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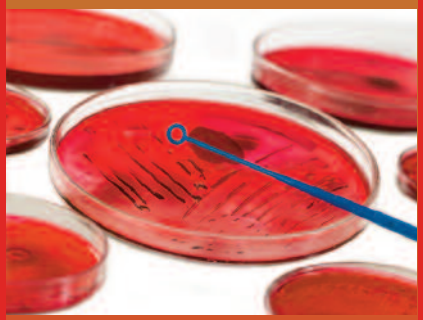
BIOSECURITY
MANAGEMENT HANDBOOK



Cherry Valley®

This Handbook

Cherry Valley has invested for many years in a research and development resource covering all aspects of duck production. This handbook is based on that research, along with more than 50 years' experience of integrated duck production and the benefit of working with customers in all of the World's important duck markets.

The modern duck industry is an international business, with production in many countries and varying climatic and environmental conditions. This handbook is not designed to provide definitive information on all aspects of duck management in every scenario. It is a guide to best practice, aimed at helping customers produce the best results from their breeding stock, hatcheries and growing farms, whilst maintaining flock health, vigour and wellbeing.

Much of this technology is unique. It is important not to rely on previous experience of other ducks, but to apply **Cherry Valley** management to **Cherry Valley** ducks. Users must be aware of local legislation, which may influence the management practice that they choose to adopt. **Cherry Valley Farms** cannot accept any liability for the consequences of using this information, as it does not control the detail of its application.

Biosecurity and the Control of Disease

The control of disease is a fundamental requirement of any successful livestock operation. Ducks are a very hardy species and are capable of adapting to a wide range of environments, not only in terms of climatic conditions, but also to management and disease. Many of the diseases that may infect other poultry species do not affect ducks, but good biosecurity will help to control those that do.

Biosecurity Contributes Towards:

- Predictable flock performance that will enhance profitability
- Uniformity of carcass quality
- Reduced costs of disease control
- Meeting market requirements by reducing the use of antibiotics and their residue levels
- Meeting the needs of global markets
- Minimising the costs of production

The Following Measures are Also an Important Part of any Flock Health Program:

- Vaccines – essential for the control of certain diseases. Successful vaccination requires proper application of the appropriate vaccine to healthy birds, by trained operators.
- Probiotics – have an increasing role in poultry production, but their use for ducks is still in development.
- Antibiotics – although there is great concern about the use of antibiotics in livestock and the development of resistance in certain species of bacteria, as well as the potential for residues to appear in food, antibiotics remain important in the treatment of disease in livestock.

Technical Support

Additional information on specific issues is available from the **Cherry Valley Farms'** Technical Department. The Technical Desk is maintained to provide a technical service to **Cherry Valley** customers worldwide and can be contacted as follows:

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Introduction

The control of disease is a fundamental requirement of any successful livestock operation. Ducks are very hardy species and are capable of adapting to a wide range of environments, not only in terms of climatic background; but also of management and infection. In addition ducks are not affected by many of the diseases which may infect other types of poultry. Having said all of this there is still no substitute for the application of good biosecurity.

Biosecurity Contributes Towards:

- Predictable performance results, which in turn enable sales and market requirements to be accurately met.
- Uniformity of product quality.
- Reduction in disease control costs.
- Meeting new market trends in terms of consumer concerns re residues, antibiotics use etc.
- Meeting the needs of global markets.
- Minimising costs of production.

In Addition to Biosecurity the Following Measures Help to Control Disease:

- Vaccines - though essential in relation to certain diseases the application of vaccines does have some potential risks, including the stress of administration, reduced uniformity, immuno-suppression, operators' mistakes (storage / administration) etc.
- Probiotics - they have an increasing role in poultry but are this at the development stage in relation to ducks.
- Antibiotics - there is, however, great concern with regards to increasing resistance, not only in terms of the bacteria affecting the stock but also in the treatment of humans. In addition the potential for residues is also a problem.
  (Extracts from a paper by G.PH. TE Winkel - Euribrid - The Netherlands)

Although each project will be different in terms of specific biosecurity requirements, the basic principles are universal and can be grouped together under four headings:

Controlling the Sources and Routes of Infection

Hygiene

Management and Husbandry

Preventive Medicine

This handbook seeks to deal with the issue of biosecurity and health under these 4 headings.

In addition specific information is provided on how to deal with a possible disease problem and how to recognise specific diseases.

Specific aspects of biosecurity which apply to the hatchery operation are covered in the Hatchery Handbook.

Layout and Design

Farm layout and design present significant risks of the spread of infection.

Duck production farms should be located separately from other poultry production areas, especially other ducks. The recommended distance between such units is 3 km. Each farm should be designed for a specific operation within the production process and different production operations should be kept apart. Parent stock rearing, parent stock egg laying farms, hatcheries and commercial growing farms should be in separate locations.

In terms of the layout the maximum level of isolation and hence protection is achieved when each farm accommodates only one age of stock. Single age farms eliminate the risk of infectious agents carried by older birds being passed on to younger, more susceptible, stock. They also provide the opportunity for full de-stocking, thorough cleaning and disinfection and a complete break in the cycle of infection.

Farm size should be limited as large farms involve high levels of movement, hence increased opportunity for the transfer of potential pathogens. Farm location and layout should provide for the control of access to the farm. House design should consider the need for thorough cleaning. Design details and materials should aid cleaning and allow the use of appropriate cleaning agents and disinfectants. Security fences, the provision of concrete aprons around the building and no trees or bushes within the site, are all measures that limit the habitat for vermin, especially rats and mice that may be important disease vectors.

A good design will provide protection from contact with potential pathogens and carriers of potential pathogens. The building should be proof against access by rodents and wild birds. It must provide an internal environment that is comfortable for the stock, reducing stress and promoting health, high immune status and resistance to disease.

Litter conditions, hence house and stock conditions, will be improved by well-designed ventilation systems, floor layouts and equipment. All will limit the opportunity for infection to come into contact with the stock.

Dust, draughts, noise, poor quality materials and equipment will all increase the stress on the stock as well as increasing the possibility of injury and induce immuno-suppression.

People

People are an important route for the transfer of infection in livestock. It is, therefore, important that their contact is regarded as a potential risk and controlled accordingly. All staff must be fully educated in the risks and control measures that are applied.

People who have contact with livestock must not keep other pigs, poultry or pet birds. It is recommended that this is a condition of employment for all members of the company. Only Authorised personnel should be allowed access to the farm area.

The provision of shower-in facilities for high health status premises, including parent stock farms and hatcheries, creates a break between the outside world and the house environment that enhances biosecurity. Staff enter the work area clean and change into dedicated clothes and footwear that do not travel between different flocks. The minimum requirement for all farms and hatcheries is that everyone must change their clothes and footwear before entering the bird areas.

A disinfectant foot dip and hand sanitiser should be located at the entrance to each house. Staff should dip and scrub their footwear and use the hand sanitiser every time they enter or leave the bird area. This is for their own protection as well as the protection of the livestock. Staff should work in one location as far as practically possible and should arrange their work so that they move from clean to dirty areas, especially when it is necessary to work in different sites.

Only essential visitors should be allowed on the farm or in the hatchery. Visitors should not have contact with other livestock, especially pigs and poultry for at least 72 hours prior to their visit and must respect the same hygiene precautions as the local workers. All visits must be recorded in a visitors book, which should include the details of the person concerned, the date and time, their contact details, mode of transport, the reason for their visit and any locations that they have previously visited.

Vehicles

Vehicles are important in the spread of infectious disease. As a general principle the farm should be organised so that the minimum number of vehicles need to enter the perimeter. Those that do have to enter must be kept clean and should be disinfected when they arrive. A practical means of disinfection is the use of a wheel dip at the entrance to the farm. The dip must be kept clean and the disinfectant must be fresh; dipping will only be effective if the vehicles pass through it slowly. In case of a high risk of the spread of infectious disease in a local area, spray the whole vehicle with disinfectant.

Vehicles that must enter parent stock farms, hatcheries and grower farms on the same day, must always visit the cleanest areas first (parent farms) and move downstream to the dirtiest locations (the oldest grower farms).

Moving equipment between farms should be avoided. If there is no choice, then the equipment must be thoroughly washed and disinfected on leaving from one location and again on entry to the next.

Raw Materials - Feed

Feed should come from a reliable source with a reputation for using and storing good quality raw materials (very important with regard to mycotoxins).

The feedmill should incorporate an enclosed area of production and loading. Personnel involved in the feed manufacture process must be properly trained in both quality and hygiene.

- Prior to delivery, feed should be heat treated at 70°C for 2 to 3 minutes in order to kill potential infectious agents such as salmonella.
- On the farm feed must be kept dry in sealed containers (bins) which ensure no contact with wild birds or vermin and protect it from potential contamination.
- Treatment of feed with organic acids such as formic or propionic acid will prevent feed from becoming re-contaminated.

Raw Materials - Water

- Both quality and quantity are important to the health of the stock.
- The water source must be secure in terms of meeting the supply needs of the operation.
- Water can be treated to decontaminate it if necessary and also to provide some residual protection. The materials and methods used include chlorine dioxide (2ppm), UV treatment plus hydrogen peroxide, or organic acids. The use of descaler for drinkers reduces the places where bacteria or moulds can grow.
- Filters will need to be used in certain locations.
- Biofilm can build up on the inside of water tanks and drinker lines that are not regularly cleaned. This gelatinous substance can harbour pathogens and lead to the spread of disease within a flock. Biofilm can be removed using a variety of branded products.
- Pipelines should also be treated to remove biofilm.
- Drinking water systems must be well flushed prior to stocking to remove all treatment product residues.
- Where evaporative cooling systems are used algae, bacteria and fungi can grow under the humid conditions. Water in these systems should be treated to control any build up.
- The drainage system available for the removal of waste water is also an important aspect of reducing the level of micro-organisms on a farm and in preventing water sources from becoming contaminated.

Raw Materials - Litter

- A consistently good quality material is essential.
- Moisture content should be below 15% at collection.
- Good storage which maintains or reduces moisture content and avoids contact with vermin and/or wild birds, or other animals, is important.

Effective Vermin Control Should be Ongoing in All Storage Areas.

Many aspects are covered under the heading of 'hygiene'. The principle sector, however, is the work which goes into cleaning the house / farm prior to the arrival of the stock. If this operation is not carried out properly all subsequent efforts relating to hygiene are compromised.

Terminal Cleaning of Duck Houses

Constructing Buildings for Effective Cleaning

All surfaces to be cleaned should be constructed of impervious material and have a smooth surface. Floors and the lower section of walls should be constructed of concrete.

Detergents

Detergents are used in the initial stages of cleaning in order to help remove organic matter. It is important that all organic matter, even if invisible, is removed if subsequent disinfection is to be fully effective.

Disinfectants

Disinfectants work by reacting with essential proteins of micro - organisms. Therefore any agents that coagulate, precipitate or denature proteins will act as general disinfectants.

Natural disinfectants have limited use. The Ultra Violet in sunlight has little penetrating power and the heat from steam barely a few centimetres from the end of the application nozzle, is too low in temperature.

Chemical disinfectants have selective action for different types of microbes, or broad spectrum activity which means that they are active against most species of micro organisms.

In poultry practice it is usually essential to have this type of action.

Choosing the Right Disinfectant

1. Will it control the range of pathogens required?
2. Will it control pathogens under the conditions in which it will be used?
3. Is it cost effective?
4. Is it simple to use effectively?

Factors that affect the success of disinfection are; choice of disinfectant, dilution rate, application rate, contact time, temperature, organic challenge and water quality. These issues should be discussed with the product supplier and / or, local veterinary centre to ensure their effective use.

Safety

- All electrical equipment should be isolated and covered.
- Warning signs should be posted regarding switch controls.
- Protective clothing should be made available and worn.
- First aid equipment should be available and staff made aware of the procedures to be followed in the event of an incident.

Removal of Equipment and Dry Cleaning

It is essential that all organic soiling is removed at the first stage of cleaning. Litter and faeces contain high levels of contamination and are a major source of infection. The efficacy of the cleaning and disinfection process will be compromised by any residue soiling. However, before this is done:

- Remove any remaining food from the feeder system and silo.
- Remove equipment from the house.
- Brush down all surface dust from the ceilings, water pipes etc.
- Remove all litter from the house and brush loose debris from the ceiling.
- Remove litter from site, ensuring all outside areas are cleared of old litter, dust etc. Loads should be covered before transporting from the site.
- Wash down bulk feed bins and disinfect.
- Non waterproofed motors should be dry cleaned and covered.

Water System/Evaporative Cooling System

All elements of water systems contain bacterial contamination; header tanks and, in particular, small bore pipes.

The problem may be aggravated when medication of any kind has been provided through the drinking system.

This contamination could be a source of disease spread from one flock to the next.

Sanitising the system will help remove bacterial and fungal growth, any biofilm and associated contaminants.

- Drain the header tank and remove any debris.
- Fill the tank with water adding a suitable disinfectant.
- Fill the drinking system, leave for 24 hours, drain and repeat 2 or 3 times.
- Drain and flush the system with fresh water.
- Refill with fresh chlorinated water.

Cleaning and Sanitising Buildings and Equipment

- Wash all surfaces with a detergent sanitiser solution applied at low pressure with a fan jet. Leave for 30 minutes and then wash all surfaces with water at high pressure.
- Pay particular attention to swimming areas and drinker islands, particularly the underside of slats if these are installed.
- Ideally slats should be removed for proper cleaning.
- All movable equipment; partitions, feeders, drinkers etc., should be removed from the house, before the house is washed, and then washed before moved back into the already washed house.
- The service room should be included in the cleaning procedure, taking care to avoid electrical installations which should be cleaned by a qualified electrician.
- Externally, spray air inlets, deposits from around the fans and the loading area. Ensure that all dirty areas such as concrete aprons around the houses and bulk feed bins are washed clean.
- Clean out feed bins on a regular basis; between breeder flocks, or annually on grower farms; and disinfect with an organic acid powder product.

Repair and Maintenance of Equipment

At this stage all preventive and general maintenance and repairs should be carried out.

- Ensure equipment is properly isolated and warning signs posted.
- Motors should be inspected for water damage, bearings and seals checked, and fan blades cleaned.
- All non-waterproof motors should be covered prior to terminal disinfection.

Disinfection

Using a disinfectant active against viruses, bacteria, yeast's and mould is essential. Use a pressure washer with a spray at a low pressure setting.

- It is important that disinfectants are applied to dry surfaces.
- Thoroughly wet all washed surfaces, paying particular attention to corners, cracks, and supporting posts etc.
- Start by spraying into the apex of the roof, working down the walls to the floors.
- When disinfection is completed, close all doors and curtains, place foot dips at the entrances, and display notice boards advising that the house has been disinfected.

Monitoring

A regular monitoring programme should be in place to evaluate the effectiveness of the washing and disinfection being carried out. This will enable the early detection of problems and thus minimise the risk of serious financial losses from disease related causes.

- Use direct contact methods; for example contact plates, or environment swabs, from areas of risk; floors, walls, air inlets, feeders and drinkers.
- All results should be recorded and charted, along with information detailing the types of disinfectants used and methods of application. Over time it will be possible to build up an overall picture of the most effective disinfection programmes.
- Should any test results show an unacceptable level of contamination the house should be disinfected again and further samples taken.

Fumigation

During the setting up procedure disease organisms are easily introduced to the house. To reduce the level of such contamination and to disinfect inaccessible areas, the house should be fumigated.

Insect Control

Domestic flies and beetles are capable of transmitting salmonellae and infection can persist through these insects from one generation to another in eggs and larvae.

- When an insect problem has been identified, band spray immediately after depopulation, before the house cools,
- Spray with a strip 1m wide on the lower walls, all around the house, meeting the litter surface.
- Include dividing walls and posts.
- After disinfection spray floors and walls evenly with insecticide using low pressure and a fan jet.
- Use an appropriate insecticide.

Rodent Control

Rats and mice cause damage to buildings and equipment. They eat and spoil foodstuffs, carry disease that can infect both humans and livestock, including leptospirosis (Weil's disease), Salmonellosis and foot and mouth disease.

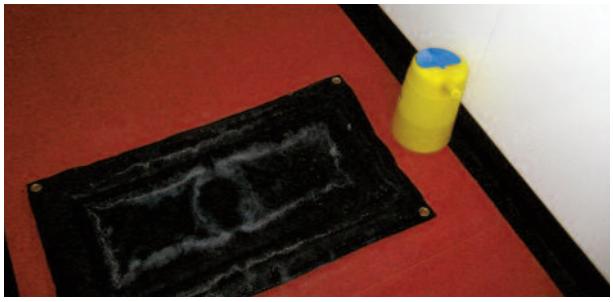
Rodent control should be practiced on an ongoing basis. The most efficient method of controlling rats and mice, the biggest carriers of Salmonella, is by poison baiting, using one of the anticoagulant poisons. Initial baiting should be done by placing bait in as many places as possible; regular checks will identify problem areas. Once the rat population is controlled then subsequent baiting (permanent baiting) should be placed in strategic places around the farm.

Continuous Hygiene Routines

Between applications of the Terminal Hygiene Programme there are many opportunities to prevent the introduction of infection, or cross infection within the farm. Continuous routines take into account the different disease problems which occur at different stages of production.

Site Security

To avoid the introduction of infection onto a farm or of the transfer of infection from house to house, the following precautions should be observed:



Foot Dips - all personnel should use foot dips on entering the site or house.

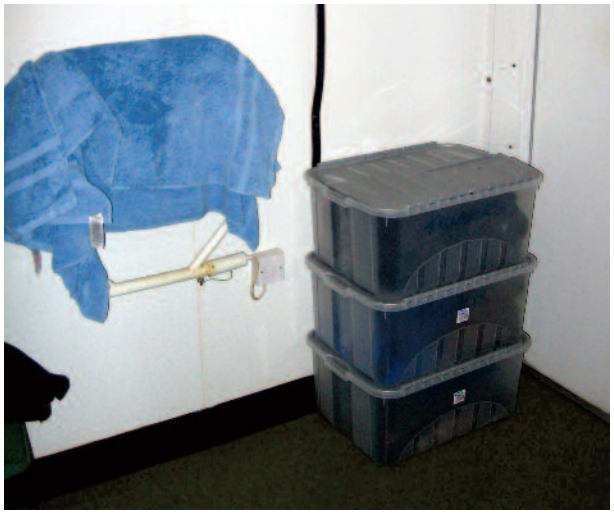
Wheel dips / vehicle sprays - any vehicle entering the site must pass through a wheel dip or vehicle spray. Top up and change regularly to avoid dilution or contamination.

Use disinfectants which work in the face of organic matter, and replace regularly (suggest twice weekly), UV from the sun will de-activate the disinfectant. Try and use foot dips which have lids.

Shower in Facilities - these facilities should be at the entrance to all sites. All farm personnel and visitors must use such facilities if provided.

Hand Washing - hands obviously have tremendous potential to transfer infection. This potential needs interrupting as frequently as is practically possible during the working day, by hand washing at appropriately sited facilities.

Visitors - do not allow non-essential visitors onto the site or into the houses. Essential visitors should be provided with protective clothing. Pay special attention to cleaning teams, catching crews, engineers etc. They are frequently the cause of spread of infection.



Disposal of Dead Birds – collect and dispose of dead birds quickly either by incineration, storage in sealed bins for subsequent collection, or by burying well away from the farm.

General Farm Tidiness - keep the general farm area clean and tidy. Materials and/or equipment not in use should be properly stored away from the houses. Any spilt feed or litter should be cleaned up immediately.

The farm management have four key roles in maintaining biosecurity and health.

Management and Husbandry Discipline

The farm management must establish and maintain the discipline necessary to achieve an effective biosecurity programme. The standards of isolation, farm and house hygiene will ultimately be the responsibility of the farm management. The stronger their level of control the higher will be the standard achieved.

Management and Husbandry Practices

As noted previously ducks are a hardy species with a high level of resistance to infection. This level of resistance is, however, impaired when under increased levels of stress. By applying high standards of management and husbandry, stress levels are minimised and the stocks immunity is optimised.

Good management and husbandry is especially important when the stock are young. Key areas include:

- water availability and quality
- accurate brooding heat control
- good ventilation but without draughts
- adequate floor space
- feed quality and availability
- litter quality
- good stock handling with attention to, and care for, individual birds if necessary

Recommended standards in all areas of management and husbandry are outlined in the relevant Cherry Valley management handbook.

The application of these standards can be summarised by emphasising the importance of attention to detail. If the details of the management and husbandry are right then the birds welfare will be well protected.

Raw Material Quality

Apparent disease challenge in production situations are often, in reality, the result of poor management or, more regularly, poor raw material quality. This area is especially important in relation to feed, water and litter.

For example aflatoxins in feed, as well as clinical symptoms in its own right, can produce depressed immune response leading to all sorts of secondary infection. Water can be a prime carrier of Cholera as well as conditions such as Botulism.

Litter can frequently have a problem of Aspergillous mould, with the spores produced leading to Aspergillosis in heavily contaminated areas.

Some of the conditions associated with poor raw material quality are easily spotted, others are much more complex.

Stress experienced either collectively or by individual members of the flock can be caused by one or a combination of contributing factors.

As in human populations certain individuals may be more susceptible to specific stresses than others. Stress affects the condition of the stock both directly and indirectly via subsequent effects.

It is the farm management's responsibility to consider all aspects of the flock's environment, management and inputs to ensure that all potential stress factors are minimised.

An appreciation, or empathy, on the part of the farm management and workers with the stock is very important. This empathy will enable recognition and correction of potential stress factors at the earliest stage.

Records

Good records are important in both maintaining standards and in the early identification of problems. They are essential in the case of official investigations of notifiable disease, when they will help in tracing contacts and may help to control an outbreak. Routine checks help maintain effective rodent control programmes. Monitoring water and feed consumption provide early warning of a compromise to the well being of the birds.

Mortality and culling records should be accompanied by comments on the suspected cause of the losses. From this information a profile of specific problems can be developed.

Vaccination

There are three major diseases of ducks, all of which can be effectively controlled by vaccination.

Duck Viral Hepatitis (DVH)
Duck Viral Enteritis (DVE)
Pasteurella Multocida (PM) (Cholera)

If any of these diseases is endemic to the area where the stock will be accommodated then a suitable vaccination programme from a reputable vaccine manufacturer should be applied. Specific details of sources of vaccine and vaccination programmes are available from the Technical Department.

Duck Viral Hepatitis

DVH affects ducks at a very young age (0-5 weeks). Provision for vaccination must therefore be made well in advance of delivery.

Cherry Valley breeding stock from the UK originate from the stock which is completely free from DVH. They will therefore have no maternal immunity and must be vaccinated on arrival and prior to placing in the houses if they are to be accommodated in an area where DVH is endemic.

Following vaccination on arrival the ducklings should be held for a period of 8 to 12 hours in their boxes or in a clean area to allow time for some DVH immunity to develop. If held in boxes the ducklings should be sprayed with a fine mist of water every 2 hours to stop them becoming dehydrated.

Subsequent vaccinations should be applied according to the vaccine manufacturers recommendations. This ensures that the parents in lay pass on a high level of maternal immunity to their offspring.

Duck Viral Enteritis

DVE can affect ducks from as early as 2 weeks of age. In areas where the disease is endemic a suitable vaccination programme should be applied as standard procedure.

As with DVH, Cherry Valley breeding stock from the UK originate from the stock which are completely free from contact with DVE and DVE vaccine. They will, therefore, carry no maternal immunity.

Provision for the availability of a suitable vaccine and a vaccination schedule should be made well in advance of delivery.

Though DVE can cause significant losses, its onset and effect is normally much less severe than DVH. Its spread is very much a function of contact so good isolation is important in limiting risk, particularly between the stock arrival and the first vaccination which would normally take place at 4 weeks of age.

As with DVH a full vaccination programme should be applied to parents thus providing protection of stock throughout their lives and enabling them to pass on a good level of immunity to their offspring.

Pasteurella Multocida

PM can cause septicaemia, particularly in young ducks.

The condition may be endemic to an area i.e. in the form of fowl cholera in chickens.

In such areas prevention and protection by application of a vaccine is sensible. To produce the best results the vaccine should be custom-made and based upon the particular strain of PM which is responsible for the condition locally. The initial vaccination would normally be applied at around 3 weeks of age.

Vaccination in the face of an outbreak can be very effective.

It is important to note that the incidence and spread of this disease is usually a result of poor husbandry, i.e. dirty conditions and a low level of hygiene. It is associated with rodents, especially rats. Therefore the primary method of prevention is the use of good husbandry techniques and pest control.

As this is a bacterial infection the birds can be effectively treated with antibiotics in the event of an outbreak.

Salmonella Vaccination

In certain areas of the world there is increasing emphasis on the eradication of salmonella from food animals production systems.

This issue is particularly important with regard to poultry which traditionally has a strong association with salmonella infection. As a result a series of salmonella vaccines are available principally for application to chickens but are also being applied to ducks.

Riemerella Anatipestifer Vaccination

In response to increased losses resulting from Riemerella anatipestifer infection in areas of intensive duck production, specialised vaccines have been developed.

These vaccines are often locally made in order to incorporate the specific strains of the bacteria which are prevalent in that area.

In certain situations results of vaccine application are reported to be good while in others long term protection is not achieved due to the changing virulence of the many different strains which can be involved. As this infection is very much the result of specific management and housing conditions the most effective long term protection from it is to ensure that the production structure is designed in such a way as to limit any potential threat from the infection.

Medication

Medication would normally only be applied to ducks in relation to a specific problem and then only when it is clear that the condition is sensitive to the specific antibiotic etc being applied.

There are no specific disease conditions associated with ducks which require routine medication.

Conditions such as coccidiosis or intestinal worms do not normally affect ducks.

When using antibiotics, ensure that the dose and method of application are correct. Record the details of any usage, including batch numbers and any effects of the application.

Having applied medication to deal with a specific problem, it is very important that the actual cause of the problem is identified so that it can be corrected or avoided in future and a reliance on ongoing medication avoided.

The Technical Department can provide additional advice on medications which are commonly used to treat specific conditions.

Vitamin, Mineral and Electrolyte Preparations

These types of additives can be beneficial to the ducks during periods of stress; for example prior to handling or transit which could leave them dehydrated.

Any preparations added to the feed or water should be specifically produced for the job and obtained from a reputable manufacturer.

It can be very dangerous to the well being of the ducks to add such things as sugar or glucose to the water. Such preparations can in fact increase levels of dehydration.

The Technical Department can provide advice on specific products if needed.

Dealing with a Suspected Disease Problem

Good managers and stock people will pay close attention to the condition and behaviour of their stock on a day to day basis. Any deviation from the norm in either of these areas should raise suspicions of a potential problem.

Be vigilant on symptoms for notifiable diseases. It is essential to seek professional advice as soon as any suspicious disease situation is identified.

Confirmation of a disease problem will usually come in the form of a significant drop in egg production, a reduction in appetite, water consumption or an increase in mortality. As soon as such a change is recognised and until otherwise confirmed, it should be assumed that an infectious agent is involved and the following action taken:

Isolation

As effectively as possible isolate the affected flock in order to reduce the opportunity for any infection which may be involved to spread.

Management Investigation

Check all management or raw material inputs to identify a possible cause. Try to establish common factors i.e.

- One flock or several flocks affected.
- One age group or various ages.
- Any pattern of spread.
- One feed type; one specific batch of feed.
- Common water supply.
- Common stock person.
- Common litter.

Veterinary Investigation

If no management, husbandry or raw material problems can be identified as the possible cause, arrange for a veterinarian (preferably one with poultry experience) to visit the farm to:

1. inspect the affected flocks
2. discuss the flocks history
3. collect relevant material / samples for post mortem and laboratory testing.

In the event that a veterinarian cannot visit the farm, samples of dead birds should be taken to the veterinarian. Any samples collected should be strictly in accordance with the specific instructions of the veterinarian or laboratory.

Diagnosis

On the basis of the farm visit and laboratory investigation it should be possible to establish the most likely cause of the problem.

If the infectious agent is a bacteria then the laboratory should carry out an antibiogram in order to confirm which antibiotic is likely to be the most effective in treating the condition. At the same time as diagnosing the disease, the possible causes of the infection or other problem should be established.

Treatment

The relevant treatment or corrective action is applied at the farm according to the veterinarians recommendations.

The effect of the treatment on the stock must then be closely monitored to ensure that they react as anticipated. If they do not the investigation must be reopened and an alternative treatment established.

Avoiding Reoccurrence

In association with the treatment, action should be taken by the farm management to remove, correct or avoid the root cause of the problem. When the treatment is complete the problem will not then reoccur in either the treated or other susceptible flocks.

When dealing with any disease that has the potential to cause economic loss, rapid and decisive action is crucial.

Good, accessible records of routine flock parameters (culling and mortality, water and feed intakes, mediation, unusual observations etc) are invaluable to any veterinary investigation.

DISEASE	AGE OF INCIDENCE	CLINICAL RECOGNITION	DIAGNOSIS	DIFFERENTIAL DIAGNOSIS	TREATMENT	PREVENTION	OTHER REMARKS
DUCK VIRAL HEPATITIS (DVH)	0-3 weeks common. 3-5 weeks complicated by septicaemia. Adults not susceptible.	Sudden death in considerable numbers. Birds usually in good condition. Opisthotonus.	Typical haemorrhages of liver. Virus causes stunning of 9 d.o. chick embryos, serum neutralisation tests IF test.	Duck Septicaemia. Coccidiosis. Duck Plague. Mycotoxicosis. Poisoning.	-	Dayold foot stab vaccination. Adult vaccination by live attenuated (chick embryo) vaccine.	Worldwide incidence. Very important disease.
DUCK PLAGUE (DUCK VIRAL ENTERITIS) (DVE)	Most adults but also from 2 weeks of age. Incidence really a function of contact probability.	Acute epidemic disease of adult and young ducks, causing death in both.	Diptheritic cloacitis and oesophagitis, wide spread petechae. 12 d.o. duck embryos die in 4 days. Many haemorrhages. Serum neutralisation test.	Oesophagitis in birds on restricted feed. Pasteurella multocida or other septicaemia. Parasitic oesophagitis. DVH. Poisoning. Mycotoxins.	Vaccination in face of an outbreak: rapid protection by interference.	Vaccination using chicken egg-adapted live virus.	Diagnosis for the first time in UK in 1972 - only in ornamental collections. In Netherlands for many years, in USA since 1967. An imported disease.
NEWCASTLE DISEASE	Presumably all ages, but not yet recognised clinically other than in laying ducks or by experimental infection.	Drop in egg production, birds go into moult.	As for fowl.	Any drop in egg production and fertility.	-	As for fowl.	Rarely diagnosed in ducks. Notifiable.
INFLUENZA	At any time during the life of the flock.	Sinusitis. Respiratory distress, high morbidity, low mortality, drop in egg production, soft shelled eggs.	Virus isolation and H.I. test. May be associated with a Mycoplasma Serology erratic.	Bacterial Sinusitis.	Control secondary infections.	None.	Notifiable.

DISEASE	AGE OF INCIDENCE	CLINICAL RECOGNITION	DIAGNOSIS	DIFFERENTIAL DIAGNOSIS	TREATMENT	PREVENTION	OTHER REMARKS
RIEMERELLA ANATIPESTIFER SEPTICAEMIA (R.a.)	2 to 6 weeks (or later in isolated flocks)	Tucked in neck, disinclined to walk, uncoordinated. Arthritis - hock lameness.	Lesions of septicaemia, culture of organisms on blood agar (incubate for 48 hours before calling negative) Culture brain and heart. Recovery from Liver is poor.	E. coli of septicaemia, DVH, Duck Plague, Coccidiosis.	Sulphadimine in drinking water 30-60g / 100 birds per day - OR -83 mg each of Streptomycin and Dihydrostreptomycin by i/m injection - OR - 250-350 ppm SQX in feed. 110 ppm Lincocin in feed.	Good husbandry, correct hardening off before moving. Farm structure which provides reasonable isolation between different ages of stock. Protection from weather. Correct house r.h. SQX in feed (125 ppm) Vaccination?	Basically a disease of intensive husbandry and poor hygiene. Used to be known as Pasteurella anatipestifer.
E. COLI SEPTICAEMIA	2 to 8 weeks.	-	Culture brain, heart or liver.	Pasteurella septicaemia, DVH, Duck Plague, coccidiosis.	Tetracycline? Injection of suitable a/b after checking sensitivity.	Good husbandry and hygiene. Vaccination.	(As above)
PASTEURELLA MULTOCIDA	**THIS ORGANISM CAN CAUSE SEPTICAEMIA IN DUCKLINGS. ALSO SEVERE LOSSES IN YOUNG BREEDERS (C.F. FOWL CHOLERA)**				Use appropriate antibiotics.	Vaccination.	Can be very important in some countries.
STAPHYLO-COCCUS	**THIS ORGANISM MAY BE INVOLVED IN A SEPTICAEMIA CONDITION OR AIR SACCULITIS. IT IS COMMON SECONDARY TO RIEMERELLA ANATIPESTIFIER. IT MAY BE INVOLVED IN SYNOVITIS; AS MAY E. COLI AND PASTEURELLA.**						
STREPTO-COCCUS faecallis/faecium	2 to 6 weeks.	Looks like R.a.	Culture - S Zooepidemicus strep. Like aerococcus not yet named.	R.a., E. coli	Probably suitable antibiotics orally or by injection.	Low stress management.	Further investigation needed to demonstrate extent and primary / secondary role in disease.
STREPTO-COCCUS bovis	6 to 14 days (prolonged if reinfection)	Increased mortality and nervous signs.	Culture liver and brain. Enlarged spleen in younger birds and septicaemia in older birds.	R.a., E. coli, Salmonella	Amoxycillin 20 mgs per kg (body weight) in water.	Low stress management.	Bovis 1 is more prevalent than Bovis 2. Diagnosed as problem in pigeons.
SALMONELLA	Not usually a clinical disease but sometimes involved 3 to 14 days.	Ruffled down, dehydrated, stand still not move but hunched up, purulent conjunctivitis. Pasted vents.	Often Caseous typhilitis greyish white miliary lesions of liver, culture organism from parenchymateus organs.	Nutritional deficiency. Chilling. Lack of water. Ornithosis. All may precipitate this disease.	Correct the primary cause. Use of Neomycin or Streptomycin administered orally may be successful. Important to check sensitivity prior to treatment.	Eliminate the primary cause. Vaccination can successfully prevent infections with specific Sa spp.	Salmonella is not usually the cause of clinical disease in ducks, but under poor nutritional or environmental conditions may assume pathogenicity as may other 'non-pathogenic' organisms.

DISEASE	AGE OF INCIDENCE	CLINICAL RECOGNITION	DIAGNOSIS	DIFFERENTIAL DIAGNOSIS	TREATMENT	PREVENTION	OTHER REMARKS
ASPER-GILLOSIS	All ages.	Gasping respiration progressive wasting or failure to grow.	Typical lesions in lungs and/or air sacs. Often sporing lesions seen in older growers and adults. Culture fungus, usually aspergillus, but others may be involved (penicillium, mucor). Merozoites in lumen.	In day-olds, exposure to formalin. In older birds heat stress.	Smoke or spray with clinafarm for chicken (Janssen Pharm. Belgium)	Good hatchery hygiene, good house ventilation, avoid use of mouldy litter. Litter should be harvested with a moisture content of less than 15% with good storage.	Not usually an acute problem in hatcheries. A common cause of low level losses in breeder flocks.
COCCIDIOSIS	Mainly 1-8 weeks.	Sudden death, although sometimes tucked appearance before death, blood stained vent.	Massive haemorrhage in upper small intestine. Oocysts not usually visible but numerous.	Sudden death from septicaemia, DVH or DVE.	Sulphadimidine in water 30-60g / 100 birds / day on 3-2-3 basis is very successful. Sulphaqinoxaline.	Good hygiene. Sulphonamides in feed.	Can be the cause of serious losses but appears to be self limited not a major disease of the duck industry.
LEUCOCYTO-ZOON AND PLASMODIUM	**THESE BLOOD PROTOZOON PARASITES ARE IMPORTANT IN SOME COUNTRIES, WHERE CONTROL OF ARTHROPOD VECTORS IS INDICATED, DOES NOT OCCUR IN THE UK.**						
MYCOTOXI-COSIS	Especially young ducklings.	Sudden death. Depressed egg production in laying stock.	Bile duct proliferation. Analysis of feed. Mottled liver.	Other causes of sudden death.	-	Avoid use of mouldy feed ingredients.	Identical to the disease in turkeys no longer an important disease in UK but often significant in other areas of the world.

DISEASE	AGE OF INCIDENCE	CLINICAL RECOGNITION	DIAGNOSIS	DIFFERENTIAL DIAGNOSIS	TREATMENT	PREVENTION	OTHER REMARKS
CHLAMYDIOSIS ORNITHOSIS (PSITTACOSIS OF MAN AND PSITTACINES)	All ages, but possibly not a clinical disease.	-	Possibly enlarged spleen; exudates in serous cavities. As for fowl.	Often secondary diseases occur e.g. Salmonella, DVH, Duck septicaemia.	? Chlortetracycline. Oxytetracycline 300g / tonne for 1-2 weeks.	?	Zoonosis. Seldom diagnosed in UK except from imported cage birds. Diagnosed in some European countries following signs of the disease in duck processing plant workers. (esp. pluckers)
MYCOPLASMA	?	?	Isolation or PCR techniques for one or more unidentified types.	?	Not called for apparently. Tylan does not appear to enhance health status of coughing or sneezing ducks.	?	Not, so far, identified as a problem. Leg problems similar to TS65 of turkeys?
AMYLOIDOSIS	Adult ducks - increasing incidence with age.	Abdomen may be distended with ascitic fluid, a chronic disease.	Enlarged parboiled liver, ascitic spleen grossly enlarged haemorrhagic or may be ruptured vegetative endocarditis.	-	-	-	Largest single cause of breeder mortality. Cause uncertain, considered due to bacteraemia or bacterial toxaemia, some workers say defect of carbohydrate metabolism.
SALPINGITIS	Point of lay females recover from R.a. challenge. Female growers post R.a. Strep or E. coli challenge.	Sudden death.	Caseous material in oviduct, peritonitis, mottled and enlarged spleen, culture of organism - often E. coli, R.a. or Strep.	-	-	Good early rearing, select breeders from healthy ducks.	Considered to be due to Septicaemia in early life. Lesions in oviduct not important until sexual maturity is reached. May result in carcass rejection at slaughter.
OMPHALITIS (YOLK SAC INFECTION)	First two days.	Poorly healed navels, puffed abdomen.	Large yolk sac which may be ruptured, culture of organism from yolk, esp. E. coli.	-	-	Clean eggs. Good hatchery hygiene.	Not usually a disease affecting more than 1% of population.
ENTERITIS 'NON SPECIFIC'	In lay adults.	Sudden death in good condition often in full lay.	Caseous enteritis, particularly lower small intestine (sometimes also haemorrhagic enteritis)	Sudden death from Salpingitis or DVE.	Many drugs tried without success. Neomycin or Erythromycin used in USA. Emtryl at low level seems to confer benefit.	May follow forced change in feeding habit, e.g. Onset of lay or moult.	Not a cause of sudden heavy losses in UK. (unlike USA) but usually continuous throughout lay? Higher losses in heavier strains.

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