

Producing Pork Without Antibiotic Growth Promoters: the Danish Experience

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■ Introduction to Danish Pig Production

Annually, 13,500 pig producers produce 22.5 million pigs in Denmark (=1.8 million tonnes of pig meat), and of this approximately 1.6 million are used for live export. More than 95% of all pigs in Denmark are slaughtered at the three farmer-owned co-operative slaughterhouses (Danish Crown, Tican and Steff-Houlberg). 80-85% of the pig meat is exported, primarily to the EU, Japan and the USA. The remaining 15-20% is sold in the domestic market – for a total value of \$5.8 billion CAD.

Table 1 presents the key statistics from Danish pig production.

Table 1. The average production level in Denmark (April 2000 - April 2001).

Sows:	
Sows per herd, #.	230
Weaned pigs per litter, #.	10.4
Dead before weaning, %	12.8

Weaners (7-30 kg):	
Age at weaning, days	29.8
Weight at weaning, kg	7.25
Dead after weaning, %	3.5
Daily gain, g	411
Age at 30 kg, days	85.5

Finishers (30-100):

Produced pigs per herd, #	3,180
Daily gain, g	817
Kg feed/kg gain *	2.70
Average lean meat %	60.0
Dead and rejected, %	3.4

* with 13. MJ ME/kg

The Danish pig producers delivering pigs for slaughter to one of the co-operative slaughterhouses pay a levy of approximately \$2.70 CAD (DKK 14 Denmark Kroner) per pig. The money is administered by the **Danish Bacon & Meat Council**, and is spent on research and development (The National Committee for Pig Production, NCPP), marketing, information etc.

■ Chain of Events in Denmark

On January 1, 2000 antibiotic growth promoters (AGPs) were removed from animal production in Denmark. The reason for removing the antibiotic growth promoters from the feed was to minimize the consumption of antibiotics so that they are only used for therapeutic purposes. The chain of events leading up to this decision were:

1995	National ban on avoparcin.
1995	Voluntary agreement between NCPP and the feedstuff industry to minimize the use of AGPs.
Jan. 1998	National ban on virginiamycin.
Mar. 1998	Voluntary agreement not to use AGPs for pigs >35 kg (finishers). Control and penalty systems introduced.
Sep. 1998	National tax on AGPs.
Oct. 1998	NCPP announced action plan to phase out AGPs for weaners by January 1, 2000.
Jul. 1999	EU ban: tylosin, bacitracin, spiramycin & virginiamycin.
Sep. 1999	EU ban: olaquinox & carbadox
Jan. 2000	Voluntary agreement not to use AGPs for pig <35 kg (weaners). Control and penalty systems introduced.

■ Consequences of Ban on Antibiotic Growth Promoters

Finishers

The NCPP gathered experiences from 62 Danish finisher herds in the period after they stopped using APGs. The majority (63%) of the herds did not experience problems such as reduced daily gain or increased frequency of treatments for diarrhoea when APGs were removed from the feed. 26% of the herds experienced a temporary decrease in the daily gain, while 11% experienced permanent problems, probably due to the removal of APGs from the feed. Thus the removal of APGs from the feed has been fairly unproblematic in the majority of herds participating in this study.

The results from the study are confirmed by NCPP statements about the national average of the production efficiency controls. The developments in daily gain and mortality reveal no significant changes in the 1998 statement (the first year without growth promoters for finishers) compared to the previous year (Table 2). It is, however, remarkable that the increase in daily gain (from 1997/98 to 1998/99) apparently was not quite as high as in the previous years, and mortality was marginally higher.

Table 2. National average for production efficiency control – finishers

	Growth promoters			No growth promoters		
	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Year ¹						
Daily gain, g	744	762	778	786	798	817
Change in gain		+18 g	+16 g	+8 g	+12 g	+19 g
Mortality, %	3.0	3.2	3.2	3.4	3.6	3.4

¹ April to April

Weaners

The use of APGs for weaners ceased completely as of January 1, 2000. However, a large percentage of the pigs (approximately 50%) were fed without APGs already from mid-1999. Table 3 presents the effects on in daily gain and mortality. The table illustrates the decrease in daily gain (20 g) and a corresponding increase in the pigs' age at 30 kg. Post-weaning mortality was also increased (0.7%) in the 1999 statement compared to 1998.

Table 3. National average for production efficiency control – weaners

Year ¹	Growth promoters				Reduced AGP	No AGP
	1995-96	1996-97	1997-98	1998-99	1999-00	2000-01
Daily gain, g	422	420	419	427	407	411
Change in gain					- 20 g	+ 4 g
Mortality, %	2.7	2.8	2.9	2.9	3.6	3.5
Change in mortality					+ 0.7	- 0.1
Age at 30 kg, d	82.6	82.6	82.8	82.9	85.3	85.5
Change in age					+ 2.4	+ 0.2

¹ April to April

Thus, the removal of AGPs from feed for weaners has had significantly negative consequences in the form of reduced gain and higher mortality. Removal of AGPs has also enhanced a number of fundamental problems:

- Increased post-weaning diarrhoea
- Increased chronic infections (*Lawsonia Intracellularis*)
- Increased nutritional overload
- Reduced utilization of nutrients in the feed

■ Effect of the Ban on the Consumption of Medicine for Treatment of Disease

Denmark has some of the world's tightest legislation on medicine. This is one of the reasons why Denmark only uses approx. 1% of the EU consumption of medicine for pigs even though we produce 10% of the pigs in the EU.

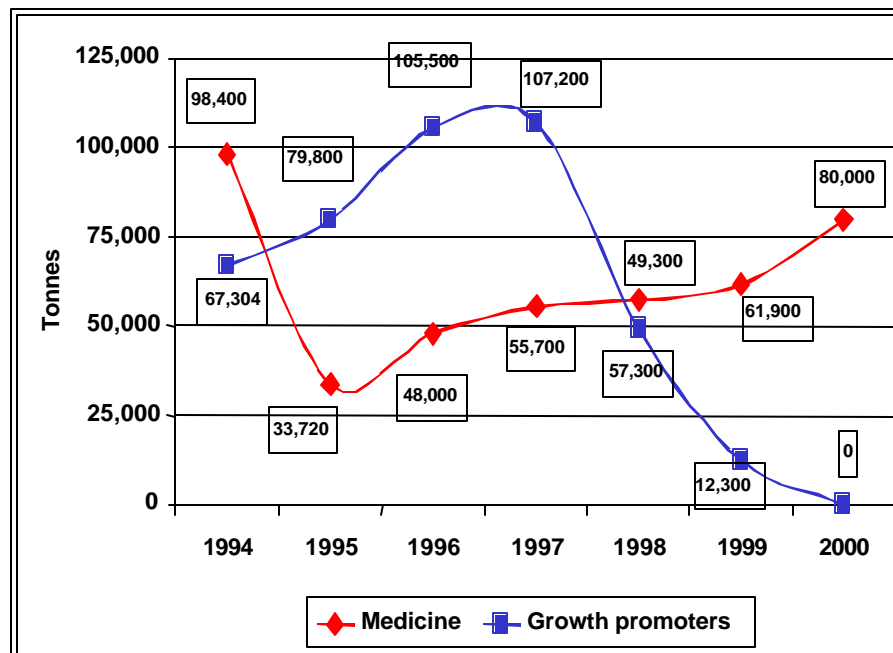
Veterinarians are not allowed to profit on sales of medicine after a change in legislation in 1995. This resulted in a halving of the consumption of medicine used in pig production from 90 tonnes in 1994 to 48 tonnes in 1996.

A number of changes were required in nutrition and management in order to combat the increase in outbreaks of diarrhoea after removing AGPs from the

feed. Nevertheless, many herds today find it necessary to apply medicine for treatment of diarrhoea in weaners and young stock.

Figure 1 below illustrates the influence of the increase in outbreaks of diarrhoea on the present consumption of antibiotics.

Figure 1. Total consumption of antibiotics in Denmark for medicine (treatment of disease) and for growth promotion.



While the consumption of AGPs has decreased from 107 tonnes in 1997 to 0 tonnes 2000, the consumption of antibiotics – primarily macrolides and tetracyclines – for treatment of diseases has increased from 56 tonnes in 1997 to 80 tonnes in 2000. Overall, the consumption of antibiotics was halved in four years, but both politicians and consumers have put great attention to the increasing usage of antibiotics for medicine.

In order to get an overview of the consumption of medicine in Denmark, the Ministry of Food, Agriculture and Fisheries has created the database VETSTAT with the aim of supervising the usage of medicine for livestock animals at herd and veterinarian level. The aim is to provide focused advice on guidelines for sensible application of antibiotics. VETSTAT has recorded the consumption for

one year approximately now, and is expected to be fully functional at the beginning of 2002.

At the same time, the development of antibiotic resistance is monitored among a number of bacteria types by way of the supervision programme DANMAP. Here, the consumption of antibiotics and the development in resistance are linked, facilitating improvement in advice on selection of preparations to be used in the herds.

Due to the increased focus on the consumption of medicine and development of resistance, great efforts in both herds and on the research and development area are put into improving management and nutrition so that the problems may be reduced without using AGPs or increasing the usage of medicine.

■ Management Factors

One of the most significant effort areas for relieving the negative consequences of the removal of AGPs is optimisation of the management in the herds, including:

- Health promoting housing systems with sectioned batch operation. All in All out and WTF **W**eaning **T**o **F**inish in the same pen) have become more widespread, and Danish tests of these systems show that they may improve both health and productivity.
- The decreasing growth in weaners has resulted in accumulation of weaners in many herds (because of longer stay in the weaner unit). Overcrowding, increased batch sizes and lack of relief pens have probably enhanced the negative consequences due to the removal of AGPs.
- More focus on the pigs' immediate environment in the pen. Experience from Danish herds with problems shows that management, dimensioning and maintenance of the ventilation systems is often faulty. As a consequence, the pigs are exposed to draught, cold and humidity resulting in poorer health.
- More focus on weight at weaning. A Danish test showed that management in the farrowing unit affects the weight at weaning. In the past, too many piglets were moved between sows. Recent experiments show that generally piglets should be re-moved after 12 hours, but within 48 hours of farrowing.

■ Nutrition

The composition of the feed, its physical form and the method of presentation may also affect the gastro-intestinal health and productivity. In Denmark, focus is in particular on:

- Restrictive feeding.
- Use of additives.
- Use of protective diets.
- Fermented liquid feed.
- Experience from eradicating Salmonella in finishers.

Restrictive feeding

A Danish test of restrictive feeding (75% of the feed allocated in control) during the first 14 days post-weaning showed that the pigs' health was significantly improved compared to ad libitum feeding. Mortality was also reduced in one of three herds. The production results for the entire test period (4-5 weeks) were reduced during restrictive feeding in one of three herds. Restrictive feeding is fairly widespread in Danish weaner herds in numerous variants. International literature states that the feed intake must be stimulated the first days post-weaning (eg. days 0-3) in order to minimize injuries on the surface of the intestines and thereby a reduction in the digestive capacity. In the following period (eg. days 4-8) the feed intake must be reduced until the intestinal structure is re-established. This modified model of restrictive feeding is presently being tested in Denmark.

Use of additives

NCPP has tested more than 100 commercial products (additives) for weaners and finishers in the last five years. For weaners, the group of acid products has shown on average to improve the production results as when AGPs were used. However, these tests were carried out in herds without significant disease problems.

Use of protective diets

These are typically characterised by low protein content, high proportion of animal protein (fish meal, whey powder, skimmed milk powder), high proportion of barley, addition of an organic acid product. Danish tests with various types of protective diets have shown that the type mentioned may reduce the prevalence of diarrhoea compared to control. Protective diets with reduced content of energy, however, had no effect on the pigs' health, and the production results were significantly reduced.

Fermented liquid feed

This feeding principle is being developed in Denmark, and is presently used in very few herds. NCPP has performed a number of tests with the aim of making it applicable in practice. The tests showed that amino acids added in free form were converted during fermentation, and thus were not available to the pigs, which substantially reduced the production results. A recently finished test in which only the grain share was fermented showed a significant improvement of the production results in finishers. One of the aspects of fermented liquid feed is that it is a cheap way in which to add lactic acid (fermentation product) and reduce pH.

Experience from eradicating Salmonella in finishers

E.coli is often used as an indicator bacterium of Salmonella. Therefore, it must be assumed that some of the measures effective against Salmonella in finishers may be transferred to eradicating post-weaning diarrhoea (*E.coli*) in weaners. Measures such as application of meal feed (not pelleted nor heat-treated), coarse grinding (large particle size), liquid feed and a high share of barley reduce the prevalence of Salmonella in finishers. However, any effect on the health of these measures has not yet been documented in Danish tests with weaners.

■ Optimised production in herds with problems

NCPP has recently performed tests in a number of herds experiencing problems with weaners. The herds all had poor health, a high consumption of medicine and low gain in the weaner period. The aim was to examine if it was possible to increase the level of health and production results in the weaner section by optimising the production conditions in general. Improvements in the test group included: improved management procedures, improved hygiene, pen design, composition of the feed, feeding strategy etc. The measures in the test group were compared to the herd's normal practice with and without a growth promoter (Avilamycine) added to the feed.

Preliminary results show that the pigs given AGPs in the feed generally have the best productivity – this was the case in four of eight herds. However, the optimised management reduced the number of treatments for diarrhoea (in five out of eight herds) even when compared to using a growth promoter in the feed. The optimised management reduced mortality significantly in two herds.

■ Conclusion

Overall, we can say that the removal of antibiotic growth promoters from the feed in Denmark has only had significant consequences for the weaner production in the form of increased mortality and reduced gain. Experiences from weaner herds with problems at weaning show that the existing knowledge on fundamental management aspects, feeding etc. are not implemented optimally in practice - especially measures requiring a great work effort are difficult to establish. Tests in herds with problems at weaning show that optimisation of the production conditions significantly improves health of the pigs - even when compared to use of a growth promoter. However, it is harder to maintain the same level of productivity, compared to using an AGP.

It can be concluded that: ***It is possible to produce pigs without AGP, but it is not an easy task.***