Vaccination Workshop

Vaccination of deer: a pragmatic and philosophical question

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Abstract

Vaccination is practiced by a limited number of deer farmers. The probable major reason is that the risk of disease is not perceived as high, based on population prevalence estimates However, lack of knowledge of the potential epidemic nature of some diseases, perceptions of poor cost/benefit, lack of confidence in vaccine effectiveness, animal handling concerns and low risk-aversion based on the general belief that deer are healthy animals, are also likely factors Some farmers have ceased to vaccinate because they have never seen the disease, or that the disease has not recurred after an earlier outbreak

This paper examines risk factors for vaccination and proposes that the "best" decisions are made on an individual farm basis when all the risk factors that may contribute to the occurrence of disease are evaluated against the farmer's goals, objectives, management, financial and personal circumstances There are no generic recipes that apply equally to all farms and all farmers

Introduction

There are several diseases of deer for which vaccination may be employed for control and/or prevention However, observational (Audige, 1995) and anecdotal information suggests that the majority of deer farmers in New Zealand do not use vaccines on their deer Vaccines for only yersiniosis and leptospirosis are licenced for use in deer Both of these are Class I Prescription Animal Remedies Clostridial vaccines are used off-label

The development and efficacy of a vaccine for yersiniosis ("Yersiniavax", AgVax NZ Ltd) has been described by Mackintosh et al (1986, 1990, 1991, 1992) Wilson et al (1999) discussed some of the factors affecting the efficacy of "Yersiniavax" including genetic susceptibility Two bivalent leptospiral vaccines have been licenced for use in deer However, while the ability of leptospiral vaccines to produce antibodies in deer has been described (Wilson and Schollum, 1984), there are no data on the effectiveness of leptospiral vaccination programmes in farmed deer Only one publication is available on the serological responses of deer to a clostridial vaccine (Wilson, 1984) showing titres to be less than observed in other grazing species Cervine parapox virus has antigenic similarities to ovine parapox virus for which there are vaccines Mackintosh and Smith (1987) suggest that vaccination of deer with ovine parapox virus vaccine may prevent severe ovine parapox virus infections

This paper summarises a number of aspects of the use of vaccines in farmed deer, based on an interactive workshop involving delegates at the conference It proposes a systematic risk-based approach for decision making about vaccination, based on the premise that circumstances existing on each farm are unique, and that no one programme will be appropriate for all

Deer diseases and vaccines

Table 1 lists the diseases that have been diagnosed in deer in New Zealand or which are endemic in other species in New Zealand and which deer are susceptible to, for which vaccines are currently available in New Zealand Most of these conditions are dealt with in more detail in the paper in these proceedings by Mackintosh

Clostridial diseases. Enterotoxaemia has been confirmed on occasion It is likely the true prevalence of this disease is higher than currently believed, given its similarity to other causes of enteritis and sudden death There are a small number of anecdotal reports of tetanus in deer Blackleg has been diagnosed and stags in particular may be at risk because of their aggressive nature during the rut

Septic oedema has been associated with post velvet removal infections (Seifert, 1997). Black's disease may occur associated with liver fluke infections

Table 1. Vaccines available in New Zealand of use or potential use in deer (source. Index of Veterinary Specialties, 2000)

Disease	Vaccine	Brands	Licenced for Deer
BVD (?)		Several	No
Clostridial			
Enterotoxaemia	5-in-1	Several	No
Tetanus	2-in-1	Several	No
Blackleg	2-in-1	Several	No
Septic oedema			
Black's disease?			
Dichelobacter[a]		Footvax	
IBR[b]		Ibepur	No
Johne's disease		Neoparasec	No
Leptospirosos	2-in-1	Leptoshield (CSL)	Yes
		Leptovoid-2 (Schering Plough)	Yes
	3-in-1	Several	No
Necrobacillosis		N/A[c]	
Rotavirus/E coli (?)		Rotavac K 99	No
Parapox[d]		Several	No
Pasteurella (?)		Ovipast	No
Salmonella		Salvexin	No
Toxaplasma (?)		Toxovax	No
Yersiniosis		Yersiniavax	Yes

? = Doubt about clinical significance
a = Foot lesions
b = Possible cross-protection with CvHV1
c = Possible cross-protection with Cervine Parapoxvirus
d = Attempts made to import for fallow deer

Yersiniosis - This disease is widespread and its incidence rate in non-vaccinated deer herds was 3 2% (mortality rate 2 1%) (Mackintosh *et al* (1992) Audigé (1995) showed a mean weaner mortality rate of 1 09 per 100 deer years

Leptospirosis is reasonably commonly diagnosed in farmed deer (Wilson and McGhie, 1993), and a more recent survey (Wilson *et al* 1998) suggests its prevalence may be higher than is commonly accepted

Johne's disease - This is an emerging disease and has now been observed in many cases in outbreak form, causing significant losses of deer less than 1 year of age (Mackintosh CG, 2000)

Parapox virus - Cervine parapox virus is seen commonly associated with antler lesions (Hilson, 1997) but also produces buccal, oral, perineal and coronary band lesions (Cox, 1986) in young deer

Necrobacillosis is a condition sometimes involving liver abscessation, particularly in fallow deer (Bertram, 1986)

Salmonella - Salmonella isolates are found occasionally from deer with gastroenteritis This disease may be under-diagnosed given its clinical similarity to yersiniosis, and other causes of enteritis

Toxoplasma - There are no reports of disease associated with toxoplasma in deer in New Zealand However, there is evidence that this organism does infect deer and there has been a widely publicised out of court settlement by the Game Industry Board to a complainant in the USA who claimed a miscarriage due to toxoplasma contracted from New Zealand venison

Pasteurella - Pasteurella spp are occasionally isolated from respiratory disease cases There are occasional outbreaks of respiratory disease, particularly in post-weaned deer

Rotavirus, IBR, BVD - The significance of these viruses or their serological evidence in deer is currently no known Of interest is the recent report of cervine herpesvirus isolated from semen samples (Motha, pers. comm) It is possible that the IBR vaccine could provide cross protection to CvHV1

Why have some deer farmers never vaccinated?

Some deer farmers have never vaccinated for any or some of the diseases for which vaccinations exist. For veterinarians involved in advising deer farmer clients on deer herd health and production, it may be useful to examine some of the reasons why farmers currently do not vaccinate

"I have never seen the disease so why should I bother?"
Having never seen the disease does not mean that the disease is not present on the farm It is clear that a significant number of diseases are not investigated It is common that a farmer will misdiagnose the cause of losses or clinical disease because of their limited understanding of the range of diseases deer are susceptible to For example, sudden death is usually ascribed to malignant catarrhal fever, yet blackleg, tetanus, leptospirosis, anthrax, salmonella, nutritional disease, poisoning etc , could all be involved

The occurrence of disease varies significantly between farms. For example, Audigé (1995) showed the incidence rate of yersiniosis between farms to be 0 to 30%. Factors such as environment, season, management, genetic susceptibility, are all involved

However, the above comment raises a philosophical question about what preventive medicine constitutes Is preventive medicine about waiting for a disease to occur before preventive measures are implemented? Or is it about evaluating the risk of the disease to the whole farming enterprise?

An analogy with insurance against house fire is appropriate in this instance Some owners never experience fire Others experience more than one in their lifetime There are significant risk factors that contribute to house fires and there are significant risk management practices that can reduce that risk Furthermore, the size of excess to be paid by the insured is frequently based on risk evaluation by the insured and/or the insurer.

Economics: costs/benefit

Some have the impression that vaccine cost is high Table 2 summarises the approximate cost of the common three vaccines used in deer against weaner, carcass and velvet stag values Thus, on a direct cost basis the incidence rate of disease above or below which vaccination is economical or not can be determined Labour cost is not involved in this calculation

Table 2. The approximate retail cost of vaccine against animal values

Disease	$/animal	Proportion of animal value (%)		
		Weaner ($250)	Carcass ($400)	Velvet stag ($600)
Clostridial	0 52	0 21	0.13	0 08
Leptospirosis	1 28	0 51	0.32	0 21
yersiniosis	3 20	1 28	0.80	N A

However, while these figures may provide some guidelines they do not address the non-uniform occurrence of many diseases In outbreak form, significantly greater loss can arise than those based on average statistics Further, sub-clinical losses associated with these diseases are currently unknown, and are therefore not taken into account The risk of costs of veterinary attention and treatment in the event of an outbreak must be added to the cost-benefit calculation.

The comment sometimes heard that "I can't afford the cost of vaccination" is likely to be a self-fulfilling prophecy!

"I don't like injecting my deer"
Many farmers do not like using needles and do not like inflicting pain by injecting animals. Some regard it as a negative experience for young deer, making them more difficult to handle later Other farmers do not want to undertake the additional handling of deer Some have observed vaccination site lesions in the past sometimes these can be unsightly and may rupture Residual fibrotic lesions may interfere with TB testing

"My management is OK therefore my deer are not a risk"
In optimum management situations this statement is likely to be true However, that conclusion can only be reached if the farmer has a very detailed knowledge of the range of disease conditions and risk factors that precipitate or introduce disease onto their property, and can pre-empt or respond quickly to the unexpected problem which may alter the equilibrium on the property. Furthermore, that statement is usually based on present and/or past history and does not acknowledge that unpredictable situations could arise in the future which alter the balance between the animals' resistance, susceptibility or exposure to disease These could include inclement weather, flood restricting grazing area, storage failures of supplementary feed, unpredicted financial restrictions, retention of stock beyond that desired because of meatworks strikes, inability to sell animals because of other disease, eg Johne's disease, Tb

"I didn't know that you could vaccinate"
Some farmers do not have sufficient knowledge of the range of diseases and their risks For example, many do ont know that leptospirosis can cause outbreaks of fatal disease in young deer Advice is frequently not sought by deer farmers, or given to deer farmers by their professional advisor(s). There is no industry-wide plan to upskill deer farmers so that they are better informed to make the most appropriate decisions for management of their properties

"I've heard the vaccine is not effective anyway"
This is a common perception amongst deer farmers, given that there have been some instances where mortalities have occurred despite yersinia vaccination (Mackintosh et al 1992, Wilson et al 1999) The major reasons for this have been reviewed by Wilson et al (1999). It is not appropriate for a veterinary profession to prescribe a prescription animal remedy such as "Yersiniavax" without advice on the appropriate expectation of the performance of that vaccine. It is the author's opinion that the veterinary profession must therefore take some responsibility for the less than complete faith in the yersinia vaccine.

There is no evidence of the effectiveness of clostridial or leptospiral vaccination programmes There is an urgent need for research work to be undertaken, particularly into leptospirosis epidemiology and vaccine programme effectiveness, since the occupational safety and health implications of this disease are becoming more topical

Why do farmers vaccinate some or all deer?

"I want to protect my stock"
Many farmers have a very caring attitude towards their stock and are prepared to implement programmes to prevent sickness or mortalities

"I have experienced this disease and don't want to have it again"

It is not uncommon for deer farmers to suffer an outbreak of disease before they adopt a vaccination programme.

"I want to protect my investment"
This is similar to, but not necessarily the same, as protecting stock Some farmers are more concerned about their money than their animals However, the outcome for the animal would be the same

In this context, there has been a general observation that the higher the input on a property the higher the output (Wilson and Audigé, 1996)

While the clinical effects of disease are evident if accurately diagnosed, the sub-clinical effects of disease for which vaccines exist may not be so evident Currently, more research needs to be undertaken to investigate the sub-clinical effects of disease because this certainly will affect the cost-benefit ratio This is an important consideration for farmers focussing on protecting their investment

"I want to protect myself"
Some farmers are aware that leptospirosis and yersiniosis are zoonotic, potentially causing serious illness

"I don't like taking risks"
Some farmers will be prepared to vaccinate for peace of mind

In reality, decisions to vaccinate are usually based on a combination of these factors

Why do some farmers no longer vaccinate?

"I used to vaccinate but the vaccine was ineffective"
There are some farmers who have experienced outbreaks of yersiniosis and have blamed vaccine ineffectiveness While this may have been a factor, others such as genetic susceptibility and management, vaccine handling etc., may also have been involved Farmers will frequently attempt to blame the simplest or most obvious factor and overlook underlying factors.

"I used to vaccinate but never saw the disease"
Some farmers started to vaccinate when deer were of higher value and eventually became aware that most others did not Peer pressure is an important factor in influencing farm management decisions It is intriguing that a number of farmers will cease vaccination after a period, on the basis that they have not seen the disease since and therefore vaccination is no longer needed The logic of this conclusion may be cause for some intrigue

"Animal values no longer warrant vaccine protection"
When individual animal values were high vaccine usage probably was more prevalent. The cost-benefit equation changes significantly with animal values The potentially epidemic occurrence of disease, however, is an important consideration The value at risk is not the individual animal, but the individual animal multiplied by the possible worst case incidence rate scenario in an outbreak

To vaccinate or not to vaccinate

This section addresses some of the issues to be considered in having the right decision for the individual farm

The concept of making the "right" decision

The "right" decision is ultimately one that the farmer makes and which the farmer is satisfied with at that time Thus, the "right" decision is one that is relevant to the individual farmer and only the farmer can ensure that outcome Only history will tell if the decision was correct in terms of the biological and/or economic outcome ie , the "right" decision at the time may not always be the "best" decision

The following discussion is based on the premise that the best decision is made when all knowledge related to that decision is known and evaluated The role of the advisor should be as an independent source of knowledge and evaluator/advisor of risk Some aspects of that process are discussed

Farmer goals and objectives

If a farmer has a goal of high outcomes, eg biologically maximum production, maximum reproductive performance, maximum growth, minimum clinical and sub-clinical losses, maximum

velvet production, high financial returns etc , the risk to that farmer of an outbreak of disease would be high Therefore the perceived or real value of vaccination may be higher. Individual farmers vary in their risk aversiveness some gamble, some don't

Direct and indirect animal value

The direct value of individual animals, determined by the market, will influence the farmer's risk aversion However, the indirect or hidden value of the animal is often not considered This is particularly important to stud farms and others where records are kept This is because the investment that is made in the individual animal, in terms of recording and the infrastructure on that farm for recording systems, is high, and therefore the animal has an inherently higher value Put another way, the value is placed not on the animal itself, but its genes How many times have we heard "It was my top weaner that died " There is a high overhead in establishing the data upon which genetic value is estimated

Attitude, caring and personal security

Farmers who don't have a particularly nurturing attitude towards their animals will likely be less inclined to vaccinate The corollary of that, though, is that the farmer must be prepared to have the same attitude towards the consequence of their inaction or actions

Personal security, and satisfaction that everything has been done well and that all risks are minimised, is important to the psyche of some individuals Human health concerns are also important to some farmers who are aware that illness due to leptospirosis, for example, could be disabling and therefore affect their ability to manage their farms Other farmers may have off-farm employment that may be at risk due to personal illness

These factors tend to be personal to the individual farmer

Financial situation

In situations of high debt burden on a farm, the risk of disease to financial security is correspondingly high, ie an outbreak of disease may be financially crippling Vaccination may improve the financial security of the farm, even though it comes at a cost, thus effectively acting as an insurance policy.

The farm

A large number of environmental management and animal factors contribute to susceptibility of disease. These should all be considered in relation to the overall management strategy and practices on a given farm The following is a short list

- Classes of stock - deer and others
- Management factors that contribute to risk of transmission of disease
- General health management, eg· parasite control, trace elements
- Feeding, including type, quantity and quality
- Shelter/shade
- Handling/temperament
- Group structure, eg stratifying weaner mobs in relation to their bodyweight
- Managing social stress, eg. mixing different age groups
- Managing mob size

Buying policy

Grazing of animals on or off the property

The neighbourhood - farms including watershed, stray stock, stock classes, disease risk avoidance by neighbouring properties

The industry "Big Picture"

The industry's Pasture to Plate quality assurance programme focuses significantly on disease control and animal welfare. One of the concepts that this programme attempts to instil in farmers is that they should "think globally and act locally", ie look at issues the industry faces off-farm and address them by appropriate management strategies on-farm

Food safety perceptions are of serious concern in the market place While diseases such as tuberculosis, johnes disease, yersiniosis and leptospirosis are unlikely in reality to transmit to the consumer through meat, any perception that deer carry diseases that could affect humans may affect the marketplace Control of those diseases may therefore become a marketing necessity

Occupational safety and health are important for farmers, but also others who come into contact with their animals Thus, veterinarians, stock agents, transporters, deer slaughter premise workers, may all be exposed to zoonotic pathogens from deer Increasing concern by Occupational Safety and Health authorities may bring external pressure to bear upon farmers to vaccinate, eg leptospirosis.

Carcass quality is important for the processor Any carcass abnormality or blemish must be avoided, thus the vaccination technique should be clean and vaccinations should be given into the anterior portion of the neck as advised by the Agricultural Compounds Unit

Conclusion

A large number of deer farmers do not vaccinate There is a wide range of reasons, including lack of good disease prevalence data, vaccine effectiveness and widespread misunderstanding of disease that influences vaccination decisions Diseases for which vaccines are available occur either sporadically or in outbreak form While many disease outbreaks are predictable, based on an understanding of farm management practices, it is difficult to quantify in dollar or prevalence terms what the risk is Decisions about vaccination should combine farmer attitudes, farm attributes and industry "big picture" issues

Best decisions about vaccine use on an individual farm are based on an understanding of the complex multi-dimensional matrix of factors involved There is no place for generic recipes to be prescribed for all farms The most sustainable decisions are those which are determined by the farmer, based on their competence, that is, their knowledge and ability to effectively weigh up the risks for or against vaccination

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