). In the case of hog/gilt pairs the results were given as an average for the pair and therefore pairs have been classified as follows: both treated, one treated, neither treated. Although the trends were the same in summer and winter it was only in the winter that significant differences could be demonstrated using the small numbers of pigs in this sample.

#### *The effect of the extent of lung consolidation on performance*

The mean number of days to complete test by pigs with varying percentages of consolidated lung tissue are given in Table IV. No significant correlation could be demonstrated between the extent of lung consolidation and the days on test, either in treated or in non-treated animals or when these were combined. Data for food conversion are shown in Table V. No significant correlation could be demonstrated between the extent of lung consolidation and the food conversion efficiency in either treated or untreated animals or when these were combined. Pigs that had been treated for pneumonia were excluded from the table because of the small numbers in each group.

#### DISCUSSION

Some previous reports (Table I) have suggested a depression in growth in the order of 16–25% resulting from porcine pneumonia. In this investigation we were unable to show that pneumonia as judged by the percentage of the lung found to be consolidated at post mortem examination had any effect on either the growth rate or the food conversion efficiency.

Pigs with clinical symptoms of respiratory disease and which were treated, were shown to have significantly lowered performance during the winter under both systems of housing. Clinical pneumonia during the summer also tended to have an adverse effect but this was not shown to be significant, possibly because of the smaller number of animals involved. It is stressed, however, that treatments were instituted on the basis of clinical judgments, which are not necessarily a reflection of the severity and duration of lung pathology. Pigs treated for pneumonia performed less well than pigs which were not treated and yet correlations within treated groups were not significant between lung consolidation and performance. Possibly the range of the amount of pneumonic tissue in these pigs (Table II) was insufficient to show a significant correlation between lung consolidation and performance. Similarly, much may have been learned about the effect of the clinical disease had the experimental design included one group of pigs worthy of treatment but allowed to run its course without treatment.

Housing has long been thought to be an important factor affecting the incidence and severity of pneumonia in pigs. This investigation has shown that the incidence and extent of lung lesions are to some degree affected by housing. The natural ventilation, more open housing and less density for boars may have been a superior environment for reducing re-

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TABLE III (A)  
THE EFFECT ON AVERAGE DAYS ON TEST (D.O.T.) OF PNEUMONIA WHICH REQUIRED TREATMENT

	Hog/Gilt Pairs			Boar Pairs	
	Both Treated	One Treated	Neither Treated	Treated	Not Treated
<i>Summer</i>					
Number of Animals	12	26	97	13	36
D.O.T.	90.1	88.5	87.7	95	92.6
% Depression from value of not treated animals	2.7%	0.9%	—	2.6%	—
<i>Winter</i>					
Number of Animals	24	20	128	25	51
D.O.T.	97.2 <sup>(ø)</sup>	91.4	87.8 <sup>(ø)</sup>	99.5 <sup>(‡)</sup>	93.3 <sup>(‡)</sup>
% Depression from value of not treated animals	10.4%	4.1%	—	6.7%	—

Summer Period—None of the groups differed significantly from one another.

Winter Period—(ø) D.O.T. significantly different  $p = <0.01$

(‡) D.O.T. significantly different  $p = <0.01$

TABLE III (B)  
THE EFFECT ON AVERAGE FOOD CONVERSION EFFICIENCY (F.C.E.) OF PNEUMONIA WHICH REQUIRED TREATMENT

	Hog/Gilt Pairs			Boar Pairs	
	Both Treated	One Treated	Neither Treated	Treated	Not Treated
<i>Summer</i>					
Number of Animals	12	26	97	13	36
F.C.E.	2.97	3.02	2.96	3.08	2.98
% Depression from value of not treated animals	0.3%	2.0%	—	3.4%	—
<i>Winter</i>					
Number of Animals	24	20	128	25	51
F.C.E.	3.12 <sup>(×)</sup>	3.0	2.97 <sup>(×)</sup>	3.36 <sup>(+)</sup>	3.19 <sup>(+)</sup>
% Depression from value of not treated animals	5.0%	1.0%	—	5.0%	—

Summer Period—None of the groups differed significantly from one another.

Winter Period—(×) F.C.E. significantly different  $p = <0.05$

(+) F.C.E. significantly different  $p = <0.01$

spiratory disease. The differences observed are not likely due to sex; Huhn (7) found that sex does not influence susceptibility of pigs to pneumonia.

Only one study has been reported which attempted to evaluate the effect of porcine pneumonia on total farm economics. Goodwin (6) compared the production cost per pig on one farm for the same quarter of three consecutive years. In the second year an increased

production cost of £ 1.7 per pig was recorded. In the same year pneumonia was evident in about 90% of 128 lungs examined macroscopically. This was higher than for the other two years, however, the proportion of pneumonic tissue was not evaluated. It was assumed that the increased production cost per pig of that year was due to the effect of pneumonia on the production parameters of food conversion and rate of growth, rather than to any of the

TABLE IV

THE EFFECT OF PERCENTAGE OF LUNG CONSOLIDATION ON DAYS ON TEST IN UNTREATED PIGS

	0%	0-5%	5-10%	10% and more
	Days on test	Days on test	Days on test	Days on test
<i>Summer</i>				
Hog/gilt pairs	87 (33)	85 (25)	87 (14)	87 (25)
Boar pairs	92 (21)	94 (6)	95 (5)	93 (4)
<i>Winter</i>				
Hog/gilt pairs	88 (56)	91 (28)	89 (16)	92 (28)
Boar pairs	91 (26)	95 (16)	95 (2)	96 (7)

The figures in parentheses indicate the number of pairs in the group.

TABLE V

THE EFFECT OF PERCENTAGE OF LUNG CONSOLIDATION ON FOOD CONVERSION RATIO IN UNTREATED PIGS

	0%	0-5%	5-10%	10% and more
	FC Ratio	FC Ratio	FC Ratio	FC Ratio
<i>Summer</i>				
Hog/gilt pairs	2.95 (33)	2.98 (25)	2.94 (14)	2.93 (25)
Boar pairs	2.93 (21)	3.06 (6)	3.18 (5)	3.02 (4)
<i>Winter</i>				
Hog/gilt pairs	2.92 (56)	2.97 (28)	2.97 (16)	3.00 (28)
Boar pairs	3.14 (26)	3.23 (16)	3.23 (2)	3.23 (7)

The figures in parentheses indicate the number of pairs in the group.

numerous other variables of livestock production. This assumption is supported by the results of Huhn (7) who found that the average daily body weight gain of experimental pigs was significantly affected by moderate (involving more than 50% of at least two lobes but involving other lobes less) and severe pneumonia. However, based on the results of the present study and that of Eikmeier and Mayer (4), Englert and Eisenack (5) and Björklund and Henricson (3), this possible effect remains unanswered.

One observation in this study of considerable interest in the epizootiology of porcine pneumonia pertains to the amount of pneumonia amongst sibs. Of 102 hog/gilt pairs examined, 50 were from pens of which only one animal revealed pneumonia. In 17 of these pairs one pig had as much as 10% or more of its lungs diseased while its pen-mate was free of pneumonia. This data suggests either a low infectivity of the agents involved or considerable difference in the susceptibility between pigs to the prevailing pneumonia-producing factors.

Initially this study was undertaken to hopefully provide a reliable assessment of the effect of the amount of pneumonia on important production parameters of swine herds in general. However, with completion of the study it was

realized that this objective would not be met and the findings were thought worthy of recording. These may be summarized as follows:

1. Correlation of diseased tissue with performance parameters may be statistically significant, however, this does not necessarily imply economic significance.
2. Conditions of husbandry influence the incidence of pneumonia and pneumonia may have an effect on production parameters. The correction of faults in husbandry may thus be of more benefit than measures specifically aimed to control pneumonia.
3. Any calculated effect of pneumonia on performance parameters applies only to the particular conditions of study; transposition of these results to other conditions (farms) is inappropriate.

## SUMMARY

Pigs drawn from split litter groups were fattened under two different housing conditions. The proportion of lungs showing macroscopic signs of pneumonia was estimated in pigs after slaughter. Lungs from pigs fattened in a force-ventilated building showed a higher incidence of lung consolidation than did pigs from a more open naturally ventilated environ-

ment, during both summer and winter. The extent of the consolidation was also greater in pigs from the large force-ventilated building. It was not possible to show a relationship between production traits and the proportion of lung showing consolidation under either type of environment. In pairs of pigs with clinical pneumonia requiring treatment significant depressions in performance were evident, but only for pigs raised during the winter. The results of this study were discussed and compared to reports of similar studies. The limited applicability of data from studies of specific diseases tissue to economics of production in general were indicated.

#### RÉSUMÉ

On a regroupé par deux des porcs issus de mêmes portées et on les a engraisés dans deux types de porcherie. On détermina la proportion des poumons qui présentaient des lésions macroscopiques de pneumonie, après l'abatage. Ces lésions s'avèrent plus fréquentes chez les sujets engraisés dans une porcherie à ventilation forcée que chez ceux qu'on avait gardés dans une porcherie ventilée de façon naturelle, aussi bien en été qu'en hiver. La consolidation pulmonaire manifesta plus d'ampleur chez les sujets gardés dans la grande porcherie à ventilation forcée. On ne put démontrer de relation entre les caractères de la production et la proportion des poumons présentant de la consolidation, indépendamment du type d'environnement. Les couples de porcs atteints d'une pneumonie clinique qui nécessita un traitement manifestèrent une baisse appréciable de leur performance, mais seulement en hiver. Les auteurs commentent les résultats de leur expérience et ils les comparent à ceux d'études similaires. Ils soulignent aussi le peu de relation qui existe entre les données fournies par des études sur des mala-

dies tissulaires spécifiques et l'aspect économique de la production, en général.

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