

REPORT FROM EUROPEAN FARM TRIP (February 6-14, 2001)

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INTRODUCTION

In February 2001, five coalition members from the Campaign to Keep Antibiotics Working visited broiler and swine farms in Denmark and Sweden. The organizations represented were Center for a Livable Future/Global Resource Action Center for the Environment, Center for Science in the Public Interest, and Food Animal Concerns Trust. Our purpose was to learn first-hand from Danish and Swedish farmers, veterinarians, and scientists about their experience in raising food animals without antibiotic* growth promoters (AGP), and to determine if the Scandinavian experience could be applied to the U.S. poultry and swine industries.

This report and photos from the trip are also available at <http://www.farmanimals.net/>.

HISTORY OF THE ANTIBIOTIC GROWTH PROMOTER BAN IN SWEDEN AND DENMARK

Author: Deborah Huang, CSPI

SWEDEN

Sweden is widely cited as the first country to stop using antibiotic growth promoters (AGPs). In 1986, Sweden became the first European country to ban non-therapeutic use of antibiotics in response to pressure from the Swedish Farmers Union and consumers. (Sweden previously banned the use of penicillin, streptomycin, and tetracyclines as AGPs in response to the 1969 Swann committee report.) Farmers and consumers were concerned about the potential threat of antibiotic resistance as well as environmental effects. Additionally, the New Feed Act of 1986 made all antibiotics used in food animals available only by prescription.

Sweden also enacted animal welfare laws in 1988, mandating the amount of space per animal, animal management practices (i.e. banning sow tethering, requiring straw or litter), and animal housing. The management changes mandated by the animal welfare laws likely eased Sweden's transition from AGP use.

* For the purposes of this report, antibiotics are defined as compounds with antibacterial activity, regardless of method of administration and systemic absorption. Antimicrobials are defined as compounds with activity against bacteria, viruses, fungi, or parasites. Antibiotic growth promoters include antimicrobial feed additives.

Effects of the ban

Chickens

Necrotic enteritis was the primary problem for Swedish broiler producers after the AGP ban. (Prior to the ban, avoparcin was commonly used as an AGP.) Veterinarians were allowed to prescribe virginiamycin to prevent necrotic enteritis until 1988. Additional changes in hygiene, animal management, and diet were made to prevent necrotic enteritis. Currently, ionophore coccidiostats are prescribed to prevent necrotic enteritis, though Sweden's long-term goal is to develop other preventive measures for coccidiosis and subsequent necrotic enteritis.

Turkeys

Necrotic enteritis was also a problem for the Swedish turkey industry after the AGP ban. Average daily gain decreased slightly. Narasin is still used as a coccidiostat, with the long-term goal of developing other preventive measures for coccidiosis.

Swine

Prior to the AGP ban, standard practice in Sweden included giving piglets carbadox or olaquinox until 25 kg or 10-12 weeks old. Finishing pigs were given avoparcin or virginiamycin until slaughter at 7 months (Swedish Model of Animal Production, page 6).

The swine industry experienced problems with post-weaning diarrhea in piglets after the AGP ban. Post-weaning mortality increased by 1.5% and the number of days to reach 25 kg increased by 5-6 days (Swedish Model of Animal Production, page 6). Initially, quinoxalines (carbadox and olaquinox) were used for treatment. Zinc oxide was also used but became prescription-only after 1998, due to environmental concerns. Changes in animal management, hygiene, and feed were also made, including age-segregated and "birth-to-slaughter" systems.

Medicated feed use decreased from 75% of pigs ("at some point [during lifespan]") in 1989 to 11% of weaning piglets in 1995 (Swedish Model of Animal Production, page 6). As of 1996, post-weaning mortality remains 0.5% higher than before the ban.

Few or no clinical problems occurred in finishing pigs.

Cattle

The cattle industry had discontinued most use of AGPs prior to 1986 and was not affected by the ban (Swedish Model of Animal Production, page 7).

DENMARK

Denmark also followed the recommendations of the Swann committee report by banning the use of penicillins and tetracyclines as AGPs in the 1970s. In 1995, avoparcin was no longer permitted to be used as an AGP due to concerns about increasing vancomycin-resistant *Enterococci* (VRE). This was followed by a ban on the use of virginiamycin as an AGP in January 1998. Subsequently, a voluntary ban on all AGPs commenced in February 1998. A national tax on AGPs was added in September 1998. All therapeutic antibiotics are available only by prescription.

Denmark was able to learn from the Swedish experience in discontinuing the use of AGPs. Like Sweden, Denmark has a number of farm and animal welfare regulations restricting the number of animals per farm and farm density. Overall, the Danes experienced fewer problems in phasing out the use of AGPs.

Effects of the ban

Poultry

The Danish broiler industry did not experience many clinical problems after the AGP ban. There were 25 cases of necrotic enteritis among more than 1800 flocks, compared with 1-2 cases before the ban. Danish veterinarians do not report an increase in therapeutic use of antibiotics for necrotic enteritis (DANMAP 99, page 7). Coccidiostats, especially ionophores, are still used for prevention of necrotic enteritis; use has increased since the AGP ban (DANMAP 99, page 11). Coccidiostats in feed do not require a veterinary prescription.

The mean monthly feed conversion ratio increased after the AGP ban by 0.016 kg feed per kg broiler. There was no significant difference in mean monthly kilograms of broilers per m² or the mean monthly mortality percentage after the ban.

Swine

The voluntary ban on AGPs began in March 1998 for finishers (> 35 kg). In October 1998, a plan was initiated to phase-out the use of AGPs in piglets < 35 kg.

Preliminary results of a survey observing the effects of the AGP ban show an increase in post-weaning diarrhea (*E. coli*) in piglet herds after the AGP ban. Average daily gain decreased from April 1999 to April 2000. During the same time period, mortality increased by 0.7% and the time to reach 30 kg increased by 2.4 days. Some farmers are also experiencing problems with failure-to-thrive caused by *Lawsonia intracellularis* infection. Several management changes are being tested to reduce post-weaning diarrhea.

In finishers, there was a slight increase in mortality. A slight decrease in productivity appears to be resolving. There was no increase in therapeutic antibiotic use (DANMAP 99, page 7).

Overall, antibiotic use initially increased above pre-ban levels, but appears to be decreasing since 4 months after the ban. Post-weaning diarrhea in piglets accounts for most of the increase in therapeutic antibiotic use. Since the AGP ban, metaphylaxis appears to be needed to avoid swine mortality. Tetracyclines are most commonly used.

NEW DEVELOPMENTS

When Sweden joined the European Union in the late 1990s, the European Commission banned the use of bacitracin, tylosin, spiramycin, and virginiamycin (as well as carbadox and olaquinox) as AGPs. (Most European countries also stopped using penicillins and tetracyclines after the Swann committee report.) Germany and Austria requested extending the EU ban in January 2001 to the remaining AGPs: avilamycin (related to the investigational antibiotic Ziracin), bambarmycins/flavophospholipol, and the ionophores salinomycin and monensin.

COLLECTION OF ANTIBIOTIC-USE DATA IN SWEDEN AND DENMARK

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SWEDEN

Antibiotic-use data can be considered as two components. Prior to 1986, antibiotics that were used as growth promoters were not considered pharmaceuticals, and statistics on their use was collected by the Swedish Board of Agriculture. Antibiotics that are classified as pharmaceuticals have been tracked since 1980, and are available only by prescription. These antimicrobial agents are dispensed by Swedish pharmacies or by veterinarians. The data on use is collected via sales statistics produced by the Central Statistics System of Apoteksbolaget -- the National Corporation of Swedish Pharmacies (NCSP). NCSP has exclusive rights regarding retail sales of all medications in Sweden, and is state-owned. All sales from wholesalers to local pharmacies, veterinarians, and feed companies are registered. There are only two wholesalers in Sweden. This data represents total usage in Sweden. Only problems that affect national statistics will prompt a prescription review. That may be adequate in a country the size of Sweden because smaller shifts in use might affect national data. However, that would be of limited use in the United States.

According to Swedish data, overall usage of antibiotics decreased by 55% since the ban was instituted (Swedish Model of Animal Production, page 9). Use of antibiotics continues for therapeutic applications. Treatment of mastitis is not included in the 1986 ban on non-therapeutic agents, and accounts for a significant amount of the continued antibiotic use in Sweden.

DENMARK

Prior to 1995, data on antimicrobial drugs used for therapeutic purposes were provided by the Federation of Danish Pig Producers and Slaughterhouses and the Danish Pharmacy Association. This was accomplished by voluntary reporting to Danish Medical Statistics. After 1996, quantities of antimicrobial drugs sold by the pharmaceutical industry to the Danish Medicines Agency form the basis for the data. All medicines must be registered by the Danish Medicines Agency and annual reports on the quantities sold are required from manufacturers and importers. Growth promoters and coccidiostats are monitored by the Danish Plant Directorate via compulsory reporting by companies authorized to produce premixes containing antimicrobial agents. Therefore, even before the current reporting system, there was some capability to distinguish therapeutic and non-therapeutic use of antibiotics.

Based on that data, it was determined that 163 tons of active compound were used in 1997, and that decreased to 74 tons as of 1999. After the ban, during the last six months of 1999, there was a 90% decrease in the use of growth promoters. Coccidiostat use increased by 40% (DANMAP 1999).

As of 1996, all human antibiotic usage is recorded by pharmacy data and available for analysis. On the veterinary side, new monitoring was recently instituted. VETSTAT monitors all therapeutic uses, including sera and vaccines, at the farm level. All antimicrobials require an prescription from a veterinarian. Pharmacies distribute the drugs to farmers (in conjunction with a prescription) for 85% of the medications. The veterinarians provide the drug for the remaining 15%. Both pharmacies and veterinarians, as of May 1, 2000, have been required to report the medication, dose and quantity of drug dispensed, the identity of the farm, the species being treated, the age group of the animal being treated, and the reason for treatment. As of July 1, 2000, all feed mills have been required to report all medicated feed in detail. All information is reported to VETSTAT and becomes part of a central database for the Danish Zoonosis Centre. In addition, as mentioned above, there is data from the manufacturers and importers in an annual report to the Danish Medicines Agency, and data provided by the Danish Plant Directorate.

In summary, both Denmark and Sweden can monitor antibiotic use in animal husbandry accurately and this information is readily available to the public.

UNITED STATES

In contrast to Sweden and Denmark, the United States has no publicly available antimicrobial-usage data in animals. Information provided to the FDA currently is not contained in a database that allows analysis of the data. Neither total usage, nor specific usage can be ascertained with currently available information. Published reports of total antibiotic use vary significantly. Improvement in data collection in the U.S. will be of great importance.

AGRICULTURAL STRUCTURE

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SWEDEN

The Swedish Federation of Farmers is the umbrella organization for farmers throughout the country, and consists of 140,000 individual farmers and about 50 incorporated associations. These associations, in turn, represent individuals or cooperatives within the various sectors of agriculture (e.g., Swedish Poultry Meat Association). In total, the Federation of Farmers represents over 300,000 individuals, almost all of Swedish agriculture. The stated goals of the Federation include “influence, profitability, and fellowship.” The Federation seeks to make Swedish agriculture the cleanest in the world.

By European standards, the Swedish poultry meat industry is small, producing about 65 million broilers in 1997. This is a marked increase from 23.8 million in 1970. There are approximately 174 growers with 3,300 flocks, and the trend in recent years is toward a steady number of producers with larger flocks. About 90% of production is for domestic consumption. This consumption escalated from 4.4 kg per person in 1988 to 11 kg in 2000. Thus, the industry’s production has risen and intensified.

Although there are numerous associations representing hobby farmers, ostrich producers, etc., the Swedish Poultry Meat Association represents more than 99% of all broiler production. Most of the membership of the organization comes from six cooperatives, and the Association represents members in selling to the few slaughterhouses in the country. The Association works very closely with government to forge consensus, having a closer working relationship with government than trade associations do in the United States. The Association works to develop voluntary standards that it can enforce, preempting, in many cases, government action. The major issues faced by the Swedish Poultry Meat Association, and its agricultural counterparts in Sweden and Denmark, are government relations, food safety, animal welfare, the environment, and the setting of industry standards.

Swedish Meats was created in 1999. The farmer-owned meat industry created this “food group” to bring together meat producers (beef and pork), as well as abattoirs and cutting operations. Swedish Meats is one of the country’s largest food groups, with annual sales of \$1.25 billion. The organization is owned by four regional farmers’ cooperatives, representing 50,000 farmers. It produces the Scan brand, controls two-thirds of the slaughter in Sweden, and has several subsidiary corporations (e.g., Ellco Food for blood and fat processing, and SQM Pork, for pork production and processing). Due to the recent scares about mad cow disease, pork consumption has increased by 21% since 1995; production has not kept pace, partially due to the rigorous environmental and health rules.

Swedish poultry meat and pork production is thus heavily controlled by cooperatives, which in turn have formed associations and farmer-owned agribusinesses to process and market their products. While membership is technically voluntary, economic conditions make it very

important for farmers to join with their colleagues in these collective enterprises.

DENMARK

The Danish broiler industry produces approximately 137 million birds per year, with about 460,000 birds per farm (about 250 producers). The Danish Poultry Meat Association represents the poultry cooperatives similar to the Swedish association. The trend continues toward intensified production and greater economies of scale to meet the growing demand for poultry meat.

Denmark has a sizable, export-oriented pork industry, producing more than 7.4 million pigs per year, 80-85% of which is exported. There are 18,000 producers, and 30% of them produce 80% of the pork. The number of slaughterhouses declined from 70 in 1970 to 3 in 2000. The Danish Bacon and Meat Council, made up primarily of cooperatives (including 95% of swine farmers), represents the industry.

Organizationally, pork production in Denmark is similar to Sweden. The vast majority of farmers belong to cooperatives and they are obligated to supply their entire production to the cooperative-owned commercial company. Conversely, the company is required to take the farmer's entire production, freeing the latter from worrying about marketing. While cooperatives are voluntary, as in Sweden, they are economically essential for most farmers, whose share of the profits is commensurate with their production. The cooperatives are democratically administered (one farmer, one vote), and are operated with professional management, like any company. In effect, the farmers are the board and the shareholders and are responsible for selecting the management.

The cooperatives undertake most manufacturing and processing, with cooperative-owned farm-supply companies providing inputs in competition with private companies. Like corporations, cooperatives in Denmark have grown larger, often through mergers, and are increasingly involved in export-promotion and international marketing. The cooperatives compete among themselves as well, although they often work cooperatively to set standards, and on veterinary and technology issues, and in the trade associations.

CASE STUDY: DANPO

The Danish and Swedish pork and poultry industries are small, geographically confined, consolidated, and are controlled by a few large enterprises. Some of these enterprises, such as the poultry company Danpo (a subsidiary of Spira AB), operate in both countries.

The recent history of the development of Danpo is illustrative of the organizational development of these industries in these two countries.

Danpo was founded in 1971 following a merger of four cooperatively-owned poultry slaughterhouses in Denmark. In 1974 the organization was divided into Danpo Amba (owned by

farmers) and Danpo A/S (controlling the slaughtering facilities). In 1977, Danpo A/S merged with KFK's two slaughterhouses, and in 1990, the new company merged yet again with another firm.

In 1995 Danpo A/S was taken over by Scandinavian Poultry AB (Spo), owned by Spira AB of Sweden. Spo was founded in 1993, and immediately acquired the Kronfågel Group, and then Danpo A/S. In 1999, Scandinavian Poultry was abolished and today, Spira AB is the actual owner of Danpo.

Sweden's Spira AB thus owns the dominant poultry company in each country, accounting for 47 million slaughtered chickens annually in Denmark and 38 million in Sweden. In Denmark, 100 producers supply the company, 70 in Sweden. The company employs 3500 workers.

The ownership of Spira AB is diverse, to say the least, and includes a variety of Swedish cooperatives and agricultural associations. Danpo's subsidiary companies are owned by Danish cooperatives, a German corporation, and by a number of independent food companies.

SUMMARY

Danish and Swedish pork and poultry meat production is becoming increasingly large and corporate in terms of ownership. Small, independent farmers and cooperatives are being replaced by large agribusinesses, although farmer ownership is very significant. Both pork and poultry meat production and consumption are increasing and are expected to do so in the foreseeable future. As the Danish and Swedish industries grow, there are apt to be only a few large companies controlling the market, and contracting with producer associations and individual cooperatives to provide the raw material for slaughter, processing, and marketing.

BROILER FARMS IN SWEDEN AND DENMARK

Author: Richard Wood, FACT

SWEDEN BROILERS

I. Broiler Production Overview

Annual Demographic Data:

Total number of producers	130
Approx. number of broilers slaughtered	65 million
Average number of broilers produced per farm	110,000

Broiler flocks average between 20,000 and 30,000 birds per house. Ninety-nine percent of all poultry produced in Sweden comes from members of the Swedish Poultry Meat Association. The Association is a voluntary cooperative made up of hatcheries, slaughterhouses and processors, feed mills and farmers. Primary breeders for the Association come from the United

Kingdom. The Association works closely with Swedish government agencies, such as its veterinary service.

The Association members created national standards for animal management and health care, establishing a classification system. Producers are rewarded on the basis of their classification results judged in terms of how their houses are equipped, the measure of livestock care, and production results. Part of this classification is based on the condition of 100 randomly selected feet at slaughter.

In terms of stocking density, national law allows only 20 kg/m² (approximately 0.845 lb/ft²). Association members are allowed to stock up to 36 kg/m² (approximately 1.52 lb/ft²) if they meet the classification standards. Those who meet the standards, therefore, can produce more birds and have bigger profits. Today, 97% of the Association members meet the standards and therefore are allowed a greater stocking density.

It is illegal to sell animal food products in Sweden that are contaminated with *Salmonella*. The association provides insurance for producers in case they must have a flock destroyed due to *Salmonella* contamination.

Since the 1986 ban, broiler production substantially increased -- from 23.8 million in 1970 to 65 million in 1997. During the last 13 years, the consumption of poultry meat in Sweden doubled. Ninety percent of all chicken meat consumed in Sweden is Swedish-produced. Very little poultry is exported from Sweden. Thirty percent of the poultry is sold fresh and 70% is sold frozen. In terms of production and consumption figures, the ban on growth promoters has had a positive, rather than a negative impact on production.

Manure restrictions exist and are more stringent in southern Sweden where there is a greater population density.

II. Antibiotic Use

Following the 1986 ban, the broiler industry initially had problems with necrotic enteritis. Before the ban, virginiamycin was used as a disease-prevention tool. Later penicillin was administered via drinking water when disease occurred. Additionally, changes were made to the composition of the chicken feed. The protein content was reduced, fiber was increased, and coarse grain and enzymes were added to improve wheat digestion. The main feed ingredient is whole wheat.

The construction of the houses promotes bird health. On the farms we visited, the walls were solid. The houses' heating systems either used warm-air heat or hot water in the floors. Wood chips were used for litter. A biosecurity layer surrounded each house with entrance allowed only after changing or covering shoes and clothes, or wearing disposable coveralls. The houses had washable surfaces. One of the farms we visited had a new house costing \$1.3 million -- testimony to confidence in Sweden's broiler industry.

The use of coccidiostats is also seen as a key control. In Sweden the use of coccidiostats is now allowed without a veterinarian's prescription. Prior to joining the European Union, coccidiostats were used only by prescription. Today, Sweden monitors its use through a control program that seeks to minimize resistance. Alternatives to coccidiostats have not been found yet. With these interventions, currently there are minimal problems with necrotic enteritis.

Antibiotics are only allowed with a veterinarian's prescription. Veterinarians are not allowed to sell medicine or to make a profit where sales are allowed. In remote regions or emergency situations veterinarians can dispense a sufficient amount of medicine to complete the prescribed cure. (There has been some abuse of this provision.)

Quinolones are approved for poultry, although its use is limited. In 2000, 200 grams of quinolones were prescribed for broilers. Last year in all the flocks, only 600 grams of tylosin were used. On the farms we visited, growth promoters were never used because they began farming after the ban. The therapeutic use of antibiotics was also minimal on these farms. Statistics on the overall use of antibiotics in all birds will be available in a report to be posted at <http://www.sva.se/> in June 2001.

DENMARK BROILERS

I. Broiler Production Overview

Demographic Data - 1999:

Total number of broilers in Denmark	36,313,328
Total number of flocks	342
Approx. number of broilers slaughtered	137 million (DANMAP 99)
Average number of broilers produced per farm	460,000 (Danpo)

Broiler flocks average between 40,000 and 50,000 birds per house. There are caps on flock size based on the amount of available land for manure disposal and a limit on how many farms can be owned by one producer.

The Denmark broiler farm tour was hosted by Dr. Niels Tornøe, a veterinarian with Danpo. Danpo is a cooperative of over 100 producers and three processing plants, which together produces about 40% of the broilers in Denmark. All of Danpo broiler products are certified *Salmonella*-free. Danpo also has a line that is certified both *Salmonella*- and *Campylobacter*-free. No antibiotics are used to promote growth or prevent disease in Danish broilers. Danpo products do not receive a premium for these practices. Most of the Danpo broiler products are exported.

II. Antibiotic Use

All medication must be by prescription and the preventive use of medications is illegal.

Veterinarians are not allowed to profit from drug sales. Drug prices are set nationally and are publicly available, although a company can set its own price.

In response to consumer demand, in February 1998, the Danpo producers and slaughterhouses initiated a voluntary ban on using antibiotics as growth promoters. This was prior to the EU action. Producers in the cooperative were penalized at sale if antibiotic growth promoters were used.

In taking the step to ban growth promoters, producers were concerned about:
the increase in disease, particularly necrotic enteritis;
morbidity;
feed conversion -- how much feed and how many days to market weight.

The Danish broiler producers took several steps to respond.

The composition of the feed mixture was improved. Broilers are now fed coarser feed, supplemented with whole-wheat kernels. The feed mixture is characteristically composed of the following ingredients: wheat, 38%; soy meal, 23%; peas, 17%; rape seeds, 15%; minerals, 3%; soy bean oil, 2.5%; vitamins, 1.5%. If corn is added to this mixture, it replaces a maximum of 10% of the wheat content. The feed is heat-treated and pelleted.

The ban initially had an impact on feed conversion. Initially an increase of 0.016 kg of feed per kg of broiler was observed. The slaughter weight at 42 days decreased at first by approximately 30 grams (0.0137 lb), however, it has since increased and is now higher than 2,000 grams (approximately 4.41 lb). Birds are currently heavier at 42 days than before the ban. Part of this increase may be due to the industry now using a different breed of birds.

Producers have also been able to maintain and even increase floor space density with no seasonal variations. The stocking density in Denmark is around 25 birds/m² or more commonly 43.45 kg/m² (approximately 1.83 lb/ft²). One farm we visited had 120,000 birds in three houses, with approximately 40,000 birds per house. A second farm had 48,000 birds in one house.

Initially there was a rise in necrotic enteritis, from 2 flocks to 25 flocks out of 1700 flocks in 1998. Less than 1% of the Danpo flocks were treated therapeutically (amoxicillin). The use of coccidiostats has increased across the industry. In broilers, coccidiostats are not regulated as medicines. Today, there is only a slightly higher rate of necrotic enteritis than before the ban.

Steps were taken to improve hygiene and biosecurity in the houses. The houses at the farms we visited were very solid with thick walls. New houses have cinderblock construction. The houses are heated by forced air, or in newer houses through the walls and the floors. Litter in the houses is from wheat straw or wood chips. Sand is not used as litter in Denmark. Dead birds are removed at least daily and kept in a cooler on the farm site until collected by a rendering facility. Workers follow biosecurity steps when entering the houses. Shoes are changed at the door and workers either change clothes or wear disposable coveralls. Houses are cleaned and disinfected

after each flock. After clean-out, manure is moved to at least 100 meters from the house and spread on the land when allowed by law.

Overall in the Danpo flocks we visited, the ban on growth promoters has resulted only in a slight increase in morbidity and no loss in productivity. Thanks to the biosecurity measures, *Salmonella* contamination of a poultry flock is very rare and Danpo broiler products are certified free from all types of *Salmonella*.

SWINE PRODUCTION IN SWEDEN AND DENMARK

Author: Steven Roach, FACT

SWEDEN

Sweden, which is slightly larger than California, produces approximately four million pigs per year, most of which are consumed domestically. Consolidation has occurred in Sweden during the past twenty years, although the average swine herd still contains approximately 300 pigs. There are also larger farms; over 60 percent of Sweden's pigs are kept in herds of greater than 500. Herd size is limited by environmental legislation based on an upper limit of animal units per farm.

Skure Farm

On February 12, 2001, we visited several pig farms. The first farm, owned by Markus and Lena Skure, is part of a larger agricultural business that is spread over several non-adjacent farms with different livestock operations. The Skure's swine business operates as a sow pool providing baby pigs through contracts to other farms that either practice farrow-to-finish or multi-stage production. The farm raises 1,000 sows that supply 23,000 pigs annually to 7 other farms. Each satellite farm is contracted for 40 sows every nine weeks.

At the sow barn, the breeding pigs are kept in an open straw-bedded area where they are individually fed. Each sow is bred twice through artificial insemination over a period of a week. Several boars are kept with the sows as well. After breeding, the sows are moved to group pens where they are trough-fed. The gestating sows are kept on partially slatted floors where they are given some straw for entertainment and as dietary roughage.

We visited both a farrow-to-finish and a conventional satellite farm. The sows are moved to the satellite barns 3 weeks before farrowing, where they are kept in a group on straw, until moved to individual farrowing pens. The houses all have in-floor heating and heat lamps are provided while the piglets are small. The pen is divided into an open area where the sow is housed and a creep area where only the piglets could enter. In the pens where the sow was still present, there was more straw litter. When they were not feeding, the baby pigs clustered under the heat lamps.

This swine operation was started after the ban on growth promoters. They use several measures to control post-weaning diarrhea. One of the most important factors is waiting for the appropriate time to wean. Other factors are careful cleaning of premises, and controlling temperature and environment through heat lamps and proper ventilation. Diet is also very important along with feeding several times per day.

Markus Skure stated that he would not go back to using antibiotics if given the choice. He would like to wean earlier and would like to be able to restrict the movement of the sow just after farrowing.

Hjulsta Integrerand Produktion

After the Skure farm, we visited the Hjulsta Integrerand Produktion, a pig farm using the deep-bedded system. This farm has 83 sows plus 16 replacement gilts. All swine are kept in deep-bedded pens with no slatted floors. The facilities were noticeably cooler than the other farm we visited and there was also less odor. The deep-bedded system also produced notably cleaner pigs.

Sows farrow in individual pens and are moved to group housing 1 week before weaning. The pigs are weaned at five weeks and kept until 70 days old when they are sold to a finisher at 30 to 35 kilograms. The farmer produces all replacement stock from his own herd and also finishes a small number of pigs for family and friends. He is able to control crushing by selecting replacement stock that has better maternal skills.

This farm was in operation before the ban. At first, they controlled diarrhea with zinc oxide. When they had to stop using zinc, the piglets developed diarrhea problems. The farmers controlled these problems by adding oats to the feed and adjusting the amount and timing of feeding. He currently has to treat only 1 or 2 pigs out of 300.

DENMARK

Denmark, which is roughly one-third the size of North Carolina, produces approximately 23 million pigs each year. Over 80 percent of this production is sold for export, with the majority going to other European Union member states. While the swine industry in Denmark experienced substantial consolidation over the last twenty years, the maximum size of farms is limited by environmental regulations. The largest farms have 7,500 slaughter pigs and 1,100 sows per site. Most pigs in Denmark are kept on farms with 500 to 3,000 pigs and between 100 and 300 sows. About half the farms have both pigs and sows. Because of the environmental regulations limiting farm size, future consolidations will need to be based on multi-site operations.

Recently introduced welfare regulations in Denmark ban fully slatted floors in pig barns. There is also a movement towards loose housing of sows. Most pigs in Denmark are weaned at four weeks. The major health problems in Danish herds are diarrheal diseases and respiratory

diseases. *E. coli* and *Lawsonia intracellularis* are problems in weaners. Those diseases have become more of a problem since the banning of growth promoters. Viral respiratory diseases and mycoplasma arthritis are also of concern.

Helmer Farm

On February 9, 2001, we visited the pig farm owned by Peter Helmer at Sorø, Northern Zealand. He houses approximately 700 sows in barns at his home farm site and transfers the weaned pigs to an adjacent farm, where he keeps them until they reach 50 days of age. He produces from 13,000 to 14,000 pigs per year. He recently switched to loose housing for his sows, which has resulted in a decrease in the number of pigs per sow.

After weaning, pigs are moved to an adjacent farm, where they are kept in same-age batches from 24 days until 50 days, when they are sold to finishers. He does not currently have a location to finish pigs, but is working with his son to locate a farm to purchase for this purpose.

The pens housing the growing pigs are all partially slatted with some straw given for bedding and as environmental enrichment. Each pen has a covered area under which the pigs are able to rest. He felt that area is very effective in allowing the pigs to regulate their own body temperature. He maintains a separate area for sick pigs and does not move poor-performing pigs back into younger groups. We saw bottles of medication in his barn that were presumably used to treat post-weaning diarrhea. Since this farm is primarily a weaner operation, it would be expected to have been most impacted by the ban.

CONCLUSION

We conclude that it is possible to raise food animals in large numbers without routine or non-therapeutic use of medically important antibiotics. The broiler industries in both Sweden and Denmark continue to raise chickens at high density levels, in some cases at even higher density than American farms. Ionophore coccidiostats are used in both countries. In the swine industry, both Sweden and Denmark are raising finishing pigs without antibiotics, though there are some clinical problems with piglets/weaners. However, we recognize that the United States is not Sweden or Denmark. There are a number of challenges that the U.S. would need to overcome in order to phase out the use of non-therapeutic antibiotics and/or antibiotic growth promoters (AGPs).

Consumer knowledge and attitude. Consumers in Sweden and Denmark are very aware that antibiotic use in food animals can cause antibiotic-resistant bacterial infections in people, and are willing to pay for antibiotic-free meat. All changes in the use of non-therapeutic antibiotics in food-animal production were made because of consumer demand for safe food. Consumer concern about antibiotic resistance in Sweden led to the 1986 withdrawal of AGPs. Additionally, the Swedish *Salmonella* and *Campylobacter* outbreaks and deaths in the 1950s and 1980s, respectively, first prompted consumers to inquire about animal-management practices. In response, farmers and industry associations developed programs to reduce the level of *Salmonella* and *Campylobacter* contaminating meat and poultry. Thus, Scandinavian consumers are quite aware of food-safety issues.

In comparison, the level of American consumer awareness is low. A strong consumer education and mobilization campaign will be instrumental in prompting food-animal producers to change their practices and make antibiotic-free meat widely available. We should not have to wait for deaths to occur to activate consumers (industry representatives have been quoted as saying “show me the bodies”). The campaign should devote extensive resources to developing a strong hook to capture public interest in the issue. It is also not known how much more American consumers will pay for antibiotic-free meat; consumer surveys may be an important tool to gauge the amount consumers are willing to pay.

Form of vertical integration. Agribusiness in the U.S., Sweden, and Denmark are vertically integrated, though in different ways. In Sweden and Denmark, industry associations integrate independent farmers, feed mills, and slaughterhouses into cooperatives (e.g., for poultry, pork, etc.). The industry associations control livestock slaughter and marketing of food-animal products. In contrast, U.S. agribusiness corporations control slaughter and marketing and contract with individual farmers. The corporations own the livestock and provide feed while the farmers provide labor, housing, and disposal of waste. In the U.S., there is an imbalance of power between the corporation and farmer, which limits the contract farmers’ ability to make long-term investments in their facilities and to modify practices. In Scandinavia, the cooperative associations mediate between the farmers and the slaughter and marketing facilities, greatly reducing this imbalance.

Scandinavian farmers are willing to invest in antibiotic-free farming because they are interested in future viability of their industry. The American system promotes a mentality that only deals with present agricultural and economic conditions.

Animal husbandry, management practices, and biosecurity. Some current American animal-husbandry practices promote the use of antibiotics. For example, U.S. broiler houses are not cleaned out and disinfected between every flock. While this may allow chicks to build immunity to coccidiosis, it may also allow bacteria (both susceptible and resistant to antibiotics) to persist in the litter. The bacteria may be transmitted to the broilers, causing illness (clinical or subclinical) that requires antibiotics. We recognize that complete clean-out and disinfection between each flock would require more labor and expense, but it should not prolong the waiting period between flocks (typically 14 days -- approximately the same in the U.S., Sweden, and

Denmark). Complete clean-out and disinfection between broiler flocks should help reduce the need for antibiotics.

It is not quite as clear which animal-management practices in the U.S. swine industry increase the need for antibiotics. Some possible areas highlighted by our visit include management changes to reduce post-weaning diarrhea; reducing stress, including moving stress; strict adherence to the “all-in-all-out” system (e.g., not moving smaller pigs back into younger herds); maintaining a separate “sick room” for ill pigs; and changes in feed composition.

In Sweden and Denmark, piglets are weaned slightly later at 4-5 weeks, compared to 3-4 weeks in the U.S. The Scandinavian farmers have found that later weaning alone does not prevent post-weaning diarrhea (and antibiotic therapy). Other management changes are also needed to reduce the need for antibiotics.

Some Swedish farms reduce moving stress by moving the sow after weaning, not the piglets. The pigs remain in the same pen until they reach market weight. Currently, piglets may be moved after weaning and to a separate finishing site. Each move increases stress and the susceptibility to disease. We recognize that most U.S. farms are not currently set up to raise pigs “from farrowing to slaughter,” but modifying the current system may reduce the need for antibiotics.

Biosecurity on broiler farms in Sweden and Denmark is stricter than the U.S. We were required to wear disposable coveralls and plastic shoe covers on each farm, but were not allowed to enter the chickens’ area without showering and completely changing clothes. (It is possible that this level of biosecurity is similar to American antibiotic-free broiler farms, but we have not been able to confirm this.) The higher level of biosecurity was made possible by the construction of the houses, which included an entry area with a shower and windows looking into the chickens’ area.

It is also worth noting that Scandinavian farm buildings are generally constructed of cement blocks, with built-in heating systems and computerized ventilation systems. This type of construction is needed because of the colder climate. It is unclear how much the difference in building construction contributes to their ability to raise food animals without AGPs.

Feed composition. The Swedish and Danish farmers use a whole grain-based feed with a lower energy and protein content. It is also heat-treated and tested for bacteria. While American producers use corn- and soy-based diets, it would be possible to adjust the content of energy and protein. We are aware that some companies do test the feed for bacteria in the U.S. Industry-wide testing of feed could potentially reduce introducing bacteria to the animals.

Availability of antibiotics over-the-counter. The widespread availability of antibiotics in the U.S. makes it more difficult to discontinue the routine use of antibiotics. Making antibiotics only available by prescription would facilitate monitoring usage and compliance. That change was made in both Sweden and Denmark. Based on both countries’ experiences, making the

changes needed to stop using AGPs would promote animal health, thus decreasing the need for therapeutic antibiotics. Making all veterinary antibiotics only available by prescription would not make it more difficult to treat sick animals. Swedish and Danish veterinarians are still allowed to distribute antibiotics to farmers who are not able to fill their prescription at a pharmacy. However, Swedish and Danish veterinarians are not allowed to profit from the sales of pharmaceuticals.

Making veterinary antibiotics available only by prescription in the U.S. would require significant regulatory changes. It might also require making antibiotic use for “disease prevention” illegal (as in Denmark).

Differences in regulatory agencies. Antibiotics and antimicrobial feed additives are licensed by separate agencies in Sweden and Denmark. Thus, it was easier for both countries to prohibit the use of antimicrobial feed additives used as AGPs. In the U.S., the Food and Drug Administration (FDA) is responsible for approving all antibiotics, including antimicrobial feed additives used as AGPs. The same regulatory withdrawal procedures apply to all animal antimicrobials and requires the FDA to prove that the product is harmful.

Additionally, Sweden and Denmark are much smaller countries, making it easier to implement regulations. In the U.S., states implement most regulations, which may vary from state-to-state. It is worth noting that regulatory agency decisions in Scandinavia are not typically open to public input, and may not be as accountable to the public.

Fear of Congressional interference. The US Food and Drug Administration (FDA) may risk Congressional interference in its actions. In the late 1970s, the FDA attempted to withdraw approvals for subtherapeutic use of penicillin and tetracyclines in food animals (based on the Swann committee report). Congress threatened to cut the FDA’s funding and required further research, and the FDA halted work on the issue. In Denmark and Sweden, the parliament does not interfere with the Ministry of Agriculture. If the FDA proposes any action related to the antibiotic-resistance issue, it is possible that Congress may legislate to stop it.

Water sources. Groundwater is frequently used in Sweden, Denmark, and the U.S., but the groundwater is less likely to be contaminated in Scandinavia. Some Scandinavian farms are able to use potable water. We are aware that many American farms test their water for coliform bacteria and chlorinate the water. Strict industry-wide monitoring and control of the water supply would reduce the risk of introducing bacteria to the animals.

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