Alternative techniques for deer AI / ET programmes

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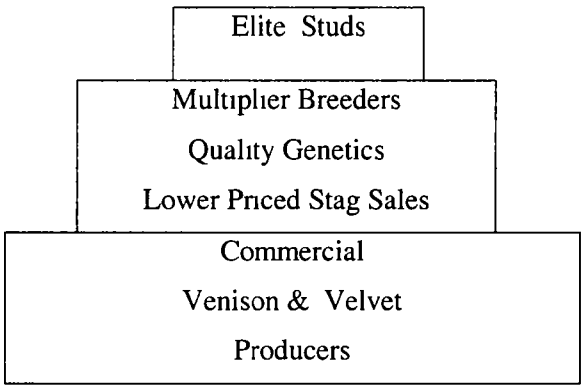
Background

New Zealand deer farmer use of advanced reproductive technologies has declined over the past few seasons. Discussions with veterinary practitioners involved in techniques such as laparascopic artificial insemination (AI) and embryo transfer (ET) report that these options were being used only by the top level of New Zealand Stud deer farms and that penetration to the next tier of multiplier breeders shown by the diagram below was actually shrinking



This situation contrasts greatly with some of our international competitors, such as Canada and U S A. where AI enjoys widespread usage throughout the deer farming spectrum If this situation continues long term, New Zealand's initial genetic advantage will be rapidly eroded, and this has the potential to reduce our cost of production advantages in the velvet market and provide ever increasing competition in the rapidly growing trophy market American hunters won't travel to New Zealand if bigger and better can be procured at home!!

Ideally, New Zealand should be aiming for a genetic advancement system similar to the New Zealand Dairy Industry where top genetic material is disseminated throughout the country. Currently much of our top material accumulates in various semen banks and high quality stags and bulls are vastly under utilized Attempts at starting some form of National Deer genetic evaluation system have foundered after brief periods for a number of reasons

- Unwillingness of elite studs to allow 'uncontrolled' genetic evaluation of top sires
- Perceived / real risks of semen collection to levels required.
- Physical and financial costs involved in transferring genetic material to properties involved in progeny testing.
- No simple technique for AI in red deer Current methods are not farmer friendly
- Lack of uniform on-farm recording systems and historical production data.
- Poorly utilized systems for establishing breeding values of individual sires for particular traits within top studs. [EBV]

The reasons for declining AI /ET are further complicated by reduced international market product prices (venison – velvet) over the last few years and its flow-on effect on internal deer prices and demand

Cost involved with laparascopic AI and the physical effort/personnel required have ultimately discouraged many farmers from using the technique

New techniques

AI using trans-cervical insemination methods has become the norm in Elk and Wapiti-type animals over the past 3-4 years In red deer however, laparascopic insemination continued to be the standard approach for a number of reasons

- anal and rectal-tissue size Most of themen involved in the field of deer reproduction found their hand size was too large to be accommodated by average red-deer anal and rectal tissues
- Rectal-cervical manipulation problems The deer cervix (cf. bovine) is much smaller and, combined with the reduced mobility of rectal tissues, it was believed that passing AI pistolettes through the cervix into the uterus would be difficult.
- Commonly available bovine AI equipment was not ideal.

The issue was further complicated by the failure of earlier intra-cervical AI techniques to produce consistent and reliable results In those trials the semen was often deposited just within the cervical os (opening) or past the first or second "rings" of the cervix increasing the distance for sperm to travel to achieve fertilization

These problems have now been largely overcome using highly skilled female AI technicians, with appropriate sized hands, using modified AI pistolettes to match the physical characteristics of the cervine cervix

Results

For the past 5 breeding seasons on my own property, cervical insemination of 50 – 70 deer / year have been carried out. While the bulk of the animals were red x wapiti hybrids of 140 – 165 kg live weight, increasing numbers of red deer were included and these posed no additional physical problems for those already encountered in the hybrids I could detect no difference in the conception rates so on the basis of this we encouraged other farmers of red deer to trial the technique In the first season with red deer, animals as light as 85 – 90 kg were inseminated without major problems (1 – 2% rejection rate) A split trial involving 50 laparascopic AI / 50 cervical AI in red deer resulted in a 3% advantage for laparascopic, but nothing statistically significant considering the numbers involved This season (2000) the extent of red deer cervical AI has increased rapidly and early reported results to scanning have been as high as 80% By the end of the breeding season meaningful comparative data should be available

Table 1. Oraka Wapiti Cervical AI Results, both wapiti hybrids and red deer

	No. inseminated	No. pregnant	%	Semen type	% not pregnant after subsequent natural mating
2000	53	38	72	frozen	NA
1999	25	20	80	fresh @ 80 x 10^6 sperm	9
	20	12	60	frozen	
1998	39	26	67	fresh	6.5
	22	14	64	frozen	
1997	40	28	70	fresh	9
	16	11	69	frozen	
1996	63	35	53	frozen	NR

NA = not available at time of writing
NR – not recorded

I now believe this technique has the ability to greatly increase the rate of genetic gain in New Zealand red deer herds Combined with well designed, box-type, semen collection stag restraints, it is possible to collect high merit stags on a daily basis without the use of drugs. Some stags almost become 'conditioned' to the procedure to the extent that they co-operate easily even in full-rut. This should

result in lower risk and cost of production of quality semen and with more straws being sold, the price of individual straws should further decrease

Most farmers still ask what conception rates can be achieved by cervical AI, implying that the technique of semen delivery is the limiting factor I now believe the current major obstacles to improved results to be

- Precision of oestrus synchronisation
- Quality and longevity of semen
- Correct condition and feeding of hinds
- On farm selection of appropriate individuals for AI
- Low stress, efficient animal handling systems
- Correct timing of AI post CIDR withdrawal.

The use of cervical AI in maiden 18-month hinds and very small older hinds will produce lower results for a number of reasons

- More variable response to synchronisation.
- Limited ability to operate within the small rectum.
- Extremely small cervix

Current experience indicates that it may not be possible to pass beyond the final cervical rings in 20 – 25% of these animals so mid-cervical delivery of semen is the only option Before undertaking programmes involving significant numbers of young animals, advice should be taken from experts in the field.

One significant, but seldom reported, drawback I have recorded with both cervical and laparascopic AI programmes is the higher percentage of dry dry animals recorded at seasons end For me this has ranged from 7 – 10% This comes from a carefully selected group, which if mated naturally, would be expected to produce <2 – 4% non pregnant animals Lower in-calf rates from synchronised groups of dairy heifers are well recorded and similar causes may be involved here in deer More data is required in this area Donor embryo hinds are well recognised for having lower post-programme conception rates

Embryo Transfer

Adequate fertilization rates in super-ovulated hinds has always been a concern in ET programmes. Laparascopic AI and natural mating have on occasions produced variable results. The use of cervical AI sequentially 8 – 10 hours apart gives a higher chance of fertilizing most ova, particularly when ovulation occurs over a longer time interval. The quality of semen used in AI / ET programmes remains one of the most crucial factors influencing results.

In 1999, both red and Wapiti-type animals had embryos flushed using a trans-cervical technique at Oraka Wapiti. Further work was carried out using this technique in the 2000 breeding season on 4 or 5 additional New Zealand properties and at least 2 off-shore farms and it now appears that the non-surgical recovery approach is quite feasible in red deer. It must be noted however, that insufficient data is currently available to compare embryo recovery rates with current surgical approaches Limited attempts have been made to compare cervical flush embryo recovery rates with laparascopic corpora lutea (CL) counts or manual CL counts and the correlation appears acceptable

The replacement of recovered embryos non-surgically (cervically) into recipient hinds has also been successfully completed and the results from the 1999 season gave similar conception rates to surgical techniques but numbers were small (15 total) It must be noted, however, that the transfer of embryos to red deer recipients trans-cervically is not a simple process as the cervix has changed considerably 6 – 7 days post ovulation compared with the day of oestrus, making catheterisation difficult The use of hybrid hinds (140 – 170 kg) facilitated the process with 80 – 90% of recipients being suitable Hybrid type recipients may also have advantages in reducing dystocia and increasing milk production for valuable offspring

Discussion

The techniques described provide the New Zealand Deer Industry with new tools, particularly for red deer, to increase our rates of genetic progress. They provide opportunities to reduce the costs associated with improved genetic material transfer However, these preliminary results are insufficient to unequivocally advocate the approach for all programmes More people will need to invest time, money, animals and effort before wide-scale adoption of trans-cervical AI and ET can be recommended, particularly in red deer Those farmers that I have personally contacted to gauge their response to cervical AI / ET programmes have been highly supportive of the techniques involved and consider the trans-cervical insemination and ET process "user and animal friendly" Thus, it would appear that cervical AI and ET may be an economical and effective alternative option, particularly for the commercial deer farmer, if further research confirms the preliminary observations presented in this paper

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Reference

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Tuberculosis