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Safeguarding Animal Health in Global Trade :
Proceedings of Workshop 9 on Sustainable Animal Production, held at Hannover, October 5-6, 2000

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Safeguarding Animal Health in Global Trade

edited by
Volker Moennig and Alex B. Thiermann

Proceedings of Workshop 9 on Sustainable Animal Production, organized by the School of Veterinary Medicine, Hannover,

held at Hannover, October 5 - 6, 2000

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Workshop Series „Sustainable Animal Production", June - October 2000

Foreword to the Proceedings

How can agriculture provide a reliable source of food of animal origin for the world's population without compromising the basis of life of future generations? In view of the rising demand for food of animal origin in industrialized, emerging and developing countries, how can animal production on a global scale become sustainable?

These were among the key issues under scrutiny in a series of international workshops on sustainable animal production conducted during the world exposition EXPO 2000 by a consortium of scientists from four north German research institutions: the School of Veterinary Medicine Hannover (coordination), the Federal Research Institute for Agriculture (FAL), the Institute for Structural Analysis and Planning in Areas of Intensive Agriculture (ISPA) at the University of Vechta, and the Agricultural Faculty of the University of Göttingen.

A broad spectrum of current issues and problems in modern livestock production were covered: animal production and world food supply; globalization, production siting and competetiveness; product safety and quality assurance; the environmental impact of livestock farming; animal welfare and health; biotechnology and gene technology; animal genetic resources; animal nutrition: resources and new challenges; safeguarding animal health in global trade.

The individual workshops were organized by local coordinators and moderated by international discussion leaders. In all 142 scientists from 23 countries worldwide participated as speakers. The workshops produced a differentiated, inclusive and holistic vision of the future of global livestock farming without national bias and free of emotionally-tinged concepts or ideology. The results of the workshops were summarized and presented to the public in a final plenary session including a roundtable discussion with representatives of agricultural policy, public life and the media.

In addition to the publication of proceedings of the workshops as special issues of *Landbauforschung Völkenrode*, abstracts of the papers and summaries of the results are now documented in the Internet at www.agriculture.de, where a preparatory virtual conference was conducted from October 1999 until October 2000.

Volker Moennig
School of Veterinary Medicine Hannover

Workshopserie „Nachhaltige Tierproduktion", Juni – October 2000

Vorwort für die Tagungsbände

Wie kann die Landwirtschaft in Zukunft weltweit Menschen nachhaltig mit Lebensmitteln tierischer Herkunft versorgen, ohne die Lebensgrundlagen künftiger Generationen zu beeinträchtigen? Wie kann eine nachhaltige Tierproduktion global und angesichts wachsenden Bedarfs an Lebensmitteln tierischer Herkunft in Industrie-, Schwellen- und Entwicklungsländern aussehen?

Diese und ähnliche Fragen waren Anlass zur Organisation einer internationalen Workshopserie zum Thema „Nachhaltige Tierproduktion/Sustainable Animal Production" zur EXPO 2000. Veranstalter waren Wissenschaftler aus vier norddeutschen Forschungseinrichtungen: Die Tierärztliche Hochschule Hannover (federführend), die Bundesforschungsanstalt für Landwirtschaft (FAL), das Institut für Strukturforschung und Planungen in agrarischen Intensivgebieten der Hochschule Vechta (ISPA) sowie die Agrarwissenschaftliche Fakultät der Universität Göttingen.

Ein breites Spektrum von Themen, wie Tierproduktion und Welternährung, Globalisierung, Standortorientierung und Wettbewerbsfähigkeit, Umweltverträglichkeit der Tierproduktion, Tierschutz und Tiergesundheit, Produktsicherheit und Herkunftssicherung, Tierzucht und genetische Ressourcen, Sicherung der Tiergesundheit bei globalen Handelsströmen, Tierernährung: Ressourcen und neue Aufgaben, Bio- und Gentechnologie spiegeln die gesamte Bandbreite der modernen Tierhaltung und ihrer Probleme wider.

Die einzelnen Workshops wurden jeweils durch lokale Koordinatoren organisiert und von internationalen Diskussionsleiter moderiert. Insgesamt 142 Wissenschaftler und Wissenschaftlerinnen aus 23 Ländern weltweit haben als Referenten an der Serie teilgenommen. Die Workshops haben ein differenziertes und umfassendes, ganzheitliches Bild von der Tierhaltung der Zukunft ergeben, das frei von nationalen, teils emotional und ideologisch gefärbten Konzepten ist. In einem Abschlussworkshop wurden die Ergebnisse der Workshops mit Vertretern aus Politik, öffentlichem Leben und Presse diskutiert. Die jetzt vorliegenden Proceedings der Workshopserie in der *Landbauforschung Völkenrode* werden ergänzt und weltweit verfügbar gemacht durch die Veröffentlichung im Internet unter der Adresse www.agriculture.de. Unter derselben Internetadresse hatte vor den Workshops eine virtuelle Konferenz als Vorbereitung von Oktober 1999 bis Oktober 2000 stattgefunden.

Volker Moennig
Tierärztliche Hochschule Hannover

Safeguarding Animal Health in Global Trade - Conclusions and Recommendations

Volker Moennig and Alex B. Thiermann

The importance of safeguarding or protecting animal health in relation to trade in live animals and products of animal origin has been recognised since ancient times. Today with the ever increasing global trade the rapid transport of infected/contaminated animals over long distances or transport of products under conditions where pathogens can survive for weeks, months and even years, may lead to the outbreak of serious disease epidemics. Therefore the Office International des Epizooties (OIE) an organisation that was founded in 1924 has become of great importance for establishing basic animal health trade rules. The World Trade Organisation (WTO) is the legal and institutional foundation of multilateral trade and it is the platform on which trade relations among countries evolve through collective debate, negotiation and adjudication. The Sanitary and Phytosanitary agreement (SPS) of the WTO recognises the OIE as the relevant international organisation responsible for the development and promotion of international animal health standards, guidelines, and recommendations affecting trade in live animals and animal products. In the future, development of new and adjustment of existing measures safeguarding animal health and related issues will have to be handled within the framework of the WTO.

The current trade environment

The WTO SPS agreement was one of the outcomes of the Uruguay Round negotiations of the GATT (General Agreement on Tariffs and Trade). Although the GATT has dealt with trade issues since 1947, it addressed issues dealing with life and health only in a brief paragraph. As the negotiations on agriculture progressed with efforts to reduce and eventually eliminate tariffs and quotas, it became evident that countries were being limited to using health reasons for blocking trade. Therefore, it was the task of the Uruguay Round negotiators to come up with clear science-based rules which would allow countries to have sovereign rights in setting measures for protecting public, animal and plant health, while not creating unjustified barriers to trade. The SPS Agreement was signed in Marrakesh in 1994 and entered into force in 1995. Simultaneously, the GATT was transformed into the (WTO). While the implementation of the SPS Agreement has certainly facilitated international trade and has minimised trade disruptions, there are still unsolved questions that pose future challenges, e.g., animal welfare, the environment, consumer concerns, biotechnology, morality in trade, and the precautionary principle.

Environmental concerns

There are considerable amounts of effluents from modern livestock production (including fish), which have distinct impacts on air, water, soil, biodiversity in plants, forest ecology and man. There are local impacts, e.g., odour, bioaerosols and ammonia, regional impacts, e.g., ammonia, nutrients (nitrogen, phosphate), heavy metals, and there are global impacts, e.g., methane and nitrous oxide, respectively. Human health is threatened by polluted water (nitrates) and bioaerosols. Trees and other plants are affected by nitrogen input (ammonia, nitrate). Water is affected by nutrients such as nitrate and phosphate. Soil is affected by accumulation of heavy metals, e.g., zinc and copper. No conclusive data are so far available on the impact of drugs from animal treatment in the environment, and no conclusive data are available on safe distances between farms to prevent transmission of infectious diseases and on safe distances between farms and residential areas to prevent transmission of allergens and endotoxins, respectively.

Recommendation

- In order to emphasise sustainability of animal production a proposal to the WTO should be put forward that environmental standards should be established for animal production world-wide. An international organisation that has the scientific authority should establish risk analyses for all systems in the world. Environmental standards for animal protection should be established and applied to all (exporting) countries. A risk analysis is necessary for different production systems and regions in the world. The development and common implementation of low emission production systems should be encouraged. The environmental standards should also take into account aquatic animal production. For the above considerations the economy is the basis, but the sustainability of the systems

- is included in terms of protection of the ecology as well as prevention of human and animal health.
- OIE should consider making recommendations as to how to encourage optimal animal production rather than maximum production. This would result in addressing animal welfare and environmental concerns in a more scientific and acceptable way.

Welfare of animals

Animal welfare issues in global trade are still an unsolved problem since they were neither dealt with during the Uruguay Round negotiation nor during the Seattle Round. Since the WTO apparently does not have the mechanisms for dealing with the issue, and the Council on Agriculture has not yet established a working group to deal with animal welfare problems, there is no solution in sight. Another major impediment is that at present there are no international bodies dealing with standards and the relationship between animal health and animal welfare. Unless the problems are being solved they will continue to receive public and media attention. National and international trade will increasingly be influenced by consumers and retailers who are making sure that their products are originating from farms using humane practices.

Recommendation

- The link between animal health and welfare is obvious. Therefore, rather than waiting for the WTO to deal with animal welfare issues, the OIE which has the world reputation of basing its decisions on scientific facts, should be encouraged to address this topic by forming a working group to define the issue, make clear definitions and recommend as to how to progress in a rational manner. At present the OIE has adopted a strategic plan that includes the commitment to begin a study on some of the relevant topics, e.g. long distance transport and animal housing. It is recommended that aquatic species should be included in welfare research and standards.

Fin fish and shell fish farming

During the last decades the world's production of fish and shellfish (molluscs and crustacea) expanded rapidly. Whilst capture fisheries production increased only slightly, output from aquaculture (farmed fish, shellfish and algae) grew strongly. Fish, shellfish and fishery products are widely traded and the international trade has continued to grow at an accelerating rate in recent years. In 1996, some 195 countries exported part of their production and this international trade accounted for about 40% of total production from capture fisheries and aquaculture. Aquaculture contributed over 20% of the global fisheries production (and 29% of food fish) and it continues to grow at approximately 9% p.a. There is considerable potential for further expansion of aquaculture. For much of the expansion in aquaculture movement of live fish and shellfish between countries has been a necessity, but has contributed significantly to the occurrence and spread of economically-serious diseases in the industry, e.g. white spot disease in farmed shrimp, Bonamiosis and Haplosporidiosis of oysters, the parasite Gyrodactylus salaris in fish, to name a few. Multibillion dollar losses and severe socio-economic effects in terms of losses of millions of jobs are the consequences of such introductions of damaging diseases. Some countries have realised that grave mistakes have been made, most could have been avoided. Therefore they have introduced internal controls on transfers of live and dead aquatic species and also stricter control on imports. Quarantine and health certification programmes are a first line of defence against introduction or transfer of exotic fish and shellfish diseases. At present the OIE International Aquatic Animal Health Code provides the only international standards recognised under the SPS Agreement of the WTO for health certification requirements for international trade in fish and shellfish.

Recommendation

- Quarantine and health certification programmes must be further developed within the context of larger national and international standards addressing the problem of spread of infectious diseases in aquatic species.
- More research in the communicable diseases of aquatic species is necessary.

Impact of wildlife on the health status of our industries

From an historic perspective, national and international animal health regulations have been directed specifically to the health and disease concerns for traditional domesticated livestock species. However, it has long been recognised that many wild mammals and birds are susceptible to, can be infected by, and can transmit a number of very serious domestic animal diseases. With increased recognition of the disease threats of free-ranging or farmed wildlife species to domestic animals, concern has arisen with respect to the substantial implications to trade and to the unrestricted international movement of animals and animal products. Likewise, domestic livestock are potential reservoirs of important diseases to wildlife and farmed wild species. However, despite that potentially negative impact the expanded diversity offered by farmed wildlife on the economics of agriculture reflects substantial positive benefits. Our animal industries are "healthier" as a result of this increased diversity.

Recommendation

- OIE should encourage the diversity that farming of non-traditional animal species brings to animal agriculture. Accordingly the Animal Health Code should be adjusted to the realities of diseases in non-traditional farm species.
- Research should be conducted in order to understand and control diseases in wildlife.
- Of great importance is the surveillance and monitoring of wildlife diseases threatening human or domestic animal health
- OIE should provide recommendations as to how to minimise the transmission of diseases between wildlife and domestic or farmed animals.

Preventing the spread of exotic diseases by global trade

Live animals but also animal products are by far the most important vehicles for spreading diseases by trade. Each country has the right to stop importation if the risk analysis demonstrates an unacceptable risk. Rules for risk analysis are laid down in the Animal Health Code of the OIE. The Animal Health Code regulates more than 80 diseases and assists the Veterinary Administrations to use it in developing their animal health measures applicable to imports and exports of animals and animal products. The recommendations in the Code are designed to prevent diseases being introduced into the importing country, taking into account the nature of the commodity and the animal health status of the exporting country. This means that, correctly applied, they ensure that the intended importation can take place with an optimal level of sanitary security, incorporating the latest scientific findings and available techniques. In other words, each recommendation relating to a disease is based on the assumption that the importing country is free of that disease.

It is recognised that new challenges result from the increased influence of multinational companies on the capability of governments to adequately enforce regulations aimed at preventing movements of disease through trade.

Recommendation

- Trading countries should focus on the importance of enforcing and applying animal health regulations based on OIE standards.
- Encourage research and developments to encourage trade in products rather than live animals.
- The importance and the role of veterinary services should be strengthened in order to address the issues of animal health, animal welfare, human health and zoonoses appropriately.
- Veterinary Services and their laboratories should be improved by developing quality management systems and by external accreditation, respectively. This will result in increased trust in and guarantees of trade.
- With respect to disease surveillance there is a need for models applicable for different conditions, e.g. wildlife versus domestic, vector-born diseases.
- Attention should be drawn to changing environment in global trade in animals and animal products. This includes the risks posed by passenger movement (West Nile Virus, foot-and-mouth disease, classical swine fever) and global warming (e.g. spread of bluetongue virus).

Modern technologies improving trade of germplasm

Modern reproductive biotechnologies relying on gametes or embryos are particularly well adapted to global trade and they can partially replace traditional exchange and trade of domesticated animals over short and long distances. Thereby welfare problems can be avoided and health risks arising from infectious agents can be greatly reduced. In addition costs are significantly cut down.

Recommendation

- In order to benefit from the comparative advantages of new biotechnologies their benefits including improved sanitary safety have to be communicated to the public and the stakeholders.
- More research on embryo-pathogen interactions is needed.
- More training of personnel is needed for the safe use of these reproductive biotechnologies in order to make optimal use of their advantages in order to minimise potential negative effect.

Current Rules and Future Challenges

Alex B. Thiermann[1]

This is certainly an opportune time to talk about the current environment for global trade and the reasons for adherence to the World Trade Organization's Agreement on Sanitary and Phytosanitary measures. We are benefiting from a new era, and by this I am referring to the era of globalization. This globalization is the result of three simultaneous democratizations, that of finance, technology and information. These democratizations also gave birth to a new power source in the world, the Internet. In the case of sanitary issues the Internet makes the job for decision-makers much more complicated, as everyone can learn of emerging situations simultaneously and at times trading partners can learn about these events before we can educate our decision- and policy-makers. Not only is the information dissemination global, but the speed of distribution has drastically increased.

However, what is really driving this globalization is the basic human desire for a better life – a life with more freedom to chose how to prosper, what to eat, where to live, where to travel, what to import. In order to maximize the benefits of this globalization, while minimizing the potential health risks resulting from this expanded trade is that we have the rules of the WTO - SPS Agreement. We need to continue to challenge those countries who are depriving their citizens of these opportunities by not adhering to the provisions of the SPS Agreement.

During this new era of globalization, the role of Government matters more, not less. The challenge to countries today is to improve on the quality while reducing size of their governments. A truly competitive government today has to strive for a lean, efficient and transparent civil service. In the case of agricultural trade, it is the quality and transparency of our animal and plant health infrastructures that will give us this competitive advantage.

The WTO - SPS Agreement was one of the outcomes of the Uruguay Round negotiations of the GATT (General Agreement on Tariffs and Trade). Although the GATT has dealt with trade issues since 1947, it addressed issues dealing with life and health only in a brief paragraph, Article XXb. As the negotiations on agriculture progressed with

efforts to reduce and eventually eliminate tariffs and quotas, it became evident that countries were being limited to using health reasons for blocking trade. Therefore, it was the task of the Uruguay Round negotiators to come up with clear science-based rules which would allow countries to have sovereign rights in setting measures for protecting public, animal and plant health, while not creating unjustified barriers to trade. The SPS Agreement was signed in Marrakesh in 1994 and entered into force in 1995. Simultaneously, the GATT was transformed into the World Trade Organization (WTO).

The purpose of this paper is to discuss the major provisions of the SPS Agreement and to analyze progress made thus far in the incorporation of these provisions as part of our new global trade disciplines. With the signing of the Agreement came the creation of the SPS Committee with the responsibility for monitoring its implementation. Since 1995 the Committee completed and adopted its first triennial review of the operations of the Agreement, which I will use to illustrate current progress.

The SPS Committee developed new transparency procedures and formats for countries to notify proposed changes in their regulations that would have an impact on trade. This exercise allows trading parties to comment on scientific merits and trade impact of proposed rules before entering into force. These new procedures standardized reporting and made better use of electronic information sharing.

Sanitary measures applied by importing countries, unless directly based on international standards must be justified through a scientific risk analysis. In the various paragraphs of Article 5 the Agreement identifies obligations and lists of allowable factors that can be taken into account during risk management decisions. This is without a doubt one of the more important provisions of the Agreement, and the one found to be violated by importing parties in all recent formal dispute cases. Most countries are changing their regulatory practices by incorporating risk analysis into the process,

[1] CVM, PhD, USDA, APHIS, International Services.

as is the case of the U.S. when drafting a rule on regionalization of animal health conditions in exporting countries.

Article 3 encourages international harmoni-zation of SPS measures by basing them on existing international health standards adopted by the three relevant standard-setting organizations. The Agreement recognizes the International Office of Epizootics (OIE) for aspects of animal health and zoonoses, the Codex Alimentarius for food safety and public health, and the International Plant Health Convention (IPPC) for aspects of plant health. While the advantages of harmonization are clear for the benefits of trade as well as for consumers, its application is still infrequent.

Article 4 encourages Members to recognize measures as equivalent, even if these differ from those applied by others, as long as they meet the desired level of protection identified by the importer. The main purpose of this provision is to focus on the desired outcome rather than unjustifiably restricting trade strictly by focusing on a specific risk management method. Using this provision countries are also encouraged to reach bilateral and multilateral recognition of their systems, thereby reducing the need for individual inspections.

With the formation of the WTO, came revised and consistent procedures for dealing with dispute resolution. Often the simple exposure of a country's actions at the SPS Committee level, rather than the formal process, has sufficed for an early resolution of the trade disruption. An additional option has been to use the mediation under Article 12:2, where both disputing parties voluntarily agree to seek the mediation efforts of the Committee chair. The various options and outcomes of recent formal cases will be discussed and analyzed.

While the implementation of the SPS Agreement has certainly facilitated international trade and has minimized trade disruptions, we will be facing significant challenges due to the current world environment facing international agricultural trade. Within the framework of global trade, attention will have to be given to certain issues not completely covered by the SPS Agreement but which threaten to create major trade disruptions if not addressed properly. I will be discussing some of the more important ones, but not limited to biotechnology, animal welfare, the environment, consumer concerns, morality in trade, compliance with WTO rulings, and the precautionary principle.

In order to maximize the benefits of the SPS Agreement we need to all work together in addressing these challenges by forming new partnerships. As I indicated earlier under globalization, these partnerships have to consider new dimensions, all stakeholders, consumers, producers as well as officials. We need to consider the global network, we need to look at our overseas counterparts as partners rather than adversaries. We must develop strategies as to how to improve the output of the international standard-setting organizations. We will need to develop better national strategies as well as stronger collaboration with countries having similar interests.

There are still many problems to be solved. At times national regulatory processes are held captive because of selfish domestic political interests, or highly publicized paranoia on food safety or environmental risks. In conclusion, we must take advantage of these great opportunities for improving health, consumer choices and increases in incomes through international trade.

Environmental Impact of Substances Emanating from Pig and Laying Hen Husbandry Systems

Jörg Hartung[1]

Introduction

In recent decades developments in agricultural animal husbandry in Germany and other parts of Europe have been driven by three major forces:

- intensification,
- specialization and
- regional concentration.

Intensification in animal husbandry generally implies year-round indoor housing, high concentrations of animals per square meter floor area, a high degree of mechanization and automatization, e.g. in feeding, watering, manure management and ventilation; low labor requirement and – often – less air space in relation to the number of animals per unit. The European Agreement on the Protection of Animals in Agricultural Husbandry Systems (Chapter 1, Article 9) contains the following definition: „Modern intensive animal husbandry systems are overwhelmingly technical facilities run primarily automatically in which the animals are completely dependent on humans." Typical intensive animal husbandry systems are to be found in poultry and pig production. High animal population densities occur particularly toward the end of the growth or fattening period, when the animals near full size, and their body mass per square meter floor space approaches its maximum permissible limit. During the last three days in a broiler facility, the concentration of animals can approach 35 kg of animal mass per m^2 floor area (as specified in the corresponding regulation in Lower Saxony).

Specialization means agricultural enterprises are restricted to only those breeds of animals especially suited to the production of that species in specialized facilities. Consumers often find it difficult to recognize and accept such production sites, as these do not correspond to traditional farms with a whole range of species from dairy cows to chickens. The term "animal machines" arises, and with it the notion that the animals are thus reduced to production units operating under the laws of economics only. Thus "specialized intensive animal production" is construed as the derogatory term "industrialized animal production".

Regional concentration refers to the accumulation of animal production facilities in a number of European countries, e.g. in north-west Germany and certain parts of The Netherlands. This also affects the utilization of solid and liquid manure on the limited farmlands available; negative effects on the air from odours and other airborne substances (gases, dust, microorganisms), and not least the danger of the sudden spread of infectious diseases, such as the occurrence of swine fever in these regions over the last decade.

Since the nineteen-sixties, the increased numbers of animals have been accompanied with the introduction of new indoor housing forms, particularly for pigs and chickens: battery cages for laying hens and litter-free swine pens. In one county in Lower Saxony, Germany, for example, pig production increased eightfold between 1950 and 1980, from fewer than 400,000 animals to over seven million, while a previous doubling of these numbers had occurred over a period of nearly 100 years. Structural changes leading to specialized large enterprises, already well advanced in Denmark and The Netherlands, are concentrated in Germany in Lower Saxony and in certain states in former East Germany. This development is particularly marked in poultry production, where the number of producers in Germany shrank from well over three million in 1955 to fewer than 190,000 today.

Therefore we now have ever larger production units run by fewer and fewer employees, and a steady supply of products such as meat and eggs at low prices. Meanwhile, the operations and technology involved have become increasingly unfamiliar to the general public. But the future and ultimate success of these modern intensive animal production systems depends more and more on acceptance by the general public, where increasingly there is a demand for sustainability in animal production; this is a concept that expresses dissatisfaction, incomprehension, criticism and fear, as well as the hope

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for truly sustainable farm animal husbandry systems in the future.

Sustainability is a term much used in discussions of environmental soundness and ecological responsibility in the past few decades, but what does it mean?

Originally sustainability referred to those principles of forestry by which the trees harvested can always be replaced by regrowth. Nowadays sustainability includes much more than just the wood: it is also applied to other uses of forests, including their recreational value. Sustainable agriculture is therefore the attempt to achieve long-term yields using ecologically balanced management. This broad definition means in this specific case that farmers produce enough to cover their own needs, including sufficient income, by using locally available resources in ways that are efficient, socially just, humane and flexible, and that maintain or even enhance natural resources (Altieri 1994).

These principles thus also apply in the broader sense to animal production and its impact on the environment.

Considering animal production as a simple flow chart, input and output are relatively clearly defined. We provide feed, water and air to the animals in their housing and expect to receive products such as meat, eggs and milk. But in addition to the desired products we also must deal with a variety of substances which are basically undesirable by-products: 250 million tons of excrement in the form of solid or liquid manure, and an as yet insufficiently quantified amount of substances which are emitted into the air as exhaust or as feces onto grazing lands. In addition to odor, dust, germs and ammonia are of particular importance for environmental hygiene. These substances can also have adverse effects on animal and human health and comfort.

Disposal of liquid and solid waste is regulated by the German Waste Law, Paragraph 15 of which grants farmers certain advantages in that they may use agricultural waste in “usual amounts” as fertilizer on their lands. But the disposal of airborne emissions is regulated only in the case of odors and, to a certain extent, ammonia.

Sustainability must be defined more clearly for animal production, if only because it involves animals, our fellow creatures as made explicit in Paragraph 1 of the German Animal Protection Law. In addition to environmental aspects, sustainability in animal production must therefore also include animal health and welfare. Nor can the people who work in animal production be forgotten, who are exposed to the constraints of the housing system and its airborne contaminants much as are the animals.

A third area concerns consumers, as the primary goal of animal husbandry is the production of food. Revenues from the sales of meat, eggs and milk are the livestock farmer’s economic foundation. In the long term, there is a market only for safe, high-quality products. This means that food must be free of pathogens and other health-endangering substances. Hygienic surveillance of food is one of the classic fields of endeavor for veterinarians. All food of animal origin is inspected by veterinarians, who thus play a vital, but little recognized role in preventative public health.

The foundation of animal production, including sustainable animal production, is and will be economic viability. There will be no animal production here without economic success.

In summary there are three pillars supporting sustainability in animal production: animal welfare, consumer protection and ecology, all of which are equally based in the foundation of economic success. In some cases there certainly is overlap, as in the definition of the quality of food of animal origin, as for example when animal protection and species-appropriate housing systems are included in quality judgements. Consumer choices depend less and less simply on the nutritional value of food, but are linked to a personal “pleasure value”, which increasingly includes animal welfare and ecological concerns.

What are the environmental impacts of the various husbandry systems for pigs and chicken?

Substances emanating from animal production can have detrimental ecological effects on a number of areas, including soil, water, air, plants and humans who live near livestock farms.

Solid and liquid emissions

The substances which are especially detrimental to soil and water are those found in animal excrement containing nitrogen (N) and phosphorus (P, as phosphates). In addition there can be residues in feed, such as zinc, copper or antibiotics. Nitrogen and phosphates are important plant nutrients, which if applied properly can be used in commercial fertilizers with no adverse effects on the environment. These substances constitute a danger only if they are applied in too great amounts and at the wrong time in the growing season. In this case an oversupply of nitrate in the groundwater can result. Nitrate-enriched water can induce methemoglobin and cyanosis, particularly in infants, and is suspected of having a role in stomach cancer. Nitrates and phosphates can also accumulate in surface water due to over-fertilization with liquid or solid manure or via rainwater runoff from freshly fertilized fields, and cause eutrophication of natural bodies of water. The feces of one pig corresponds to ca. three human-equivalent-units (HEU), which means that a body of water contaminated with these substances must have the regenerative power to process the equivalent of ca. 350 liters of sewage from humans (which produce ca. 120 l/person/day).

We know very little about the presence and effects of residues such as antibiotics. Recent investigations show that antibiotics can be found in the soil at depths of up to ca. 30 cm after application of slurry which contained antibiotics. The ecological effects are as yet unclear.

The use of zinc (Zn) and copper (Cu) in piglet feed has increased recently, as they serve as trace elements necessary for a number of biological functions. At higher dosages they also have pharmacological effects and can prevent diarrhea and generally increase productivity. At present the annual transfer of zinc and copper from pig slurry onto agricultural areas comprises ca. 0.8 kg Zn and 0.4 kg Cu per hectare. This is four times the amount extracted in crop harvest for zinc and up to 20 times that for copper. It is vital that the input of these heavy metals does not exceed the amount extracted, as they will otherwise accumulate in soil and plants. Excessive intake of Zn and Cu can lead to serious poisoning in animals.

Under the existing legal fertilizer regulation, in the application of waste from animal production and of sewage sludge the nitrogen, phosphorus, zinc and copper input must not be greater than the amount withdrawn. Such balanced fertilization has been practiced with more and more success in recent years, as application of fertilizers must be preceded by analysis of the soil and of the substances to be applied.

Airborne emissions

It is much more difficult to estimate the amount of airborne emissions from livestock farming and their effects on the environment. The most important air pollutants in livestock housing are gases such as ammonia, hydrogen sulfide, carbon dioxide and methane, dust, bacteria, fungi and substances such as endotoxins. It has been established that these substances play a role in the occurrence of human and animal respiratory disease. It has been reported that up to 50% of the lungs of slaughter pigs show pathological tissue modifications. And about 20% of pig farmers in northern Germany complain of respiratory problems after working in the barns.

Outside the barn these substances, also known as bioaerosols, can influence:

– plants (e.g. direct damage to conifers from ammonia in the air)
– soil (over-fertilization through nitrogen input, threatened plant species, forest damage)
– bodies of water (eutrophication due to nitroget input) and
– humans (bioaerosols, allergies, infections?)

In principle these effects apply to all husbandry systems, as the composition of the indoor air contaminants is very similar in quality. But there are differences in the quantities of the individual components. However our knowledge of the amount of air contamination in the various systems is still sketchy. Furthermore existing findings are extremely disparate and contain considerable variation, making an evaluation of even seemingly identical systems difficult. The reason lies in the fact that no two facilities are exactly the same. Even in poultry housing, which is very nearly standardized, air contamination is influenced by different factors, such as the position of the building in relation to the pervailing winds, herd management, population density, cleanliness, amount and maintenance of litter, (genetically determined) temperament of the animals, amount of ventilation, type of feed, feeding system and many others. If for example the airborne dust concentration in a pig fattening unit is 0.5 mg/m^3 at night, this can increase to over 20 mg/m^3 at feeding time. Emission levels can thus vary widely at different times of the day or night and according to phases of activity and rest. All statistics on air contamination in animal housing and the calculated emission levels can only serve as guides and indicate trends.

There are however some clear findings, particularly in regard to laying hen husbandry systems. Table 1 contains data comparing the composition of air in conventional cages with that in an aviary system and in an indoor free range system (with gratings and a separate unheated litter-covered scratching area). It is clear that the highest ammonia and dust concentrations are found in the aviary, which offers the birds not only a scratching area and sand baths, but also the opportunity to fly short distances to the second or third tiers. The birds‘ behavioral needs are thus largely fulfilled in this system. The disadvantage is the high air pollution with gases and dust. This can adversly affect employees, and working without face masks is often scarcely feasible under these conditions. Because the birds can move about freely in a large area, eggs are regularly mislaid and are thus not to be found in the nests. The consequences are an increased workload for the employees and the danger of greater contamination of the eggs with pathogens and dust from the increased air contamination. The amount of pathogens found on eggs from free range and aviaries is generally higher than on eggs from caged birds. There are also noticeable differences in environmental hygiene. Ammonia emissions from aviaries can be four times that from cages, if for example a conveyor belt for droppings is installed to permit quick surface drying. Dust emissions from cages are always lower than those from other systems, so that the contamination of the surrounding area with pathogens and dust can be expected to be lower, as well. It is estimated that the additional cost of aviary systems, depending on the population density, ranges from five to 15 per cent higher than conventional cage systems.

Table 1
Ammonia and airborne dust in three different laying hen housing systems

Ammonia, ppm			
Housing system (n =6)	**Mean**	**Maximum**	**Minimum**
Aviary	3.7	16.2	0.5
Conventional cages	1.2	3.6	0.3
Floor	1.3	2.7	0.4
Total dust, mg/m^3			
Housing system (n=7)	**Mean**	**Maximum**	**Minimum**
Aviary	3.6	9.4	0.8
Conv. Cages	0.4	1.0	0.02
Floor	1.0	1.7	0.5

In considering the advantages and disadvantages (without the cost factor), there are clearly disadvantages for the caged birds concerning their behavioral needs, while there are advantages for the environment and for humans as consumers, neighbors or farmworkers. A highly-simplified comparative evaluation is given in Table 2.

Table 2
Comparison of three different laying hen systems in respect to their impact on animals, humans and the environment

System type	Animals	Humans: Consumers	Humans: Neighbors	Humans: Workers	Environment
Conventional cages	--	+	+	+	+
Floor	+	+/-	+/-	+/-	+/-
Aviary	++	+/-	-	-	-

- = negative; + = positive

Table 3
Airborne emissions and N and P output with droppings in a conventional cage system with different manure removal systems

Substance	Unit	Conventional cage system		
Manure removal		Slurry pit	Conveyor belt (c.b)	Ventilated c.b.
Storage time		4 months	3-4 days	< 7 days
N as ammonia	kg/AP h	0.25	0.12	0.0027
Odor	OU/LU h	60	50	20
Inhalable dust	mg/LU h			676
Pathogens	CFU/LU h			10^7
Manure quantity	m^3/AP a	0.06	-	0.03
TS contents	%	20-40	24-32	35-50
Total N	kg/AP a	0.21	0.5	0.7
P_20_5	kg/AP a	(0.33-0.7)		

AP: animal place; OU: odor unit; LU: livestock unit (500 kg liveweight); CFU: colony-forming unit

However, Table 3 demonstrates how difficult it is to make even a simple evaluation of the potential emissions from a particular system. If for example a ventilated conveyor belt for droppings is used properly, the ammonia output can be decreased by a factor of 100 as compared to a system in which feces are left in place for a period of four months. Frequent removal of droppings leads to a reduction of odor and ammonia. Drying the droppings reduces the amount. At the same time the nitrogen content of the feces increases, a factor which must be taken into consideration during storage and application outside the facility.

In pig farming the housing system also has an effect on the amount of emissions, but sufficient accurate data is available only for the full and partial slatted floor systems, as indicated by a summary made by the Association for Technology and Structures in Agriculture (Kuratorium für Technik und Bauwesen in der Landwirtschaft, KTBL) (Table 4).

Table 4
Airborne emissions and N and P output in animal excrement from different pig housing systems

Substance	Unit	Housing system		
		Slatted flooring	Partially slatted	Deep litter
N (ammonia)	kg/AP a	2-4	2-5	3-4
Laughing gas	kg/AP a	0.02-0.15	-	0.05-3.73
Methane	kg/AP a	2.8-4.5	4.2-11.1	-
Odor	OU/LU s	25-80	25-80	-
Inhalable dust	mg/LU h	400-720	400-720	-
Pathogens	CFU/LU h	10^7	-	-
Amount of feces	dt/AP a	1.2-2.5	1.2-2.5	12-17
DM content	%, dt/m³	10-7 %	10-7 %	7.5
Total N	kg/AP a	9-15	9-15	3.5
P_2O_5	kg/AP a	4-9	4-9	4-6

AP: animal place; OU: odor unit; LU: livestock unit (500 kg liveweight); CFU: colony-forming unit; DM: dry matter

Table 5
Air contamination in pig housing with and without litter

	Litter	Sows	Weaners	Fatteners
Dust)1, mg/m³	yes	0.63	-	1.38
	no	0.86	5.05	2.67
Ammonia)2, ppm	yes	5.1	-	4.3
	no	11.0	7.8	12.1
Microorganisms)3, CFU/m³	yes	217,550 (5)	-	-
	no	43,000 (4)	-	139,500 (4)
Endotoxins)3, ng/m³	yes	566.7 (4)	-	-
	no	7.8 (8)	14.4 (3)	99.7 (4)

CFU: colony-forming unit
[#] : Data for dust and ammonia from UK, data for microorganisms and endotoxins from Germany
)1 : Takai et al. (1998), inhalable dust
)2 : Groot Koerkamp et al. (1998)
)3 : Seedorf et al. (1998), inhalable endotoxins, mean of day and night samples
(in parentheses): number of samples

Table 5 contains the summarized findings of a study of pig farms four member states of the EU. It is clear that the use of straw and other litter material does not automatically lead to increased airborne dust. If there is sufficient straw the ammonia output is reduced. On the other hand airborne pathogens and substances such as endotoxins increase.

Thus great variation in pig farm emissions was determined depending on the type of facility and management.

Table 6
Organ findings for fattener pigs from outdoor and indoor systems

	Confined housing %	Outdoor %
Pneumonia	32	2
Pleuritis	19	5
Stomach ulcers	66-89	53
Livers seized at abattoir	18	35

Table 6 shows the comparison of findings for organs from fattener pigs from outdoor and confined systems. Respiratory health is clearly enhanced in animals from outdoor systems, while parasitoses clearly increased. Land use in outdoor systems and the concomitant danger of nitrate input into the groundwater is one of the most serious problems in outdoor systems, in addition to damage from weather and predators. Changing to new land area seems necessary every two years or alternatively the animal density must be reduced drastically. It is necessary to treat the pigs carefully against parasites before they are released to a free-range area.

The following measures appear necessary for the solution of the problems sketched here:

– Conduct a survey of the chicken and pig husbandry systems in use in Germany as to their environmental impact. Currently the KTBL has such a project in preparation.
– Increase measures in changes in feeding practice, e.g. to reduce nitrogen output.
– Intensification of investigations of air cleaning systems in animal housing.
– Further consideration whether technical possibilities from „organic farming“ can be put to use in intensive livestock production.
– Improved regional planning in production siting is essential.
– A reduction in livestock numbers would lead to a reduction in many environmental effects. This

possibility should be considered, at least at the regional level.

The attainment and maintenance of sustainability in animal production is a task involving many people, but particularly those who are entrusted with the care of animals: livestock farmers and veterinarians, public health officials and scientists, farmers and environmentalists. And it is sometimes a good thing if consumers can take a close look and ask where their food comes from. For if all the critical goals of sustainable animal husbandry at a high level of production can be attained for the future, this will be acceptable for animals and humans, compatible with the environment, safe for consumers and profitable for the farmer.

Welfare of Animals – the Current Trade Environment

A. C. David Bayvel[1]

Introduction

This presentation is designed to provide some historical context to the current debate on animal welfare and international trade in the post-Uruguay Round WTO trading environment, to identify current issues and to review some future policy options. The personal views expressed are indicative of the perspective of an agricultural trading nation committed to high domestic animal welfare standards, to a rules-based global trading environment and to meeting the market requirements of both domestic and international retailers and consumers.

Historical Context

The period 1950 – 2000 has seen dramatic increases in agricultural productivity, due to general advances in agricultural and veterinary science, specific improvements in genetics, nutrition and disease control and prophylaxis, plus the impact of agriculture support programmes. There has also been an inexorable move to more intensive systems of production, especially in the more densely populated nations of Europe, Asia and North America and particularly with pigs and poultry. More extensive systems of production continue to be practised in New Zealand, Australia, South America and Africa, for grazing species, and there is a strong public perception that more extensive management systems are synonymous with better welfare.

Seminal texts by authors including Harrison, Singer, Rollin, Webster, et al, plus the UK Brambell report, the paradigm of the "Five Freedoms" and the influence of behavioural science, have all had a significant impact on the attitudes of scientists, the public at large and, through them, politicians. Welfare aspects of animal agriculture, and associated consumer preference behaviour, have also attracted increasing attention from agricultural economists and agricultural ethicists.

Animal Welfare and Trade / Current Position and New Challenges

The conclusion of the GATT Uruguay Round in 1994 and the establishment of the WTO, with its underpinning Sanitary and Phytosanitary (SPS) and Technical Barriers to Trade (TBT) agreements plus the Agreement on Agriculture, were seen to set the stage, and create a framework, for all nations to reap the benefits of agricultural trade liberalisation. There is, however, a growing concern, particularly amongst Non-Governmental Organisations (NGOs), that the WTO rules-based trading system is biased towards the producer rather than the consumer and that the credibility of, and public support for, the WTO is thus at risk. This view has been strengthened by the outcome of the WTO dispute cases involving tuna/dolphin, shrimp/turtle and leghold trap issues

The WTO legal framework refrains from passing judgement on animal welfare and other ethical issues but growing consciousness of, and concern for, animal welfare has highlighted the animal welfare/WTO issue. This is part of a broader debate regarding linkages between morality and trade and the flexibility of the multilateral trading system to accommodate non-trade issues. The key to the WTO debate is whether trade measures based on animal welfare objectives, but which are not animal health related, are consistent with WTO rules. The majority view is that non-health measures involving animal welfare are not permitted, although this has not been tested under WTO dispute settlement procedures. Article 1 (non-discrimination) and Article 3 (identical treatment for "like product", irrespective of processing or production method) of the GATT agreement, plus the TBT provisions regarding "like product" are critical in this regard.

The significance of the WTO agreement is also reflected by the inclusion of specific WTO-related provisions in two recent EU Directives. Article 8 of Council Directive 98/58 requires that the European Commission prepare a report on the comparison between EC and third country animal welfare provisions, the scope for widening international acceptance of the welfare principles outlined in the

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Directive and the extent to which Community animal welfare objectives might be undermined by competition from non-member countries. Article 10 of Council Directive 99/74 requires that no later than 1/1/05 the Scientific Veterinary Committee submits proposals in respect of management systems for layer hens, which take into account the outcome of WTO negotiations.

Although a number of European countries were unsuccessful in having animal welfare included in the SPS agreement, in the Uruguay Round negotiations, the EU clearly signalled that it saw animal welfare as a key issue in the lead up to the Seattle meeting and has, subsequently, submitted a formal paper to the WTO Committee on Agriculture. This EU paper argues that animal welfare should be addressed primarily within Article 20 of the Agreement on Agriculture but emphasises that this is not a basis for new types of non-tariff trade barriers or sovereignty infringements. Measures proposed include the development of multilateral animal welfare agreements and appropriate labelling and compensation payments, which would have minimal effects on trade and production.

NGOs have also proposed a package of similar measures including non-trade distorting "Green Box" payments, phasing out of export subsidies which encourage intensive production methods and live animal transport, and differentiation of "high welfare" products via appropriate labelling.

In response to these EU proposals to have animal welfare included in the WTO agreement, there is an alternative view that the various suggestions being made to address animal welfare concerns are much more likely to receive broad-based international support, and to achieve the same objectives, if they remain outside the WTO agreement. This view argues that animal welfare concerns, including those that might have implications for trade, would be best addressed in specific, well-targetted agreements, rather than by seeking to treat animal welfare concerns as generic. Potentially, such measures could relate to a number of specific provisions in different trade agreements – on agriculture, subsidies and technical barriers to trade, to name a few. If specific concerns are pursued, it is believed these are likely to be more successful than a generalised animal welfare initiative in the WTO.

Change to the WTO agreements themselves would, thus, not be necessary to facilitate meaningful gains in animal welfare. International agreements, including those negotiated outside the framework of the WTO, are being taken into account in dispute settlement cases when evaluating whether a Government is justified in taking a measure which would otherwise be a breach of its WTO obligations. If, however, a direct approach reference to animal welfare was ever included in the WTO, SPS and TBT agreements, the OIE may well be an appropriate, established, inter-governmental organisation to address animal welfare issues and seek agreement on international standards.

Another important regulatory concept relevant to this issue is that of equivalence, where one country accepts the standards and regulations of another as equivalent to their own provided they adequately fulfil the objectives of their own regulations. This can give assurance that good animal welfare standards are being observed, while reducing regulatory barriers to trade.

In addition to voluntary labelling schemes, other non-regulatory approaches include consumer education initiatives and quality assurance schemes.

Conclusion

The current debate regarding the precise position of animal welfare issues in relation to WTO rules is likely to continue for some time and it is important that all views be heard. This workshop, and the commitment to public dissemination of workshop outcomes, is an excellent example of how informed debate can be promoted, to assist in formulation of robust policy.

It is also important to look beyond the "lowest common denominator/assurance of market access" notion. The challenge should be not merely to secure market access but to achieve "market success" by recognising, and responding to, the quality requirements of consumers and retailers. Webster takes a confident, forward-looking and positive view that, given an appropriate policy framework and strategic direction, livestock producers will respond to society's needs over the next 50 years, as they have done for the last 50 years.

International Trade in Farmed Fish and Shellfish: the Impact of Disease Spread

B. J. Hill[1]

During the 1990s, the world's total production of fish and shellfish (molluscs and crustacea) expanded rapidly from 99 million tonnes in 1990 to about 122 million tonnes by 1997. Whilst capture fisheries production increased only slightly, output from aquaculture (farmed fish, shellfish and algae) grew strongly from just over 13 million tonnes in 1990 to 28.3 million tonnes in 1997. Movement of live fish and shellfish between countries has been a necessity for much of this expansion in aquaculture, but has contributed significantly to the occurrence and spread of economically-serious diseases in the industry.

Fish, shellfish and fishery products are widely traded and the international trade has continued to grow at an accelerating rate in recent years. In 1996, some 195 countries exported part of their production and export volumes reached 22 million tonnes, nearly three times the volume traded in 1976. This international trade accounted for about 40% of total production from capture fisheries and aquaculture and has been estimated to have a value of US$52.5 billion, with developing countries achieving a net trade surplus of US$16.6 billion (FAO). Aquaculture (the farming of fish, shellfish and algae) contributed over 20% of the global fisheries production (and 29% of food fish). Whilst output from capture fisheries continues to flatten out, aquaculture production continues to grow at approximately 9% p.a. It is estimated by FAO that global demand for food fish by the year 2010 will be in the range of 110-120 million tonnes from the level of 90 million tonnes in 1996. There is considerable potential for further expansion of aquaculture and under favourable conditions it is estimated that total aquaculture production could rise from the level of 26 million tonnes in 1996 to 40 million tonnes by 2010.

In many countries, the rapid increase in aquaculture output has been based on species diversification which has led to an increase in the demand for introduction and transfers of live non-indigenous aquaculture animals. Although local pathogens, inadequate farm-management, environmental factors and poor water quality continue to be the most common causes of disease outbreaks in farmed fish and shellfish, pathogen transfer due to international trade in live aquaculture animals and their products is a major underlying reason for major epizootics. Disease outbreaks cause significant losses in aquaculture production and trade and are affecting economic development of some countries. An indication of the magnitude of economic loss is seen in the fact that the value of losses in shrimp farm output in China in 1993 due to one introduced disease has been calculated to be about US$400million, and that in recent estimates, based on farm surveys in 16 Asian countries, annual losses due to disease in the region total more than US$3.0 billion.

Probably the most striking example of spread of disease and consequential major economic loss in aquaculture is white spot disease in farmed shrimp. The disease first emerged in 1991 or early 1992 in a shrimp farm in Taiwan and was observed later in 1992 in mainland China. There is some evidence that the virus which causes the disease was introduced to the mainland with trade in live post-larvae of shrimp for on-growing. From Taiwan, thereafter, the disease spread rapidly along the coast of mainland China and in the same year appeared in Japan, Korea and India. In 1994, the disease appeared in Thailand and subsequently spread to all shrimp farming regions of the country and has since been reported in most other shrimp farming countries of Asia, including Indonesia, Malaysia, Sri Lanka, Bangladesh and Vietnam. Annual conomic losses have been estimated to be in the range of more than US$ 400 million in China (1993), US$ 17.6 million in India (1994), and over US$ 500 million in Thailand (1996). The Philippines remain free of WSD and Australia continues to be free of the disease almost certainly due to strict controls on importation of live shrimp and uncooked dead shrimp for use as fish bait. In the mid-1990s the disease was detected in the USA and during 1999 and 2000 the disease flared up in all shrimp farming countries on the Pacific coast from Mexico to Peru. The socio-economic effects of the disease in the region have been dramatic – for example, in Ecuador there were losses of US$ 280 million and 150,000 jobs lost in the sector in 1999 alone. The source of the WSD

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introduction to the Americas from Asia has not been identified with certainty, but trade in live shrimp for hatcheries and dead shrimp for processing or for bait are thought to be the most likely routes. The current global estimate of economic loss due to this disease is US$ 3000 million/year.

Serious diseases of molluscs and fish have also been spread between countries by international trade. Examples are the diseases Bonamiosis and Haplosporidiosis, which are believed to have been introduced into France and the east coast of the USA respectively via importation of live oysters for farming. These diseases have caused major reductions in the production of the native species of oysters in the affected areas. In fish, one of the most ecologically serious disease introductions has been the transfer of the parasite *Gyrodactylus salaris* to Norway via importations of live juvenile salmon from hatcheries in Sweden for stock enhancement of Norwegian rivers. The result was a rapid and severe reduction in the highly sensitive local wild salmon populations in affected rivers and draconian steps have been taken by the Norwegian authorities to eradicate the parasite from almost 30 rivers by destruction of all resident fish stocks.

Such introductions of damaging diseases has inevitably led some countries to introduce internal controls on transfers of live and dead aquatic species and also stricter control on imports. Whilst quarantine and health certification programmes are a valid part of a first line of defence against introduction or transfer of exotic fish and shellfish diseases, they must be developed within the context of larger national and international standards addressing this problem, and must not be used as an unjustified barrier to trade. The OIE International Aquatic Animal Health Code provides the only international standards recognised under the SPS Agreement of the World Trade Organisation for health certification requirements for international trade in fish and shellfish. These standards, along with national measures to reduce the risk of importation of disease by means which are scientifically as well as politically justified, will be briefly discussed.

Impact of Wildlife on the Health Status of Our Industry

Thomas E. Walton[1]

1 Introduction

From an historic perspective, national and international animal health regulations have been directed specifically to the health and disease concerns for traditional domesticated livestock species. However, it has long been recognized that many wild mammals and birds are susceptible to, can be infected by, and can transmit a number of very serious domestic animal diseases. With increased recognition of the disease threats of free-ranging wildlife species to animal agriculture, concern has arisen with respect to the substantial implications to trade and to the unrestricted international movement of animals and animal products.

2 Current situation

However, in modern agriculture internationally, there is a growing recognition that nontraditional species have become viable and valuable farmed and agriculturally important livestock. With this industry in farmed wildlife species the disease potential or threat from traditional livestock has become an equally vital concern. And, the distinction between wildlife and domestic livestock and their diseases has become blurred and unclear when assessing the risk of disease introductions to our nations and to our industries.

The wildlife industry represents a large, diverse, and growing concern for animal health officials and livestock producers. Growth in populations of wildlife and increased interest in raising traditionally wild animals domestically has increased interaction and contact with domestic livestock. This has increased the dangers of disease transmission between both populations.

Inconsistent regulations within and between countries have compounded the challenges faced by governmental regulators and wildlife owners. Although the wildlife industry has similar needs for disease control and identification of animals, captive wildlife are not subjected to the same regulations, scrutiny, and veterinary care and attention as traditional livestock. The International Animal Health Code of the OIE, for example, addresses wildlife diseases only in terms of impact on disease eradication and the health of domestic livestock. With decreasing prevalence of diseases in domestic livestock, such as brucellosis, classical swine fever, foot-and-mouth disease, and tuberculosis, which are targeted for eradication in numerous countries, the only remaining reservoirs for infection may be free-ranging or captive wildlife populations. Adequate disease surveillance in wildlife populations is critical to controlling these and other agriculturally important diseases as well as to the health and welfare of the wildlife species. Recently, governments have recognized a need to serve both agricultural and wildlife interests, but these disparate interests provoke a challenge to protect one without harming the other.

Like traditional animal agriculture, the wildlife industry in many countries is diverse, rapidly growing, and supported broadly by numerous advocacy groups, producers, and private owners. This industry includes production of captive wildlife, free-ranging and relocated wildlife cherished by sports enthusiasts and environmentalists, and importers of exotic animals and products. The number and diversity of captive-held nontraditional agricultural and pet species are dramatically increased by the millions of exotic animals imported annually. In addition, free-ranging populations in many countries have expanded because of governmental and private conservation initiatives; adaptive, natural selection processes to changing ecologic niches; reduced pressures from hunters and predators; and an abundance of food.

With changes in the wildlife industry and the expanding popularity of raising alternative livestock, the clientele of our animal health agencies is changing. Animal health officials can no longer concentrate solely on producers who raise cattle, poultry, sheep, and swine, but increasingly are expected to address the interests and concerns of

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producers of bison, buffalo, deer, elk, emu, llama, ostrich, and other captive wildlife. Complicating the protection of the health of this expanded agricultural livestock industry with it's inherent disease risks, are the exotic animals, including reptiles and amphibians, that are imported into private collections, pet shops, zoos, and animal parks; many may carry disease pathogens and vectors of pathogens.

The health impact of wildlife on livestock and of livestock on wildlife has been expressed in a number of recent and continuing disease events that have underscored the potential dangers of pathogen transmission.

3 Conclusion

Wildlife are potential reservoirs of agriculturally important diseases to the livestock industry. Likewise, domestic livestock are potential reservoirs of important diseases to wildlife. However, despite that potential, but unlikely, adverse impact, the expanded diversity offered by farmed wildlife on the economics of agriculture reflect substantial positive benefits. Our animal industries are "healthier" as a result of this increased diversity.

As surely as humanity will progress into the challenges, changes, and opportunities of the 21st century, so will animal agriculture progress. Unquestionably, as the title of my presentation implies, there will be a substantial impact of wildlife on the health status of our industries. However, I submit that the connotation of this impact will be both positive and negative. Our industry, animal agriculture, is no longer confined to the traditional species or the traditional production parameters and methodologies. Introduction of new species of farmed animals into our traditional industry offers new opportunities and new threats. The key to maximizing the opportunities while minimizing the threats and adverse impacts lies in comprehensive attention to surveillance and monitoring practices, and rigorous application of biosecurity practices that should be common practice to concerned and conscientious producers. In and of themselves, wildlife are no more dangerous to livestock than livestock are to wildlife. The dangers lie in lax practices and inadequate attention to accepted disease prevention and control practices. Opportunities in production agriculture like opportunities in unrestricted trade are not without risk but the potential benefits can be substantial.

Safeguarding Human and Animal Health – Preventing the Spread of Exotic Diseases by Global Trade

U. Kihm[1]

Each country has the right to stop importation if the risk analysis demonstrates an unacceptable risk. Rules for risk analysis are layed down in the Animal Health Code of the Office International des Epizooties (OIE). The SPS Agreement of the WTO recognises the OIE as the relevant international organisation responsible for the development and promotion of international animal health standards, guidelines, and recommendations affecting trade in live animals and animal products.

In particular, live animals but also animal products are by far the most important vehicles for spreading diseases by trade.

OIE

The Animal Health Code regulates more than 80 diseases and assists the Veterinary Administrations to use it in developing their animal health measures applicable to imports and exports of animals and animal products. The recommendations in the Code are designed to prevent diseases being introduced into the importing country, taking into account the nature of the commodity and the animal health status of the exporting country. This means that, correctly applied, they ensure that the intended importation can take place with an optimal level of sanitary security, incorporating the latest scientific findings and available techniques. In other words, each recommendation relating to a disease is based on the assumption that the importing country is free of that disease.

How to demonstrate freedom from a disease?

According to the Animal Health Code, countries wishing to obtain recognition of freedom from a disease must demonstrate that they have a reliable system of disease control and surveillance, that the disease is notifiable, and that they have an effective veterinary organisation.

Surveillance

There are two different surveillance systems:

- The passive surveillance system which relies completely on disease awareness of farmers, veterinarians, traders, slaughterhouse people, etc. These people must notify compulsory any suspect case to the Veterinary Administration.
- Active surveillance means the screening of an animal population in respect to the clinical signs, pathological lesions, seroreactors, etc.

A national epidemiological system should incorporate disease surveillance, description of host population characteristics, and environmental assessment. An effective veterinary infrastructure is necessary to support this epidemiological system.

Veterinary Systems

The quality of the Veterinary Services depends on a set of factors, which include fundamental principles of an ethical, organisational and technical nature.

Compliance with these fundamental principles (professionality, independence, integrity, etc) is important to the establishment and maintenance of confidence in its international veterinary certificates.

The Veterinary Services must be able to demonstrate by means of an appropriate legislation and organisation that they are in a position to have control of the establishment and application of animal health measures, and of international veterinary certification activities. In particular, they shall define and document the responsibilities and structure of the organisations in charge of the animal identification system, control of animal movements, animal disease control and reporting systems, epidemiological surveillance and communication of epidemiological information.

The Veterinary Services shall develop and document appropriate procedures and standards for the implementation and management of animal health measures and international veterinary certi-

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fication activities. These procedures and standards may for example relate to:

- prevention and control of disease outbreaks;
- epidemiological surveillance and zoning
- inspection and sampling techniques
- diagnostic tests for animal diseases

Preventing the spread of Classical Swine Fever (CSF) and Bovine Spongiform Encephalopathie (BSE) is discussed in respect to risk analysis, freedom from disease, surveillance and quality of Veterinary Services.

Modern Reproductive Biotechnologies and Trade of Germplasm

Michel Thibier[1]

Since the beginning of domestication (a long time ago …), exchange of domesticated animals between neighbors, villages, regions etc… has taken place making it obviously feasible. However in modern ages, there are a number of constraints that have arisen, particularly linked with the sometimes long distances of their transportation. They are of socio-economics nature including the welfare issue but also in relation with the animal health status of those animals. The diseases encountered in one given area may be radically different from those of another and the individuals may therefore carry over pathogens with them. There are means to prevent that but they are usually costly on one hand and sometimes unacceptable due to the high risks that may be associated with such movements on the other hand. The reproductive biotechnologies in relying on gametes or embryos are particularly well adapted to global trade in being associated with a much higher level of safety together with a much-reduced cost. One major technical constraint is the necessity to keep those entities alive during the exchanges. Deep freezing has been on this regard an essential achievement wherever this technique has been effectively developed, because this allows reports both in time and in space. We will see here that deep freezing is not yet applicable for all technologies. It should be stressed however that these most interesting opportunities for international movement do not preclude at all, thorough health surveillance according to relevant risks analysis.

The reproductive biotechnologies include classically (Thibier, 1990) four generations: the first is that of Artificial Insemination, the second, Embryo Transfer, the third comprehends sexing of embryos, in vitro produced embryos and nuclear transfer (cloning). The fourth, the most recent, is that of transgenesis. The present paper aims at reporting on the major features of the risk analysis of carrying pathogens with those gametes or embryos and will show how some of those biotechnologies will contribute most effectively to enhance international movements of germplasms. The bovine species will here be taken as a model.

1 Artifical Insemination

This biotechnology of the first generation started to be developed on the field just after the last world war more than 50 years ago. Since then, it has a worldwide implementation and more than 100 millions first AI's in the bovine were recorded last year (Thibier and Wagner, 2000). Several million doses of bovine semen and thousands of small ruminants or swine semen are being moved internationally every year. The risk analysis first shows that a significant number of pathogens, viruses but also bacteria, specific or non-specific can enter the male genital tract and be found associated with the semen. The Office International des Epizooties (OIE) distinguishes diseases that are the most at risks (list A of the International Animal Health Code) and those (list B) that although at risks are not quite to the same magnitude a threat to the recipient herd, region or country. Most of the pathogens of the list A diseases may be found in the semen in contaminated donor sires. Among those, are the Foot and Mouth disease virus, the rinderpest virus, the blue tongue virus, contagious bovine pleuro pneumonia mycoplasma etc. … Those pathogens if present in semen, could contaminate dramatically not only the female to which the semen is inseminated but also the whole herd or a significant part of a given area. Many of the list B agents are also possibly associated to semen. Hence a thorough management of the donor males has to take place in order to prevent such things to happen. More than 50 years of experience has allowed the industry to fully control the procedure to be put in place. The principle of management is the following: " a donor bull should be free of a given pathogen and included in a collection of individuals also free of this given pathogen". This infers that the male donors should be in a Semen Collection Center (SCC) which is free of those pathogens. In order to do so, bulls have to originate from herds free of

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the disease, be placed in quarantine stations to monitor them by adequate tests from blood and semen and once in the SCC, with restricted access, again at regular intervals be also monitored. Provided that those conditions are met, then semen can be qualified as "pathogen free" and be safely released for international trade. The health conditions of the environment (region or country) however do remain as a constraint, as in some cases, the individual could be a so-called "healthy carrier" of a pathogen. The full success of deep freezing in most species of farm animals provides an additional advantage.

2 Embryo Transfer

This second generation was launched on the field by the mid-seventies and consists of collecting embryos at the right stage (7 days after insemination) after in vivo fertilization. Embryos are then collected from a donor and either transferred as fresh to a recipient or deep frozen, stored and transferred in other herds, regions or continents. The number worldwide is less (by 3 logs) than the number of AI's and is in the magnitude of 0.5 million each year (Thibier, 1999). It requires more expertise and investments than AI. However it is also distributed worldwide although North America and Europe represent the two thirds of the total number of embryos transferred. The export of embryos increases every year and many thousands of them are being shipped from one country to another. The risk analysis made by the International Embryo Transfer Society (Import/Export Committee) has shown that pathogens both from the list A and B of the OIE International Animal Health Code could also be associated with embryos collected. The management of such risks is radically different of that in place for AI. The donors, the donor dairy cows for example, cannot easily be assembled together in a given donor center. In addition, originating from various herds with possibly distinct health statuses, those animals would be at risks of becoming affected by a given disease. This among other reasons, explain why the approach taken by the OIE Code relies on the concept of 'officially approved embryo transfer teams" in order to give full guarantee to the importing country that no pathogen is associated with the embryos moved and transferred. This official accreditation relies on four criteria: (1) a vet in the team should be responsible of the operation, (2) the equipment of the team, both in terms of facilities and equipment *stricto sensu* should be adequate and assessed as such by the official veterinarian authority, (3) the code of practice elaborated by the IETS should be strictly followed by the team and (4) control and regular monitoring should be done by the official veterinarian authorities. A special note should be made in the code of practice of the IETS (written in the IETS Manual, in English, French and Spanish), it includes a thorough washing (10 times etc…) of the embryos which was shown in most instances effective in eliminating the association of a possible pathogen to the embryo. It has been possible to claim that "provided that all those conditions are met, then the embryo transfer is the safest means of moving embryos from one herd to another" (Thibier, 1991). This further allows one to claim that at the present time, any given germplasm can be safely moved to any herd of the planet. The BSE crisis has of course raised new questions. It has been so far shown that the BSE agent was not able to be associated with embryos. However, the large experiment started in the UK in the early nineties is not entirely completed and the final results should be released in the middle of next year (Wrathall, 1997). The absence of case of this disease in a given herd obviously reinforces the level of safety.

3 The Third Generation

This generation includes embryo sexing, in vitro produced embryos and nuclear-transferred embryos (clones) for which the risk analysis gives radically distinct results.

The embryo sexing necessitates the invasion of the zona pellucida (zp), preventing the latter to efficiently exert its protective role as far as the possible pathogens associated to it are concerned. The action to be taken can be easily solved as stated in the OIE International Animal Health Code. Proper management consists in this case to ensure that, at the time of the biopsy, which would, result in invading the zp, the embryo environment, the medium in which it is put, is sterile. This can be achieved by proper washing of the embryo(s).

The in vitro produced embryos are being transferred since a more recent time, the early nineties, and the total number of such embryos in the bovine, recorded worldwide is in the magnitude of 30 000 in 1998 (Thibier, 1999). In addition, technically, even in the bovine, the deep freezing technique is not quite as efficient in terms of pregnancy rates than from fresh embryos. This has considerably slowed down the international movements of such embryos. The female gametes (occytes) used for in vitro fertilization may derive from sampling of the ovaries collected at the abattoirs or from in vivo collection, the so-called ovum pick up technique. The risks in those two situations are quite distinct. In addition, it has been recently shown by several authors that two pathogens studied as a model, namely the IBR/IPV virus (herpes virus) and the BVD virus (pestivirus) could remain associated to the embryos during the procedure. Recently it has also been shown that Foot and Mouth Disease virus could also stick to the embryo in vitro produced. It should be added that the in vitro production of embryos comprehends several steps and may in some cases include a co-culture system for previously in vitro fertilized embryos before they are transferred. This co-culture system adds one significant factor of possible contamination The OIE Code has already taken into consideration those scientific data. Such embryos can however be moved internationally and will be as soon as better deep freezing techniques emerge. Some recent data seem to be promising in this area. The concept relies on a somewhat similar one to the in vivo derived embryo; namely the "official approval of embryo production teams". The criteria to be taken into account are close to those in use for the embryo collection teams and some more monitoring of the immediate environment of the embryos will result also in safe movement of such embryos. There is no doubt that in the future due to its potential, capable of releasing more embryos per given donor, such embryos will be widely moved internationally at a competitive cost.

The nuclear-transferred (cloned) embryos for which an enucleated oocyte is to be associated with a nucleus raises new questions. It should be first recalled that such embryos are produced at this stage almost exclusively for research purposes. However they may serve as an additional tool in the process of generating transgenic animals for duplicating them. The health conditions for such embryos should therefore be visited with great caution. At this time, very little research has been made on their properties to be associated with pathogens. The IETS ad hoc committee, currently studies the possible consequences in terms of diseases that could be so generated, of having a totally new and foreign cytoplasmic environment to the nucleus. It cannot be excluded at this stage that some parts of the genome regulated by the cytoplasmic structure, such as those of pro- or retro-viruses could be then deregulated. So many unknown factors are here to preclude at this time, any free movement of such embryos.

4 Transgenic Embryos

These embryos like those produced by nuclear transfer are either the result of fundamental investigations or of very specific purposes in relation with the biopharming industry. There are so many scientific question marks that it is unreasonable at this time to recommend any international movement of such individuals.

In conclusion, the three first generations that include Artificial Insemination, Embryo Transfer, embryo sexing and in vitro production of embryos are now launched on the field. The two first of those have been used for decades and the deep freezing technique is quite operational. It has allowed an active international movements of germplasm with a high level of safety. They both have comparative advantages to live animals, both of socio-economic nature and healthwise. There is no doubt that as soon as the deep freezing technique of in vitro produced embryos will be under consistent control the latter will provide another alternative to the international movements of germplasm. Those reproductive biotechnologies widely contribute to enhance the international trade, although they sometimes need some specific investment (particularly for the latter generation). In order that these biotechnologies fully play their role as a very safe means of moving genes, a certain number of health constraints and provisions have to be met and always should be so that those reproductive biotechnologies continue to exert their enormous potential in giving access of any desired germplasm to any farmer in the world.

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