Contraceptive Treatment of Feral Female Deer as an Alternative to Lethal Methods of Population Control

By Lydia Poad

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Introduction

Overabundant deer can have significant economic impact on agriculture and forestry, undesirable effects on native flora and fauna and pose risks to livestock and humans as disease vectors (Bradford & Hobbs, 2008). Current methods for controlling overabundant populations include culling, sterilisation and controlling fertility by using contraceptives. The use of contraception for population control is necessary when lethal methods are viewed negatively by the public or in contexts where such methods are deemed inappropriate, such as in urban environments and national parks (Killian *et al*., 2009).

Discussion

Many studies explore immunocontraception to control fertility in wildlife. This involves the use of a vaccine that stimulates the body's immune system to produce antibodies against certain reproductive hormones, or proteins that suppress reproduction, thereby rendering the animal infertile (Miller *et al*., 2008). Killian *et al.* (2009) tested the efficacy of two differing doses (1000mg and 2000mg) of a Gonadotropin Releasing Hormone (GnRH) vaccine on female elks (*Cervus elaphus*) (n=22). This vaccine stimulates antibody production against GnRH, a hormone produced by the hypothalamus that triggers production of the reproductive hormones that stimulate ovulation. The females were vaccinated once, allowed access to males during the mating season and tested months later for pregnancy, GnRH and antibody titres. Both doses were sufficient to prevent pregnancy occurring for at least three years. These results show that a single vaccination can be used to reduce deer fertility rates, which over time will result in decreased population size via non-lethal methods.

However, this vaccination is not a permanent control method. Miller *et al.* (2009) tested the success of varying a commonly used porcine zona pellucida (PZP) vaccine design and adjuvant for long-lasting contraceptive effects in white-tailed deer (*Odocoileus virginianus*; (n=30). PZP vaccines prevent sperm binding to the zona pellucida coating of the oocyte thereby preventing fertilisation. Does were vaccinated, exposed to bucks during the breeding season and antibody titres and pregnancy-specific protein B was measured annually. One particular combination of vaccine and adjuvant was successful at maintaining contraception in 80% of the does for five years. These results show that the vaccine design and type of adjuvant used affect the longevity of contraception. By using a particular combination of commercially available PZP vaccine and an oil-based adjuvant, higher antibody titres can be achieved, leading to a longer-lasting contraceptive response. This decreases the need for booster vaccinations and human interaction with the herd.

Vaccinations provide a non-invasive option to deer management and can eliminate handling does if injection is via remote delivery (Kirkpatrick *et al*., 2009). This is beneficial when considering their use in wild deer populations, which would certainly be more difficult to restrain than the captive deer used in these two studies. However, the use of fertility-control vaccines could have unforeseen consequences for non-target animals such as predators consuming a treated carcass (Malcolm *et al*., 2010).

An alternative to a vaccine is an implanted contraceptive device. Malcolm *et al.* (2010) used a copper-containing intrauterine device (IUD) implanted into the uterus of white-tailed deer (n=24) to control fertility. IUDs alter the chemical and physical environment of the uterus, preventing pregnancy without disrupting oestrous cycles (Malcolm *et al*., 2010). The effects generally last until the device is removed. During pre-breeding season, 9 does received the implant, 10 received it post-breeding season and 5 received a control device. Although the sample size was low and the study proves only short-term infertility (two years), implantation

prior to the breeding season was 75% effective at preventing pregnancy for the duration of the study (two years). Timing of implantation is critical as post-breeding season implantation was not successful at preventing pregnancy.

The use of IUDs poses some problems: the device may be dislodged or expelled from the uterus causing loss of infertility; delivery of the device requires capture and sedation, possibly causing stress to the doe, and also poses logistical problems for large populations (Malcolm *et al*., 2010). Like fertility-control vaccinations, IUDs may also have unforeseen consequences for non-target animals that consume a treated carcass. However, IUDs do not disrupt oestrous cycles and hence do not disrupt normal sexual behaviour, which can be important for the social dynamics for the herd (Gray & Cameron, 2010). It is a potentially permanent procedure, provided the IUD is retained, and is a less invasive and complicated procedure than sterilisation, requiring less equipment and fewer skilled handlers (Malcolm *et al*., 2010).

Both the aforementioned fertility treatments would be best suited to small, isolated deer populations due to the cost, equipment and logistics involved in applying this method to large populations of free-ranging deer. As such, this limits the deer populations that can be controlled in this manner and also restricts extension of this type of control to other feral or wildlife species with large herding numbers. There are potential side effects associated with the use of contraceptive treatment. These include physiological, behavioural and population effects such as possible changes in the structure and function of the ovaries, injection site reactions (Nettles, 1997), inflammation of the reproductive tract (Daels & Hughes, 1995) and changes in sexual activity or sex ratio (Nettles, 1997).

Conclusion

The use of fertility-control of wildlife and feral species is generally seen as a more humane method of controlling populations than culling (Gray & Cameron, 2010) and is a less invasive, timely and less costly method than sterilisation (Malcolm *et al*., 2010). These studies show that non-lethal forms of population control can be successful at decreasing deer population size. Such methods do take longer for the desired population level to be reached when compared with culling, but have less extreme side effects.

The development of a long-term contraceptive is desirable, as treatment of fewer animals is required to maintain the population at the desired level when compared with short-term contraceptives and culling (Bradford & Hobbs, 2008). Long-term contraceptives also involve less human interaction with deer, decreasing handling stress, and less subsequent management is required. Future studies on the long-term success and side effects of such contraceptive treatments would be beneficial.

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