

AI prompts broader focus on

With avian influenza monopolising poultry news headlines, one would almost believe that there are no other diseases worthy of consideration, but in fact the contrary is true. The industry is continuously confronted with health issues which should not be ignored. How should they be controlled?

By Dr Simon Shane

With the exception of highly pathogenic avian influenza which has dominated the disease situation for the past two years, the impact of disease has been minimal in nations with intensive broiler and egg producing industries. It is evident that catastrophic H5N1 HPAI is essentially a disease of subsistence poultry and has now become endemic in flocks in SE Asia and Eurasia with the potential to infect migratory free-living birds and commercial flocks. Concerns regarding avian influenza have resulted in a marked increase in implementing more intensive bio-security in the industrial sectors producing broiler meat and eggs. International cooperation in the areas of surveillance, technology and rationalisation of regulations relating to poultry trade are an inevitable response to the potential crisis facing the world's poultry industries and consumers.

Erosive infections including diseases of the respiratory and digestive tracts continue to impose costs but the combination and control and prevention effectively reduces their financial impact. The economic consequence of disease has diminished in significance when compared to the escalation in cost of fuel and expenditures to comply with environmental and welfare regulations.

Advances in technology

Advances in molecular biology have resulted in new procedures which offer the potential for rapid diagnoses with increased sensitivity and specificity. Polymerase chain reaction (PCR) installations are in operation in many central and regional diagnostic laboratories to facilitate diagnoses of major diseases including avian influenza. Extension of this technology into systems applying deep multiplexed PCR will enable diagnosticians to differentiate among ten or more diseases on a single sample derived from an acutely infected flock. This approach was developed by scientists at the Lawrence Livermore National Laboratory in the USA in response to the need to rapidly identify potential acts of agro-bioterrorism. A ruminant-disease panel has been perfected and scientists have now developed a 12-pathogen test kit for avian respiratory and systemic infections.

Sensing of pathogens in the vicinity of farms is now a reality, applying 'sniffers' which constantly sample air to detect the RNA of paramyxoviruses (Newcastle disease) and orthomyxoviruses (avian influenza). Units have been adapted from the installations capable of detecting specific pathogens most likely to be used in episodes of bioterrorism. Microarrays (gene chips) together with gene probes developed by scientists at the University of Delaware should become commercially available within a year, following successful demonstration of the ability to differentiate infectious bronchitis from laryngotracheitis (ILT) and to identify specific strains of AI virus.

Prevention and control measures

Bio-security in commercial operations has been upgraded since the advent of HPAI. Visitors to flocks are discouraged and appropriate decontamination is now required for personnel in addition to the installation of surveillance cameras and alarm systems to prevent intrusion.

Control measures depend largely on rapid diagnosis and predetermined contingency plans. In the event of destruction of entire flocks, workers in the US have developed programmes of composting which are ecologically superior to conventional burial and incineration. Restricting the movement of live birds during the period of viral shedding of both Newcastle disease and avian influenza is a critical component of any regional or national approach to control and eradication. The indirect benefits of enhanced management of catastrophic disease will become apparent in the future as the same principles will be applied to ILT and IBD.

Vaccination

Unlike the restraints in production for human vaccines, manufacturers of avian biologicals have adequate capacity. This is based on the fact that the majority of poultry vaccines comprise attenuated live products with a lesser proportion represented by inactivated oil-emulsion products for breeders, commercial egg production flocks and avian influenza and hydropericardium syndrome of broilers.

During the past 20 years, the industry



has been well served by the major manufacturers of vaccines. They have maintained high levels of efficacy and safety for their products in compliance with government regulations and have restrained the escalation in price to levels below prevailing inflation rates. This is in part due to improved efficiency in addition to free-market competition. Unfortunately margins are so low, due to aggressive purchasing by major integrators, especially in the USA and Brazil, that it has been difficult to allocate funding for research into new products. The basic research and initial development of genetically engineered vector vaccines has been rapid at the university and government institute levels. Commercialisation has been limited by regulatory issues and disputes over ownership of intellectual property. Ill-informed opposition by consumer groups to any form of genetic engineering has impeded progress in bringing new products to market. High cost and lack of efficacy associated with the initial range of pox-vectored vaccines administered to flocks with maternal antibody has detracted from commercial adoption of vector vaccines. A new NCD-vectored H5 AI vaccine will be suitable for mass application by the aerosol route but cannot be administered in ovo which would be desirable for broilers. It is anticipated that advances in development of AI vaccines will result in commercial HVT-vectored H5 and H7 products which would be compatible with in ovo systems.

disease prevention

Research and initial development of genetically engineered vaccines has been progressed quickly by universities and government organisations

Respiratory diseases

Variant strains of infectious bronchitis are responsible for precipitating E. coli septicemia and airsacculitis. This complex is responsible for losses through elevated mortality and plant condemnation in broilers. Application of PCR and gene sequencing enables diagnosticians to characterise viruses prevalent in an area and to select appropriate vaccines. Variant infectious bronchitis strains are also responsible for shell defects in commercial laying hens and breeders.

Infectious laryngotracheitis persists as a problem in the USA and in many other areas with intensive production of broilers and eggs. Most of the outbreaks investigated disclose vaccine viruses as the predominant pathogen. The introduction of subunit vector vaccines against ILT, with proven efficacy should reduce the incidence rate of outbreaks which are both seasonal and regional in occurrence.

Intestinal infections

Coccidiosis is the most significant intestinal condition in commercial poultry based on the value of expenditure on prevention. Most broiler operations control the condition with combinations of synthetic and ionophore anti-coccidial feed additives. Producing for 'drug free' or 'natural' markets requires anticoccidial vaccines. Both precocious and conventional oocyte suspensions are used with the former generally confined to breeders due to the differential in cost.

Protozoan infections including histomo-

niasis and the lesser known infections of turkeys (*Cochlosoma*, *Trichomonas* and *Hexamita*) occur with increasing frequency during summer months. Due to the withdrawal of the imidazole compounds, treatment of these infections is difficult and requires resolution of contributory factors including all-in-all-out placement, control of immunosuppressive adenovirus hemorrhagic enteritis and enhanced inter-flock decontamination.

The incidence of clostridial enterotoxemias is increasing in "drug-free" flocks especially in Western Europe. Withdrawal of either virginiamycin or zinc bacitracin frequently results in proliferation of *Clostridium* spp. in the intestinal tract in the USA. The resulting outbreaks of ulcerative and necrotic enteritis and secondary gangrenous dermatitis and botulism frequently limit production efficiency on farms with environmental factors which predispose flocks to the condition. Strict control of immunosuppressive infections, coccidiosis, chlorination of drinking water, maintaining dry litter and the use of feed additives including mannaoligosaccharide and probiotics are appropriate control measures.

Food borne infections

Salmonella and *Campylobacter* contamination of broiler and turkey carcasses and *Listeria* in turkey-derived products continue as a problem for producers required to conform to regulatory standards which requires expenditure on control measures. Preharvest systems are generally ineffective but include enhanced biosecurity, the use of probiotic feed additives and administration of competitive exclusion cultures. Post-harvest control measures are embodied in HACCP programmes and require adherence to high standards of sanitary processing. Chlorination of immersion tanks, maintaining acceptable rates of overflow and installation of effective inside-outside carcass washers are beneficial in reducing the level of *Salmonella* contamination. These modalities are however less effective against *Campylobacter*. The issue of egg-borne *Salmonella enteritidis* (SE) is a concern for producers worldwide. In the US, egg quality assurance programmes (EQAPs) mandate vaccination of pullets and surveillance of the flock environment. Although there has been a marked reduction in incident cases, outbreaks of SE continue to be noted partly due to improved reporting of infection in consumers. In many countries efforts are under review to reduce and eventually eradicate this infection. The US Food and Drug Administration will require more frequent flock testing for SE and will mandate diversion of shell eggs to pasteurisa-

tion in the event of infection. Despite the low incidence rate of infection the US is extremely vulnerable to SE as a high proportion of the national flock of 280 million hens is housed in in-line multi-age units with 1-1.5 million birds.

Introduction of infection into these complexes results in rapid dissemination among houses by aerosol, rodents and the movement of personnel and equipment. This complicates eradication which requires high standards of bio-security, pest control and the placement of solidly immunised pullets. SE is a problem in some developing countries and in the southern tier of the EU, requiring concerted regional and national efforts to supply consumers with eggs free of infection.

Conclusion

Although the industry has made great strides in suppressing specific diseases, continued intensification and concentration of flocks will inevitably lead to the emergence of new forms of infection associated with interactions between pathogens and the commercial environment of flocks. The emergence of new and more virulent strains of disease-causing organisms is also a feature of intensification. The increasing incidence of runtling and stunting syndrome, metapneumovirus and variants of infectious bronchitis and infectious bursal disease attest to the constant struggle to diagnose and control infection. With the decline in effectiveness of antibiotics and legal restrictions on their use, bacterial infections including colibacillosis which are caused by opportunistic organisms must be addressed by resolving deficiencies in management and the environment of flocks, and also preventing immunosuppressive infections including IBD, Marek's, CAV and in addition, mycotoxicosis.

It is anticipated that HPAI will not affect the commercial flocks of Western Europe as the occasional introduction of infection from migratory birds will be detected and appropriate eradication programmes will ensure effective containment. In developing countries with a predominance of subsistence poultry sold as live birds, vaccines will be a necessary adjunct to suppress clinical outbreaks. Persistence of this catastrophic infection and the continued risk of extension to human populations in affected areas will result in a restructuring of production systems. There will be an inevitable move from live bird sales to integration which will facilitate application of bio-security and vaccination and limit dissemination of disease. ■