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in

Brufau J. (ed.).
Feed manufacturing in the Mediterranean region. Improving safety: From feed to food

Zaragoza : CIHEAM
Cahiers Options Méditerranéennes; n. 54

2001
pages 23-27

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SUMMARY – Those of the Danish swine producers who have the optimum production facilities are still able to produce pigs with a minimum of antibiotics even though they cannot use antibiotic growth promoters any longer. So far the exclusion of antibiotic growth promoters has resulted in an increase in use of antibiotics for treatment. However, approaches such as optimum management, sectionised batch operation, restricted feeding and ground raw cereals together with organic acids have minimized this increase at present.

Key words: Antibiotic, growth promoters, swine production.

RESUME – *"L'approche du Danemark pour une production porcine sans antibiotiques". Les producteurs porcins du Danemark qui ont des installation de production optimales sont encore capables de produire des porcins avec un minimum d'antibiotiques bien qu'ils ne puissent plus désormais utiliser des promoteurs de croissance antibiotiques. Jusqu'à présent l'exclusion des promoteurs de croissance antibiotiques a donné lieu à une augmentation de l'utilisation des antibiotiques comme traitements. Cependant, des approches telles qu'une gestion optimale, une conduite compartimentée des bandes, une alimentation restreinte et des céréales crues moulues accompagnées d'acides organiques, ont présentement minimisé cette augmentation.*

Mots-clés : *Antibiotiques, promoteurs de croissance, production porcine.*

The use of antibiotics has always been low in Denmark

The use of antibiotic growth promoters (AGP) in Denmark (Table 1) may have corresponded to the use in other European countries, just as the use of antibiotics for treatment may have had the same dimensions as everywhere else. Nevertheless, we do know that the use of antibiotics in the Danish swine production has always been comparatively low. The reason is that there has never been an extensive use of antibiotics, systematically or strategically, as disease prevention in Denmark. And – unlike in other swine producing countries – you cannot buy any antibiotics without having your needs estimated by a veterinarian. In the US, for instance, some antibiotics are sold (at the feedstuff companies) without any restrictions, and we know that 90% of all growing-finisher pigs in the US are treated with antibiotics preventively for 60-70 days.

Table 1. Use of antibiotics in Denmark (source: Federation of Danish Pig Producers and Slaughterhouses)

Year	Swine production	AGP	Antibiotic treatment	All together
1994	18 mio	110	70	180
1998	21 mio	40	70	110
1999	23 mio	20	Increasing	?
2000	23 mio	0	Increasing	?

Despite these facts the public opinion in Denmark has forced the Danish swine producers into an agreement with the Minister of Food (and Agriculture). This agreement has banned the use of AGP in the production of growing-finisher pigs from 1st March 1998 and in the production of piglets from 1st January 2000. In addition to this approach the Danish swine producers face a new registration by the authorities, of the use of antibiotics on farm level. This will be put in to action by the government by the end of the year. By now, the use of AGP in Denmark has been almost stopped for 6 months and totally stopped for 3 months.

What are our experiences with this "termination" so far?

The exclusion of AGP in feeding growing-finisher pigs passed off quietly. The use of antibiotics for treatment did not rise. Actually, we saw that the use of antibiotics for treatment had a downward tendency, whereas the daily gain and the feed conversion was not affected.

The exclusion of AGP in feeding weaning pigs will not pass off as quietly as with growing-finishers. The troubles we experience now are mainly diarrhoea caused by *E. coli* (149, 138, 139), *Lawsonia* and *Serpulina pilosicoli*, and we see a drop in daily gain as well. Consequently, we see that the use of antibiotics for treatment of the weaning pigs increases. And as a side effect we see that the use of antibiotics for treatment in the production of growing-finisher pigs rises, too. Furthermore, we experience that some producers begin to use antibiotics systematically and strategically.

Unfortunately, nobody has found anything as powerful as the antibiotics to replace the AGP with. However, we do see an approach towards better management, adjusted production units and new additives, which all together reduce the dependence of antibiotics.

Additional facts about swine production in Denmark are: 80% of the 23 mio pigs produced in Denmark come from production units sized 200-300 sows (labour input: one man) and/or 2000-6000 growing-finisher pigs per year (labour input: one man).

The production units are mainly:

(i) Boxed up sows (at present, but banned by 2014).

(ii) Sectioned, heated, two-climate housing for the weaning pigs with solid concrete covering two thirds of the pen floor.

(iii) Sectioned, 100% mechanically ventilated units for the growing-finisher pigs with full slatted pens, EU legislations determining the stocking density.

The average production results are shown in Table 2.

Table 2. Average production results in Denmark

Piglets (30 kg) produced per sow per year	22.2
Kilo feed per piglet	90-95
Liveborn per litter	11.5
Days of weaning age	29
Gram daily gain	800
Feed conversion (kg)	2.7
Mortality (and rejected) (%)	3.5

The Danish way of feeding pigs traditionally make use of barley, wheat, soya- and fishmeal. 50% of the Danish feed is mixed on the farm from a 3% premix or a 25% premix and served in meal. The other 50% is industrially manufactured feedstuffs in pellets.

Swine production with a minimum use of antibiotics

The most successful approaches practised so far to reduce the needs of antibiotics in the swine production are:

(i) Infection control through sectioning, batch operation and multisite is, beyond doubt, the most efficient way to reduce the needs for antibiotics in the swine production. Re-adjustment of the production units to batch operation costs money, though, and in addition, it gives changes in the daily routines. Models and dimensioning of production for batch operation are shown in Table 3.

Table 3. Models and dimensioning of production for batch operation (source: Danish Applied Pig Research Scheme)

Weeks between batch	Litter per batch	Weaning age weeks	Number of sows	Number of batch	Weeks between batch	Number of sections dry sows	Sections farrowing/ weaning
1	12	4	266	21	1	16+1	5/8
2	24	4	253	10	2 (3)	7+1	3/4
3	36	5	264	7	3 (4)	5+1	2/3
5.5	66	5	277	4	5.5	3+1	1/1

(ii) The establishing of two-tubed water supplies, that makes it possible to medicate one pen at a time, is a smaller investment. This way the swine producer does not have to treat the whole herd when it is only a few pigs that need treatment. It is especially on farms that are not operating sectionised, that they are able to reduce their use of antibiotics by making it possible to medicate one pen at a time.

(iii) Early treatments (drinking patterns as disease detectors) based on diagnoses and sensitivity tests reduce the use of ineffective antibiotics. Sensitivity tests ought to be granted. The variations between units are huge and vary from period to period as well. Table 4 shows the percent antibiotic sensitivity for 1998.

Table 4. Percent antibiotic sensitivity (1998) (source: National Veterinary Serum Laboratorium, 1999)

	0149	0138	0139
Ampicillin	70	63	83
Colistin	100	100	100
Enrofloxacin	94	96	98
Gentamicin	99	100	100
Neomycin	84	75	93
Spectinomycin	75	84	85
Streptomycin	35	37	55
Tetracyclin	47	51	66
TMP-Sulfa	75	72	92

(iv) We see that production units producing viable weaners with a high weaning weight due to high weaning age, optimum feed and exact feeding of the sows use less antibiotics. We do know that individual feeding of sows is labour-intensive, but we know as well that individual feeding gives more viable weaners and a higher weaning weight. Investigations show, that 100 grams extra birth weight gives 200 grams extra weaning weight (The National Committee, 1998) and that only 0.1 liveborn pig extra per litter yields a 5% rise in feedcost per 100 kilo sowfeed. On the other way around – it is no good to save money by reduction of labour or by reducing the quality of the sowfeed. Table 5 shows the typical Danish sowfeed and the improved sowfeed for more viable weaners.

Barley has a stabilising effect on the feed intake and seems to improve the milk yield. Oats calm down restrictively fed dry sows and make them less stressed. We know that marine oils gives extended birthweight. But considering the marine oils we have to be aware of the edibility of the carcass of the sow and we do still have doubts about the dioxin contents in marine oils.

Extended content of digestible amino acids is important for young sows which are still growing. Less crude protein relieve pressure on the sow which is particularly important when the herd has PRRS.

Table 5. Typical Danish sowfeed and improved sowfeed for more viable weaners

	Typical Danish sowfeed		Improved sowfeed for more viable weaners	
	Nursing sows	Dry sows	Nursing sows	Dry sows
Raw materials				
Barley	25%	25%	50%	60%
Wheat	50%	60%	25%	10%
Oats	0%	0%	0%	14%
Soya meal	18%	12%	15%	10%
Fish meal	2%	0%	4%	2%
Animal fat	3%	1%	0%	0%
Fish oil	0%	0%	3%	2%
Minerals and vitamins	2%	2%	3%	2%
Synthetic amino acids	+	–	+	+
Nutrients				
Crude protein (g/kg)	165.0	125.0	155.0	115.0
Lysine (g/kg)	8.0	5.0	9.0	6.0
Minerals and vitamins	Standard	Standard	+20%	+20%

(v) Restricted feeding (four times per day) leaving the trough empty 15 minutes after every feeding has proved to be an efficient way to solve problems with *E. coli*. Restricted feeding does not influence on the daily gain or the feed conversion but it lowers the mortality and the demand for medication (The National Committee, January 2000).

(vi) 25% ground raw cereals mixed with the industrially mixed pellets seems to have a positive influence on the gastric health of pigs (The National Committee, 1999). Especially salmonella is very sensitive to raw ground cereals. Though, we see the feed conversion rate affected negatively when using raw ground cereals. Actually, The National Committee has calculated the feed conversion rate to be 6% better on industrially mixed pellets compared with home mixed raw feed stuff.

(vii) In Denmark 10-20 kilo lactic acid, formic acid or some other organic acid per ton feed given through water supply or in feed is the most common way to prevent diarrhoea via additives. It works if we use 1-2%. There have been performed a number of tests with organic acids by the National Committee. Our conclusion on these tests is, that it is the amount of acids added that is important. The difference between the specific acids or combinations of acids is disappearing. However, we have to consider the taste when we use acids in the water supply. Formic acid as well as some other organic acids should only be used with maximum 1-2 promille in the water. Pigs stop drinking water when the pH value gets low. Lactic acids can be used with at least 2-4 promille in the water supply corresponding to roughly 10 kilo per ton feed, and the pigs will still drink.

Improved average gain per day and especially the improved feed conversion rate pays for the acids added (Table 6). In Denmark you can buy pure lactic acids for 1.25 US$ per kilo, at present.

There has been performed a number of tests with other alternative additives by The National Committee. Some of these products have shown some positive results.

Conclusion

The exclusion of AGP in the Danish swine production is causing troubles. The main trouble is diarrhoea among the weaning pigs. Now 3 months after the final AGP-stop, we experience that the use of antibiotics for treatment and antibiotics used systematically for prevention are increasing dramatically. So far the most successful approaches practised to avoid this increase are:

(i) Infection control through sectioning and batch operation.
(ii) High weaning weight due to higher weaning age and exact feeding of the sows.
(iii) Restricted feeding of the weaning pigs.
(iv) Ground raw cereals mixed with low protein compounds.
(v) 10-20 kilo lactic, formic or mixed organic acids per ton feed.
(vi) Early antibiotic treatments based on diagnoses and sensitivity tests.
(vii) Individual antibiotic treatment one pig, one pen or one section at a time.

Table 6. Development in percent daily gain and feed conversion ratio due to acid addition (source: The National Committee, 1997, 1998, 1999)

	Development in per cent daily gain	Development in per cent feed conversion ratio
Calprona, 1.4% and 1.2%	10.7	–5.8
Calprona, 1.4% and 1.2%	–4.9	–0.6
Fra-acid 0.75%	6.8	–1.1
Acid Lac	2.9	0
Aciprol Micropearls 0.2%	7.8	–3.9
Nutricid 0.4%	5.0	–2.8
Selacid 0.5%	4.8	–2.3
Probicid 0.8%	16.9	–3.5
Bio Pro 0.2%	15.3	–2.3
Calciumformiat 1.25	16.4	–6.9
Bolifor 2000 0.65% 1	8.5	–5.2
Luprocid 0.6%	8.8	–1.2
Lafeed 80 2.0% og 1.0%	5.5	–2.9
Euroacid LFPA 0.4%	6.8	–0.6
Greenacid	7.8	–2.3
Average 0.72%	8.61	–2.76

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