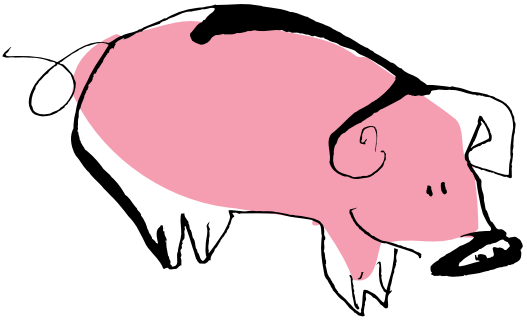
The Swedish Model of Animal Production



Information based on presentations given at a seminar held in Stockholm 3–4 September 1998

REGERINGSKANSLIET

Ministry of Agriculture

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Sweden

Contents

REGERINGSKANSLIET

In September 1998 the Swedish Ministry of Agriculture, Food and Fisheries hosted a two–day seminar and study visit in Stockholm. The participants were representatives from corresponding ministries in other EU Member States and from the European Commission. The aim of the program was to spread information about animal production without the use of antibiotic growth promoters.

Background

Antibiotic resistance is a growing health problem world-wide. Doctors are concerned that infectious diseases might once again become a major threat to public health, in a future where antibiotics have lost their effectiveness. Experts agree that to prevent the further spread of resistance, it is essential that antibiotics are used in a restrictive manner and only when necessary.

A number of scientific reports have shown that resistance can be transmitted between bacteria, and that bacteria from animal environments can easily be transferred to man. This means that there is a link between the use of antibiotics for animals, and resistance problems that doctors encounter in treating people with infections. According to EU legislation, a number of antibiotic substances are approved for use in farm animals to promote growth and production. In Sweden such use has been prohibited since 1986. The use of antibiotics for animals is only permitted with the aim of preventing or curing diseases.

Many scientists agree that knowledge available today is sufficient to motivate a much more restrictive use of antibiotics for animals throughout Europe. In October 1997 the World Health Organisation, WHO, recommended that antibiotics should not be used as growth promoters. Similar recommendations have been made by the Economic and Social Committee of the EU, the European Parliament, as well as by major European consumer organisations.

Through research and practical experience, farmers and veterinarians in Sweden have learned how to prevent animal health problems without routine use of antibiotics. The aim of this report is to spread the knowledge gained in Sweden about animal production without the use of antibiotics as growth promoters.

Animal Health Effects of the New Feed Act of 1986

Professor Martin Wierup (Swedish Animal Health Service)

In 1986 antibiotic growth promoters were banned in Sweden, and the only permitted use for antibiotics was by veterinary prescription in therapeutic doses to cure or prevent disease.

Sweden's twelve years of experience from animal production without the use of antibiotic growth promoters, has demonstrated that under good production conditions it is possible to reach competitive results in poultry, calf and pig production without continuous use of antibiotics on a routine basis.

Pig Production

Before 1986 most pigs were given olaquindox or mecadox at a dose of 50 ppm from birth until delivery to finishing units at 25 kg live weight , at the age of 10–12 weeks. After this they were given avoparcin or virginiamycin until slaughter at the age of approximately seven months.

The ban on growth promoters did not cause clinical problems in finishing pigs. In fact no negative clinical or other effects were seen in the finishing units when antibiotics were withdrawn from feed rations. The growth rate continued to be good, and is today on conventional farms, according to production efficiency control, on average over 850 g per day. Higher growth rates are not reported from countries where antibiotic growth promoters are used.

The case was, however, different in piglet producing units. During the first year after the ban was introduced, significant clinical problems emerged in piglets. Post weaning mortality increased by 1,5 percentage units. The age at 25 kg was increased by 5–6 days. This clearly demonstrated that the "growth promoters" had actually been effective in preventing diseases.

Due to the increased disease rate, veterinarians prescribed antibiotics at therapeutic dosages. During the four years following introduction of the ban, the therapeutic use of antibiotics increased. In 1989, 75 percent of the pigs were at some point given medicated feed. During this time major efforts were undertaken to introduce sectioning and planned production, and to improve hygiene in individual herds. Feed was modified and reformulated. By 1993 the use of antibiotics had decreased by approximately 50 percent. Since then there has been a gradual decrease, which has been further supported by the addition of zinc-oxide to feed. In 1995 only 11 percent of weaning piglets were given medicated feed containing antibiotics.

The Swedish Society for Veterinary Medicine has issued guidelines for veterinarians on how to prescribe antibiotics. These guidelines emphasise that prescription of antibiotics must always be accompanied by recommendations for prophylactic measure.

New rearing systems have also been developed, including the weaning of piglets on deep litter beds in large groups and the so called birth-to-slaughter system which is, as the name implies, based on keeping pigs in the same pen from birth to slaughter.

Swedish experience shows that, under optimal conditions, excellent production results can be achieved without the continuous use of antibiotic growth promoters. Progressive producers report better results today than before the ban. There are, however, still problems that need to be solved. Since 1987 post-weaning mortality has decreased by 0.9 percentage units and the age at 25 kg has been reduced by 1–2 days. Not all production units have thus managed to reach up to their pre-ban production results, which suggests that their conditions are less than optimal.

Before 1998 zinc-oxide was classified as a non-prescription medicine. After the ban on antibiotic growth promoters in 1986 the use of zinc-oxide to prevent and cure diarrhoea in piglets increased. This gave rise to concerns for the environment, as zinc may accumulate causing long-term negative effects. To prevent zinc-oxide from being used instead of other health care and preventive measures, new legislation was implemented on January 1 1998, whereby zinc-oxide in concentrations higher than 250 mg per kg of feed were regulated as prescription-only medicines. This made it possible to reduce the use further. Today (September 1998) approximately 85 percent of piglets reach the age of delivery to fattening units without having been given either antibiotics or zinc-oxide.

Specialised Beef

The use of antibiotic growth promoters in specialised beef production had more or less come to an end in Sweden before they were banned in1986. The reason for this was that the use of antibiotics was not seen to have positive effects on production. The ban did not lead to any negative clinical or other effects.

Use of Antibiotics for Animals from 1980 to 1997

Laboratory Veterinary Officer Christina Greko (National Veterinary Institute)

In Sweden, all antimicrobial substances used in animals are classified as veterinary medicines and only available on veterinary prescription. This legislation has been in force since 1986, when antimicrobial growth promoters were banned. According to Swedish experience, use of antimicrobial feed additives prevents diseases in animal production. In evaluating the effects of this ban it is therefore of interest to study the effects on the usage of antibiotics for animals. Statistics over the use of antibiotics for animals in Sweden between 1980 and 1997, show that there has been a substantial reduction in usage since the years before the ban. This is also reflected as a comparatively low prevalence of resistance in intestinal bacteria from food ,producing animals.

Collection of Data on Usage of Antibiotics

All data on the usage of pharmaceutical specialities in Sweden are based on sales statistics produced by the Central Statistics System of Apoteksbolaget (National Corporation of Swedish Pharmacies). This system contains registers of all sales from wholesalers to the local pharmacies (all belonging to Apoteksbolaget), and to feed companies. As all pharmaceutical specialities are distributed from these wholesalers to local pharmacies or to authorised feed companies, these figures represent the total usage in Sweden. With regard to antibacterials used as feed additives before 1986, data has been gathered from the Board of Agriculture. Thus, the figures presented in this report include antibacterials authorised for use in animals, i.e. for all species.

Overall Data from 1980–1997

In table 1, sales statistics for antibacterials from 1980–1997 are presented. The statistics show the total amount of antibacterials sold by pharmacies or delivered by feed

Table 1. Total quantity of antibacterial substances (kg active substance) for treatment of animals based on sales statistics from Apoteket AB (National Corporation of Pharmacies) (1, 6, 7)

ATC group[1]	Substance group	1980	1982	1984	1986	1988	1990	1992	1994	1996	1997
QJ01AA,QG01AA07	Tetracyclines	9819	10765	12955	6585	4691	4572	8023	7730	2698	2558
QJ01B	Amfenicols	47	40	49	41	35	21				
QJ01CE, QJ01R	G-and V penicillins[2]	3222	4147	4786	5933	7143	7414	7446	10318	8818	8781
QJ01CA, QJ01CR	Aminopenicillins	60	248	714	540	655	738	837	941	835	841
QJ51CA	Penicillinase-stable penicillins	9	6	2							
QJ01D	Other betalactam-antibiotics										53
QJ01G, QJ01RA,QJ51RC	Aminoglycosides	5274	4776	5608	2885	3194	2539	2139	1696	1164	1077
QJ01E	Sulfonamides	6600	4931	4325	3093	3072	2510	2362	2323	2198	2151
QJ01E	Trimethoprim and derivatives	134	142	186	197	250	272	284	352	339	352
QJ01F	Macrolides and lincosamides	603	616	887	1144	1205	1398	1710	1852	1649	1747
QJ01MA	Fluoroquinolones						84	147	246	173	179
QJ01XX92	Pleuromutilins					124	229	268	465	1142	1094
QP51AA, QJ01BA	Other substances	861	823	1637	1575	1567	2304	1634	1764		
QJ01MB	Quinoxalines[3]	6250	7700	9900	1300	7164	5778	4917	1904	1098	534
QJ01XX91	Streptogramins[3]			8800	1610	1088	2413	1275	600	525	288
————	Other feed additives	8380	9370	700	870						
	Total	**41259**	**43564**	**50549**	**25773**	**30189**	**30274**	**31043**	**30191**	**20639**	**19655**

1. According to NLN, Guidelines on ATCvet classification (1995)
2. Calculated to equivalents of benzyl penicillin. Also includes penicillin from ATC group QJ01R and QJ51
3. From 1986 authorised for veterinary use on prescription

mills during the specified time period. As the substances in question are not equal in their biological activity per weight unit, total figures may be misleading (i.e. if a substance requiring high dosages for full efficacy is replaced by a more active substance, a false impression of a reduction could be given). Therefore, each substance group should be assessed separately for trends.

Relevant Groups of Antibiotics

Of special interest in relation to feed additives is the consumption of antibacterials intended for group or flock medication. These are the tetracyclines, macrolides, quinoxalines, streptogramins, pleuromutilins and nitroimidazoles. The usage of these groups of antibacterials in 1994, 1996 and 1997 are shown in table 2. The penicillins, trimetoprim-sulfonamides, aminoglycosides and fluoroquinolones are mainly, or only, used for medication of individual animals. As the main single indication for the latter type of drugs is mastitis (2), trends in their use are assumed to be unrelated to the ban on feed additives.

After the ban, a decrease in use of tetracyclines was noted. However, between 1988 and 1993, an increase was again noted. This could not be connected to an altered disease situation, and therefore no obvious explanation was at hand.
Further investigations into the precise origins of this were initiated in 1994 by the Board of Agriculture. It was revealed that the increase could almost entirely be explained by the prescriptions of one veterinarian to one herd. The veterinarian was reported to the disciplinary board and this "over-prescription" of tetracycline came to an end. The total tetracycline consumption is nowless than a quarter of that before 1986.

The amount of macrolides sold as formulations for injection increased in the beginning of the 1990:s (2). However, the macrolides are also to a considerable extent sold as formulations for oral use (to be mixed in feed or water). The observed increase over time of macrolides for oral use, and that of the pleuromutilins introduced in 1988, is

Table 2. Sales of antibacterial substances (kg active substance) intended for group treatment in feed or water

ATC group		1994	1996	1997
QJ01A	Tetracyclines	7036	2089	1881
QJ01F	Macrolides and lincosamides	791	975	1096
QJ01M	Fluoroquinolones	30	27	32
QJ01M	Quinoxalines	1904	1098	534
QJ01X	Streptogramins and pleuromutilins	1022	1594	1317
QP51AA	Nitroimidazoles	1764		

believed to reflect an increase in the incidence of swine dysentery, which is the major indication for those drugs (3). The increase of sales of this group of drugs observed from 1995 is likely to be explained by the fact that the nitroimidazoles, the third category of drugs (formerly) available for this indication, were withdrawn from the market in 1995. It has been estimated that today, around 10 percent of the slaughter pigs are treated for swine dysentery (3).

The consumption of substances formerly approved as feed additives, and subsequent to the ban approved as therapeuticals (quinoxalines and streptogramins), has decreased substantially in spite of higher doses being given for therapy than for growth promotion. The major quinoxaline, olaquindox, was exclusively used in pigs. After the ban, the use decreased sharply. In 1988, the use as veterinary medicine for prevention of weaning diarrhoea had increased to levels approaching those pre-ban. However, as the dosage used was three times higher than before, fewer animals were exposed. After this, the use decreased gradually and from July 1997 olaquindox is no longer available in Sweden.

The Industry's Argument

The fact, that different antibiotics have different activity and that therefore sums of kilograms can be misleading has also lately been voiced by the industry.
(4) Mudd and co-workers suggest in their study that all antibacterials should be calculated as "tetracycline units" (potency units). They set a standard dosage for each substance group based on the substance that dominates. Feed additives are not included and figures are presented from 1986 and onwards. It is unclear why earlier, pre-ban, figures were not included in the study. Contrary to the Swedish opinion, Mudd et al conclude that the usage of antimicrobials has increased after the ban. They base their conclusions primarily on a selection of four antibiotics that they call "key antimicrobials". However, a closer look at the selection indicates that it is strongly biased. Two (fluoroquinolones and pleuromutilins) were not on the market at the start of the period studied. Any sales after introduction would be recorded as an increase. Older products that these drugs have replaced have not been included in the selection. The third antibiotic chosen is penicillin, which in Sweden is used primarily for treatment of mastitis. An increase of sales of this group can not possibly be correlated to the ban on antimicrobial feed additives. The fourth antibiotic group chosen is tetracyclines of which the sales have decreased during the period.

In table 3, the sales statistics have been calculated according to the principles proposed by Mudd and co-workers. For feed additives, a tentative dose of 50 ppm was fixed and calculated to a dose expressed in mg/kg assuming that a pig weighing 25 kg will consume 1 kg of feed. It is clear that the consumption of antimicrobials in animals

has declined over the years also when measured as "tetracycline dosage units". In 1996, the figures were about 70% lower than the mean annual figures for the period 1980–1984. As dosage units have yet not been internationally agreed, the data presented in this paper should be interpreted with caution. Nonetheless, calculations based on the total statistics will probably be a better basis for conclusions than presentations of selected groups.

Resistance as a Reflection of Use

Acquired resistance to antibacterials reflects the exposure of bacterial populations to the substances in question. Therefore, statistics on prevalence of resistance is an indirect way of assessing the consumption of antibacterials. Recently, a study from the Netherlands comparing prevalence of resistance in faecal indicator bacteria (E. coli and enterococci) of pigs in Sweden and Netherlands was reported (5).
A significantly lower prevalence of resistance to feed additives, but also to therapeuticals, was recorded in Swedish pigs. The authors concluded that the Swedish ban on antibacterial feed additives is effective in reducing the degree of resistance. They also considered that their data indicate that the prohibition has not led to an increase in the use of therapeuticals to such an extent that the selective pressure for resistance is higher than in countries using antibiotics for growth promotion.

Table 3. Total sales of antimicrobials from 1980–1996 expressed as "tetracycline units" according to Dr. Mudd (the number of kg active substance presented in Table 1 has been multiplied with a dosage correcting factor (Index factor) based on tetracycline dosage, see "index factor")

Substance (Arbitrary dosage in mg/kg)[1]	"Index factor"	1980	1982	1984	1986	1988	1990	1992	1994	1996
Tetracyclines (60)	1	9819	10765	12955	6585	4624	5414	8815	4968	2733
Macrolides (10)[2]	6	3618	3696	5322	6864	6937	8866	9372	10818	8916
Fluoroquinolones (2.5)	24					24	2952	4152	4800	4152
Pleuromutilins (5)	12					1680	2832	4608	10668	13704
G-andV penicillins (20)	3	9695	12459	14364	17801	21022	22269	24904	27247	25665
Aminopenicillins (25)	2.4	144	595	1714	1296	1634	1846	2062	2227	1990
Aminoglycosides (20)[3]	3	15822	14328	16824	8655	8469	6765	5814	4026	3198
Sulfonamides (37.5)[4]	1.6	10560	7890	6920	4949	4781	3795	3272	3416	3517
Trimethoprim + derivatives (7.5)[4]	8	1072	1136	1488	1576	2256	2056	2424	2648	2712
Quinoxalines (6)[8]	10	62500	77000	99000	13000	72020	51280	35230	11910	10980
Streptogramins (6)[8]	10			88000	16100	23880	13500	5500	5750	5250
Other feed additives (3)[5]	20	167600	187400	14000	17400					
Other substances (40)[6]	1.5	1377	1304	2532	2424	2807	3999	2441	1688	245
TOTAL, tonnes		**282.2**	**316.6**	**263.1**	**96.6**	**150.1**	**125.6**	**108.6**	**90.2**	**83.1**
Difference from mean of 1980-1984[7]					-66%	-48%	-56%	-62%	-69%	-71%

1. Dosages chosen according to FASS VET
2. Based on tylosin which dominates the group
3. Dosage set as derived from penicillin-dihydrostreptomycin combinations which dominate the group
4. Dosage set as derived for trimetoprim sulphonamide combinations which dominate the group. Dosage according to Prescott and Baggot, 1993
5. Arbitrarily set. assumed dosage 50 ppm
6. Set for the dimetridazole which dominates the group
7. Compared to mean of the years 1980–1984, i.e. the years before the ban on feed additives
8. From 1986 authorised for veterinary use on prescription

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Economic Effects on Swedish Farming

Agronomist Gunnela Ståhle (Federation of Swedish Farmers)

Farmers' Policy on Antibiotics

Swedish farmers are aiming towards a sustainable animal production, which as far as possible is independent of the use of drugs. This aims at sustainability both ecologically and economically.

As early as in 1981 Swedish farmers took the position that antibiotics should be used restrictively and under veterinary control. The Federation of Swedish Farmers (LRF) was prepared to refrain from the use of antibiotics as growth promoters. This was based on a need to maintain consumer confidence and on the fact that any use of antibiotics might lead to the development of resistant strains of pathogenic bacteria.

After more than ten years of experience from raising animals without antibiotic growth promoters there is broad consensus among pig and poultry producers that the benefits of antimicrobial feed additives do not outweigh the risks. The ban on antimicrobial growth promoters of 1986 is seen as an advantage for the future competitiveness of Swedish farming.

The Importance of Healthy Animals for Profitability

The most important effect of the Swedish ban on antimicrobial feed additives was that it led to improved understanding of the importance of animal health on productivity and profitability.

In the 1960's and 1970's it was generally accepted that the best way to achieve maximum profitability in animal production was to run large scale operations with low building costs and a minimum of working hours. Losses from infectious diseases were, however, not taken into account. Despite the fact that antimicrobial feed additives were used on a routine basis morbidity and mortality were high.

Practical experience has in recent years shown that in reality the most important factors to enhance profitability are healthy and unstressed animals.

After antimicrobial growth promoters were banned in Sweden in 1986, it became obvious that these feed additives had had a disease preventive effect in many herds. Through their use it had been possible to conceal bad management and poor animal environments. It became clear that improvements were necessary in hygiene and housing and that changes had to be made in feed composition and management.

There is today a greater awareness among producers, that investments in animal environment and management are necessary for economically and ecologically sound production. For this to work it is of utmost importance to know how to minimise the risk of introducing and spreading contagious diseases and how to avoid disease provoking factors such as bad climate or negative animal stress. Negative stress affects the animals' immune system. If animals are exposed to infectious diseases and stress their genetic potential can not be fully exploited.

The Costs of the Swedish Model

Swedish animal welfare legislation places high demands on housing and management. One of the aims of the new Animal Welfare Act passed in 1988, was to prevent animal diseases through sound production methods. When evaluating the costs of the "Swedish Model" it is impossible to separate the costs of not using growth promoters from the costs incurred by Sweden's strict animal welfare legislation.

In 1996 the Swedish Meat Marketing Association, the Swedish Farmers Feed Development and Swedish pig producers initiated a study into the economy of the Swedish Model. The aim of this study, which was performed by the Swedish University of Agricultural Sciences, was to analyse the costs and benefits of the various parts of the "Swedish Model", i.e. both feed legislation and animal welfare legislation.

The calculations consist of three parts:

1. The increase and decrease in costs was calculated separately for each Swedish rule on the national level, built on studies or practical experience.
2. A comparison of production costs between a Swedish production system and a fic tive Danish production system (i.e. production according to Danish animal welfare legislation, and using antibiotic feed additives) operating in Sweden.
3. A final analysis comparing the estimated results of this Danish system with those of actual herds in Denmark, i. e. effects which are not related to differences in animal welfare and feed.

Denmark was chosen for two reasons. The first reason was that the same methods are used in Sweden and Denmark to calculate production results. The second reason was that animal welfare rules in Denmark closely correspond to the relevant EC Directives.

The following aspects were analysed from an economic point of view; space requirements, ban on tethering sows, straw/litter-requirement, ban on slatted floors, higher minimum age at weaning, required sectioning, ban on antibiotic growth promoters, window requirement, ban on tail docking.

The producers' price was 13.25 SEK per kg of pig meat, and the price of a weaner pig was 528 SEK.

1. Economic Evaluation of Separate Rules

SPACE REQUIREMENTS

The increased space requirements according to Swedish legislation lead to increased building costs, but also to increased income due to improved animal health and better growth. The net gain is estimated at approximately 0.04 SEK per kg of pig meat.

BAN ON TETHERING SOWS

The main effects of housing sows in non-tethered systems are: increased building costs, increased working hours and healthier sows. The health benefits are substantial, with a lower incidence of MMA (mastitis metritis agalactia syndrome), traumatic injuries and TSS (thin sow syndrome). The net gain is estimated to 0.08 SEK per kg of pig meat.

STRAW/LITTER REQUIREMENTS

The use of straw entails costs for harvesting, storing and handling as well as increased costs for dealing with manure. Straw, however, also increases income due to improved health and increased growth. In fattening units the costs do not exceed the benefits. In weaner producing herds the costs are larger than the economic benefits, thus leading to a net cost of 0.09 SEK per kg of pig meat.

BAN ON SLATTED FLOORS

The price of installing solids floors is lower than the price of slatted floors. The price difference can be expressed as 0.34 SEK per kg of pig meat. The extra cost of clearing manure represents 0.13 SEK per kilogram. Thus the ban on slatted floors leads to a net gain of 0,21 SEK per kg of pig meat. By using slatted floors the total space can, however, be reduced, leading to economic gains. The study does not take this into account.

AGE AT WEANING

The difference in weaning age between Sweden and Denmark was 13 days. The cost is estimated to 0,01 SEK per kg of pig meat per day, i.e. a total of 0,14 SEK per kg of pig meat. As most Swedish producers wean their pigs at a later age, legislation can not be said to have an economic effect for Swedish producers compared to Danish producers.

SECTIONING

According to Swedish legislation, no more than 200 fattening pigs may be held in one unit if the production is continual. In "all-in-all-out" systems up to 400 pigs may

be kept in one unit. This results in higher building costs, but also in a lower incidence of infections, and a higher growth rate. The net gain is estimated to 0,09 SEK per kg of pig meat.

BAN ON ANTIBIOTIC GROWTH PROMOTERS
In weaner production the growth rate is reduced when no antibiotic growth promoters are used. Furthermore there are increased costs for manpower to control the health status and increased costs for veterinary intervention in cases when medication is necessary. This is only partly compensated for by the reduced costs of non-medicated feed. The net cost per weaner is 4,15 SEK. This corresponds to 0,05 SEK per kg pig meat.

In fattening herds growth rate is estimated to decrease by 1,5 percent, although there is very little to substantiate this. This leads to increased costs of 0,10 SEK per kg pig meat. The cost for feed is reduced by an amount corresponding to 0,05 SEK per kg.

The total net cost of eliminating antibiotic growth promoters from piglet and fattening feed is thus 0,10 SEK per kg pig meat.

WINDOW REQUIREMENT
The cost of installing windows is estimated at 0,06 SEK per kg pig meat. No health-improving effects have been noticed.

BAN ON TAIL DOCKING
Each case of tail biting is estimated to lead to a cost of 55 SEK due to decreased growth rate, veterinary treatment and carcass loss. Due to the use of straw the incidence of tail biting is, however, only 1,3%. Tail docking is therefore not estimated to be motivated for economic reasons.

It is not possible to sum up the costs or gains for different parameters in this first evaluation, because they are analysed separately. The conclusion is, however, that the results show a plus/minus zero result on production costs. The costs for the ban on antibiotics as feed additives, straw or litter for sows and higher weaning-age in weaner production were compensated by better health, higher daily weight gain and improved feed conversion.

2. A Danish production system in Sweden

A model calculation was carried out examining how a herd following Danish regulations on animal welfare and using antibiotic feed additives, would manage in

Sweden. Two different conceivable systems for large herds with integrated production were compared, one according to Danish regulations and the other by Swedish rules. The Swedish system assumes the production results achieved at present by the most competent Swedish farmers (the top 20 % producers in RASP, Result Analysis Swine Production). The estimated production results in the Danish system are based on Swedish results, adjusted for conditions dictated by the Danish animal welfare regulations as indicated by the results from the first part of the analysis.

Increased costs with Swedish animal welfare regulations compared with Danish regulations (SEK per kg of pig meat)

Variable costs		Fixed-costs (buildings)	
Sow	+ 0.18	Weaner production	+ 0.24
Weaner	+ 0.03	Slaughter pig production	+ 0.19
Slaughter pig	– 0.13		

Sum of added costs for the Swedish Model + 0.51 SEK per kg of pig meat.

The building cost per integrated sow was 9400 SEK higher due to the Swedish Model. A third of this cost was due to higher ceilings and wider walkways in Sweden than in Denmark. The higher costs for sows and weaners depend on higher labour costs, the use of straw and longer lactation. Some costs are compensated for by lower mortality and increased rate of gain. In slaughter pig production the Swedish model will bear fruit. Despite the ban on growth promoters, the growth rate is expected to be higher in the Swedish Model, resulting in lower feed costs. The mortality is also lower in the Swedish model compared to Danish systems.

3. Comparison Between Estimated Danish Results and Actual Results in Denmark

As a final step in the study the expected production results of the Danish system in Sweden were compared with actual results from Denmark. The fundamental aspects of the analysis above are confirmed and reinforced by this comparison. The Swedish model holds its own well in finish-feeding but not so well in weaner operations. The most important differences are mortality and growth rates for both weaners and slaughter pigs. In total the production costs between Sweden and Denmark differ by 1.13 SEK (table 4) per kilo of pig meat, of which less than half is due to the Swedish Model.

Conclusions

• The calculations compare the production results for the most competent producers in Sweden with their colleagues in Denmark. Production costs in connection with

the new investments are slightly more than 1 SEK higher in Sweden. Almost half of that, about 0,50 SEK per kg of pig meat, is due to the Swedish Model

• Most of the cost difference occurs in weaner production. Slaughter pig production tends to compensate for the higher costs ensuing from animal protection by a better rate of gain.

• The ban on growth promoters is the key issue. Given that ban, many improvements in animal environment are profitable.

• Differences in building traditions cause increased costs of 0,22 SEK per kg of pig meat.

Future opportunities

Since 1997 Denmark has decided to put a stop to the use of growth promoters for slaughter pigs and broilers.

The cost disadvantage arising from the Swedish Model can be expected to decrease as the skill and knowledge among producers are improving. The rebuilding of stables and investments in improved animal environment will mean that the effect of antibacterial feed additives will be more or less marginal. The full potential of healthy animals is still not exploited. A sero-pig production shows a growth rate exceeding the best herds by 30 % as weaners and 10 % as slaughter pigs. This corresponds to about 1.50 SEK per kg of pig-meat in decreased costs.

Swedish farmers are convinced that the ban on antimicrobial feed additives is an advantage for future competitiveness. The benefits of using antibiotics generally in feed do not outweigh the risks.

Distribution of Veterinary Medicines in Sweden

Legal Adviser Patrik Moberg (Medical Products Agency)

Marketing of pharmaceuticals in Sweden is regulated by the Medicinal Products Act, which applies both to human and veterinary pharmaceuticals.

According to the Act, a medicinal product may not be sold until it has been granted marketing authorisation, by the Medical Products Agency, (MPA). MPA is also responsible for supervising enforcement of the Medical Products Act.

The MPA has issued provisions concerning authorisation, distribution and prescription of veterinary medicinal products. The MPA has also issued provisions and guidelines on authorisation to place medicinal products on the market.

National Corporation of Swedish Pharmacies (Apoteket AB)

According to the Medicinal Products Act a license from the Government is required to trade with medicinal products. The state-owned National Corporation of Swedish Pharmacies (Apoteket AB) has exclusive rights regarding retail sales of medicines in Sweden. Its principle is the Ministry of Health and Social Affairs. Apoteket AB operates according to guidelines set out in an agreement with the State.

Apoteket AB runs approximately 900 pharmacies throughout the country, with a total of approximately 11 000 employees. Many of the pharmacies are attached to a hospital or health centre. In sparcely populated areas, agreements have been made with local food retailers, who act as pharmacy agents.

Medicinal products, that have been approved by the MPA, are distributed to the pharmacies by a wholesaler. At present there are two wholesalers supplying to pharmacies in Sweden.

Prescription and Dispensation

Provisions about prescription and dispensation of medicinal products are regulated by the MPA. These provisions correspond to Council Directive 81/851/EEC on the approximation of the laws of the member states relating to veterinary medicinal products.

According to the Medicinal Products Act only pharmacies run by the National Apoteket AB, are permitted to sell prescription only medicines.

Several categories of health professionals have the right to prescribe drugs. Doctors and veterinarians have unlimited prescribing rights. Veterinarians are permitted to pre-

scribe, not only veterinary medicines, but also products authorised for use in humans. The overriding principle of prescribing is to maintain patient and animal safety.

First time prescription by a veterinarian must be preceded by an examination of the animal/animals and a diagnosis. The veterinarian can indicate on the prescription if it is renewable or non-renewable. Subsequent prescriptions, i.e. for the continued treatment of the same condition, do not always have to be preceded by a clinical examination.

In Sweden veterinarians are not permitted to sell medicines. The prescriber is only permitted, in cases of emergency, to supply animal owners with a small amount of medicine so that the owner can initiate treatment before reaching a pharmacy to fill the prescription.

It has come to the knowledge of the MPA and the National Board of Agriculture that veterinarians in farm animal practice provide animal owners with larger quantities of medicines than the amount needed strictly for emergency treatment. Especially in remote areas, but also in other farming areas, it is not uncommon that farm animal practitioners, after having examined and diagnosed animals, hand over a sufficient amount of medicine for the farmer to complete the whole prescribed cure.

To cover storage costs, breakage, and the cost of medicines that can not be used (due to expiration dates etc) a percentage is added when veterinarians hand out medicines for emergency use or to farmers. Veterinarians are, however, under no conditions permitted to make a profit from dispensing medicines.

Chicken Production in Sweden

Managing Director Camilla Littorin (Swedish Poultry Meat Association)

Compared to many other EU countries, Sweden has a limited production of poultry. The annual production of broilers is approximately 65 million. Geographically the poultry density is low. The average flock is, however, quite large.

The Swedish Poultry Meat Association represents a very large part of all poultry production in Sweden. The Association includes hatcheries, growers and slaughter houses. 99 percent of all chicken meat in Sweden is produced by members of the Swedish Poultry Meat Association.

During the last few decades there has been a substantial increase in production of chickens in Sweden, from 23,8 million in 1970 to 65 million in 1997. In 1997 eleven percent of the total production of chickens was exported. The Poultry Meat Association organises 174 broiler producers, representing 3 346 flocks.

Classification Program for Chicken Production

Swedish chicken producers have collaborated, through the Swedish Poultry Meat Association, in creating national standards for animal management and health care. A classification system has been created for breeding farms and production farms. This system combines good livestock care with sound economy. Growers are rewarded on the basis of their classification results.

The basic population density limit in chicken production is 20 kg per square meter. Producers who satisfy specified requirements according to the classification system are permitted a higher limit-up to 36 kg per square meter. In this way the best growers can be rewarded by being allowed higher population densities without risking that this will be done at the expense of animal welfare. Good profitability leads to increased investments, to improvements in housing and technology and subsequently to better livestock care and animal conditions.

The system with differentiated population densities makes it possible for poultry growers to make investments in order to reach the top classification for population density. If they provide good livestock care they can reach a production level which is economically competitive, while still retaining the best animal welfare in the world. Growers with low standards are, on the other hand, forced out of business

The classification system evaluates not only technical equipment in the chicken house, but also livestock care and production results. Classification is carried out by the Swedish Poultry Association's National Standards Officers, together with the official salmonella control veterinarian appointed by the Swedish Board of Agriculture. The evaluation is based on conditions relating to management, ventilation, hygiene, emergency electrical power, alarm systems, cooling/humidifying standards, and the location of feed and water. Assessment points are awarded for each criteria, the points are then added and the grower is allowed a population density according to his/her total score.

Foot health is one of the most important criteria of the classification system, as it can be used as an indicator of sanitary conditions and ventilation. 100 randomly selected feet from each slaughter batch are examined by an official veterinarian. The results are reported to the Board of Agriculture twice every year.

The classification system has led to radical improvements in animal health and welfare. Swedish broiler production is of a higher standard than can be found anywhere else in the world.

Animal Health and Food Safety in Swedish Chicken Production

Chief Veterinarian Johan Lindblad (Swedish Poultry Meat Association)

The wide-spread geographic distribution of chicken producing units in Sweden has had a positive impact on poultry health, even though some "new" (previously not diagnosed in Sweden) viral diseases have caused problems during the last years.

The broiler industry, represented by the Swedish Poultry Meat Association, has been a pioneer in introducing methods that enhance animal health and welfare, as well as safe products. Measures have been taken due to legislation and also in many cases as the result of policy decisions by the Poultry Meat Association.

Ban on Antibiotic Growth Promoters

The use of antibiotics as growth promoters has been banned in Sweden since 1986, as these products may lead to an increase in salmonella colonisation and to an increase in antibiotic resistance. Antibiotics may only be used for animals after prescription by a veterinarian and on medical indications.

Initially the withdrawal of antibiotics from animal feed led to great problems for the broiler industry due to the disease necrotic enteritis. This disease is caused by the abnormal growth of a bacteria called Clostridium perfringens in the intestines of poultry. In 1987 virtually all chickens were prescribed the antibiotic virginiamycin to prevent necrotic enteritis. After this a new approach was adopted to combat the disease. Instead of continual prophylactic treatment with virginiamycin, a two-day treatment with phenoxy methyl penicillin in drinking water was given when there was an outbreak.

Necrotic enteritis is caused by a number of factors, for example poor hygiene, badanagement, feed composition and construction and climate of stables.
In the 1980:s research was carried out in close co-operation with the feed industry and broiler producers to find alternative ways to prevent necrotic enteritis. Changes were made in the composition of chicken feed, reducing the protein contents, increasing contents of fibre and course grain particles and adding enzymes. As a result of these and other measures the use of antibiotics for treatment of necrotic enteritis has

decreased from approximately two tonnes of virginiamycin in 1987 to 100 kg of phenoxy methyl penicillin in 1988 and to a negligible level since 1995.

It should be noted that coccidiostats of the ionophore type used in Sweden also inhibit the growth of Clostridium perfringens, and thus help to prevent necrotic enteritis (see below).

Coccidiosis Control

Coccidiosis is an intestinal disease in chickens, caused by various types of a protozoa called Eimeria. When chickens are floor-reared in concentrated confinement, measures are necessary to prevent coccidiosis. The use of coccidiostats, i.e. pharmaceuticals that inhibit the growth of Eimeria, started in USA in 1949, and has been a prerequisite for the modern broiler industry ever since.
Coccidiosis is a minor problem in cage systems, as birds do not have access to droppings containing the infective agents. In breeder flocks coccidiosis can be prevented using vaccines. In broiler production, however, vaccination is still not a feasible alternative. This is due, not only to the cost of vaccinating, but also to the rapid growth of the birds and the short rearing time.

The coccidiostats used in Sweden belong to the group of ionophores. Their advantages are that they are effective against all species of *Eimeria*, they are not related to any substances used in human medicine, they degrade comparatively quickly, and they inhibit the growth of *Clostridium perfringens*.

According to EC Directives there is a pronounced distinction between growth promoting feed additives and coccidiostats. Growth promoters are not permitted to have a therapeutic or prophylactic effect, i.e. they must not be effective in preventing or curing diseases. Coccidiostats, on the other hand, must have a prophylactic effect. Experience gained in Sweden, when antibiotic feed additives were withdrawn from chicken feed, demonstrates very clearly that the so called antibiotic growth promoters are in actual fact effective in preventing disease (necrotic enteritis) in chickens.

In Sweden coccidiostats are classified as prescription only medicines. They may not be added to feed without a veterinary prescription.

Goals for the future include the development of vaccines to replace the use of coccidiostats. If it proves possible to prevent coccidiosis through vaccination it will be necessary to find alternative preventive measures regarding necrotic enteritis. Hopefully it will be possible to develop vaccines also for this disease.

Salmonella Control Program

Swedish legislation is very strict with regard to Salmonella. According to the Food Act any lot of foodstuffs found to contain Salmonella (of any serotype) is considered unfit for human consumption. Such products may not be placed on the market.

A serious outbreak of salmonellosis in 1953 in the small town of Alvesta, was in many ways the starting point of Sweden's Salmonella policy. This outbreak involved 9 000 persons, of whom 90 died. With the aim of guaranteeing consumers safe and Salmonella-free foodstuffs the government issued regulations in 1961 for a "Salmonella Control Programme" to combat Salmonella in livestock

Production of Salmonella-free chickens is based on five basic principles:

1. Start production with Salmonella-free day-old chicks

Breeding stock is imported as day-old grandparent-chicks (GP-chicks). They are quarantined for seven weeks and not released until all samples have been proven negative from Salmonella.

2. Salmonella-free feed and water.

All poultry feed is heat treated and feed mills producing poultry feed are regularly monitored at critical control points.

3. Salmonella-free environment.

There are regulations in the Swedish Poultry Meat Association control program concerning housing (solid floors, walls and ceilings), cleaning and disinfection as well as rodent control.

4. Regular monitoring throughout the whole production chain.

All units are monitored with regard to sanitary conditions and bacteriological status.

5. Immediate action whenever Salmonella is detected

Regardless of serotype, any flock where Salmonella is detected is destroyed, the manure is composted, the house is thoroughly cleaned and disinfected. An investigation is carried out to identify the source of the infection.

Since 1968 the incidence of Salmonella in Swedish broiler production has constantly decreased.

Broiler flocks infected with salmonella:

Year	Number of flocks produced	Number of flocks Salmonella-infected	Percentage of flocks Salmonella-infected
1970	1500	40	2,7
1984	2400	25	1,0
1995	3500	4	0,1

Control of Campylobacter in Swedish Broiler Production

Serious efforts are made in broiler production to minimise the occurrence of Campylobacter in Swedish chickens.

As Campylobacter are earth bacteria and exist all around us, scientists believe that it is impossible to eliminate them entirely from the food chain. Researchers believe that a level of five percent in chicken production is achievable, and should be a goal for the broiler industry.

Hygiene is a key word in the fight against Campylobacter. To minimise the risk of chickens being infected, personnel entering poultry houses are required to change their boots and protective clothing. Rigorous cleaning takes place between batches of chickens. As a result of strict hygiene the prevalence of Campylobacter in Swedish chickens has been reduced to approximately seven percent.

The battle against Salmonella and Campylobacter has given rise to international interest. The World Health Organisation, WHO, has shown interest in the Swedish methods and has analysed Swedish broiler production with regard to food safety.

Consumers' Attitudes Regarding the Use of Antibiotics for Animals

Turid Ström, (Swedish Consumers Association)

Resistance to antibiotics constitutes an increasing threat to public health. During recent years resistance is increasing at an alarming rate and is now a major global public health problem.

Sweden's legislation regarding the use of antibiotics for animals is whole-heartedly supported by Swedish consumers. In fact there is broad consensus among farmers, consumers, politicians and the health professions that we must conserve the usefulness of antibiotics where they are essential, i.e. for medical and veterinary medical use. We strongly oppose giving antibiotics in feed to animals to make them grow faster.

Major consumer organisations at national and EU level now demand that animals be produced without routine use of antibiotics. Also the European Federation of Veterinarians has taken a position against the use of antibiotics as growth agents.

In January 1998 the Section for Protection of the Environment, Public Health and Consumer Affairs of the EU's Economic and Social Committee (ECOSOC) decided, on my initiative, to draw up an own-initiative opinion on resistance to antibiotics. When we started our work on preparing this opinion we could not imagine that the discussion on antibiotic resistance would gain such momentum at EU level.

Our work on the opinion was founded on the view that combating antibiotic resistance requires the combined effort and the shared responsibility of all the actors involved. The opinion was prepared by a study group made up of representatives of consumer organisations, doctors, veterinarians, the pharmaceutical industry, farmers and trade unions. In addition there was active participation of representatives of several European Commission departments (DGs III, V, VI, XII and XXIV), other European institutions as well as the World Health Organisation, WHO.

The opinion draws up recommendations. The recommendations for future action include the following: The Commission should encourage and support the framing of guidelines in all Member States for rational antibiotic use within human and veterinary medicine. In the animal field the use of antibiotics should be limited to veterinary medical purposes. It also calls for a systematic approach towards replacing growth promoting antimicrobials with safer, non-antimicrobial alternatives.

The opinion was unanimously adopted by the Section on 7 July 1998, and is expected to be officially approved at the ECOSOC's Plenary Session in September 1998 (the opinon was adopted on 9 September/editors note).

And finally:

Food quality is not just a matter of price, taste and nutritional value. Consumers are also concerned with how food is produced. Consumers no longer accept the use of antibiotics as growth promoters. Apart from the health risks, consumers see this as an ethical issue, as antibiotics make it possible to keep animals under poor conditions. To protect consumer confidence, farmers must use methods that give us safe food, produced under conditions that are acceptable from an ethical and animal welfare point of view.

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