

Optimising deer herd conception rate and date: Research and extension project messages

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Abstract

There is now a substantial amount of data collected by research and extension projects, which describes the range of reproductive outcomes on commercial deer farms. Researchers identified key management practices that contribute to high conceptions rates and early conception dates in both adult and yearling hinds. Ultrasound scanning and foetal ageing is the tool used to define conception rate and conception date. This technique, when applied diligently, is quick, minimally invasive, safe and accurate.

A large number of factors have been identified as contributing towards reproductive success, and these are summarised in this paper. Improvement of reproductive performance can be highly financially rewarding, as demonstrated by a comparison of actual data of the herd in the Deermaster Project with the best, compared with the poorest reproductive performance. For comparison, the average herd size was used. Within the assumptions described, the return based on a weaner sale value was \$14 566 higher for the herd with the better reproductive performance.

Thus, the methodology for determination of reproductive performance and the methods for achieving reproductive success are now well established and widely available. A deer farmer can therefore make an accurate decision about the achievement of reproductive performance in their deer breeding herd.

Introduction

Research by Massey University into deer herd reproductive performance (Audigé, 1995; Audigé *et al.* 1995; Wilson and Audigé, 1998; Audigé *et al.* 1999a-d; Audigé *et al.* 2000), and the Deermaster (Beatson *et al.* 1998; Beatson *et al.* 1999; Beatson *et al.*, and Campbell *et al.* [these Proceedings], and the Richmond Wrightson Deer Performance Project (Walker *et al.* 1999; Walker *et al.* [these Proceedings]), involving data from more than 42 farms over periods of up to three years, and involving in excess of 27 000 hinds, is now available. Much of this data has been summarised by Wilson *et al.* (2000). This data has established clear patterns of reproductive performance on commercial deer farms. Data shows an enormous range in both conception rate and conception date between herds with significant differences between yearling and adult hinds. Research projects above identified a number of potential factors important to reproductive outcomes. Many of those have now been investigated in the Deermaster and RWDPP projects. These investigations have identified the key factors that contribute to reproductive performance in commercial deer herds.

This work now enables the individual farmer to:

- identify and quantify reproductive outcomes at all stages;
- to compare their performance with other farmers (benchmarking);
- to identify factors affecting reproductive outcomes on their properties;
- learning and adopting new technology (information and management)

to achieve the desired outcome on a given property.

Benchmarking and target setting

Neither this paper nor the Deermaster or RWDPP projects set out to tell farmers what they should be doing. They set out only to offer the information and advice available which the farmer can then employ to achieve their desired outcome.

The concept of target setting has been discussed previously (Wilson and Audige, 1996). That paper identified potential individual farmer objectives as being financial, lifestyle, satisfaction, efficiency (by whatever measure), productivity, other, or a combination. Targets should be set in relation to farmer ability, the environment, the overall farm goals and aims, and motivation. Targets can be chosen to achieve minimum performance, to set realistic and achievable targets for incremental improvement, and/or to achieve targets for the ultimate performance potential of the biological and management system. Implicit in the concept of target setting and monitoring is the ability to accurately define and measure the desired outcome (Wilson and Audige, 1996). The principal tool employed for evaluation of reproductive outcomes is rectal ultrasound scanning and foetal ageing.

Scanning accuracy and precision

Rectal ultrasound scanning for pregnancy and foetal ageing has been the subject of a number of scientific studies (Bingham *et al.* 1990; Wilson and Bingham 1990; Revol and Wilson 1991a,b).

The accuracy of determination of pregnancy status depends on the diligence of the operator. Scanning outcomes fall into three categories:

- **Pregnant.** This requires observation of the foetus or foetal parts, foetal membranes and placentomes (the connection between foetal and maternal blood supply) either individually or in combination; these definitive signs of pregnancy are present from 28 days when a small foetus and heartbeat can be observed.
- **Not pregnant.** This requires the observation on the screen of the uterus in the absence of any of the above signs of pregnancy, and in the absence of fluid cavities which may be suggestive of pregnancy earlier than day 28 when pregnancy cannot be determined accurately. In addition, the scanner must be given an assurance that the hind in question had no access whatever to a stag within the previous 28 days!;
- **Nil diagnosis.** Occasionally neither a uterus with the above signs of pregnancy nor the non-pregnant uterus can be observed because of obstruction due to other organs. Often those animals can be set aside and scanned later during the scanning exercise on a property. Very occasionally it will be impossible to make a diagnosis of pregnancy or non-pregnancy. These hinds need to be re-scanned at a later date for confirmation.

Thus, if these principles are diligently adhered to by the operator, the accuracy of determination of pregnancy should be absolute.

The accuracy of foetal ageing depends on the parameter which can be measured and this is influenced mostly by timing. Foetal ageing is most accurate between days 28 and 60. At that time the components available for measurement have the lowest variation (standard error). Observations have shown that an eye-appraisal (spot) diagnosis rather than the more time-consuming actual measurement, is very effective. Independent evaluation of an experienced operator showed that spot diagnosis generally falls within three days of the measured conception date (using the on-screen calliper). Given that there is an error even with the use of the on-screen calliper, the variation from actual date, simply by spot visual foetal ageing is only about one day. This error is entirely acceptable for evaluation of conception profiles within a herd.

Note: foetal ageing provides an accurate pregnancy date profile which will translate to a calving profile for a herd. However, the natural variation in gestation length, coupled with the error of foetal age assessment of possibly a few days, means that this technique does not provide an accurate predictor of calving date for an individual hind. Wilson and Bingham (1990) showed on average the actual mean calving date of a herd was within 0.9 days of prediction by foetal ageing early in pregnancy, but individual animals varied from their "predicted" calving date by thirteen days.

Reproductive profiles available for benchmarking

These profiles are published in the scientific technical literature (Audigé, 1995; Audigé *et al.* 1999b, c; Wilson *et al.* 2000), in previous Deer Veterinary Association conference proceedings (Audigé *et al.*

1995; Wilson and Audigé, 1998; Beatson *et al.* 1998, 1999; Walker *et al.* 1999) and elsewhere in these Proceedings (Beatson *et al.*, Walker *et al.*). These data provide the full range of observed patterns of pregnancy rates and dates.

In addition, these studies have introduced the concept of pregnancy profiling in which either individual hind conception dates are mapped, or conceptions are categorised within a herd as early, mid and late or early and late, using various calendar date criteria. These profiles have shown variation between farms with up to 30 day difference in median calving date in mixed age hinds.

The individual farmer can now establish the pregnancy profile for their herd, both overall and by individual sire group. The outcome can then be related to sire effects and other animal factors, particularly body condition score and management practices such as weaning date. Where the individual farms pregnancy profile falls in relation to the normal range will assist the farmer to determine their future production target (Wilson, 1996).

Factors contributing to early conception and high conception rate

The following key management factors contributing to conception rates and dates are summarised from Audigé (1995), Wilson and Audigé (1998), Audigé and Audigé *et al.* (1999b, c), and have been adopted in full or in part by farmers in the Deer Master and RWDPP projects.

Adult hinds

The management model proposed for optimising the conception in adult hinds is as follows using models of association between events or observations, and the outcome.

- Early weaning – preferably in February but no later than the first week in March;
- Sell hinds not rearing a calf to weaning;
- Ensure all hinds to be mated reach a body condition score ≥ 2.5 – at weaning if hinds are below that level, preferential feeding must be given in order to increase bodyweight in the period pre-mating;
- Join hinds with stags early – a stag effect has been shown elsewhere (Wilson, 1992) as proposed earlier (Moore *et al.* 1985). While there is no definitive date at which a stag effect will or will not arise, our proposal is that stags should be joined before March 10. There appears to be no disadvantage in joining stags late February;
- Experienced sire – experienced sires have been shown to have a higher conception rate on average in their mating groups. In order to become experienced it is proposed that back-up stags be those without previous sexual experience in order for the farm to establish a pool of experienced stags;
- Back-up sire – those herds which used a back-up sire had a higher early (before May 1) conception rate;
- Avoid disturbance – herds which were moved or that had frequent disturbance of any type had lower conception rates;
- Environmental factors – while the above studies showed that some environmental factors, for example, topography, shade and shelter, were associated with conception rate, there appears currently to be no logical biological reason for these relationships. They may indeed be causal, but that they may be spurious cannot be discounted. More research needs to be done to examine these interrelationships before management advice can be given.

Yearling

The following factors were associated with high conception rates and earlier conception dates in yearlings.

- Body condition score 2.5 – 4: hinds under a BCS of 2.5 and above 4 had a lower probability of early conception. Note that the observation of an apparent effect of fatness in this study is consistent with the observation of lower conception rates in fat heifers;

- High liveweight and height – the study of Audige *et al.* (1999c) showed that hinds with the greatest shoulder height had the highest probability of conceiving early. Above the accepted threshold weight of 65 kg, higher bodyweight animals conceive early as a direct effect of bodyweight. (This should not be confused with the “categorical” bodyweight of approximately 65 kg under which hinds are unlikely to conceive; ie: bodyweight affects the ability to conceive, but above the minimum, bodyweight also affects conception date);
- Contact with peer group stags – some studies showed that yearling hinds which had been managed with their cohort males until late the previous year, followed by separation so that spiker stags can be velveted without disturbing their sisters, followed by re-joining January/February and then joining with the intended sire stag (or mated with those spikers), resulted in a significantly higher conception rate early in the breeding season. This management proposal has subsequently been tested and in a commercial farming environment appears to be successful. (Data of Lawrence and Linney, 1998) also supports this observation);
- Use of a single experienced sire;
- Use of back-up sire;
- Do not change mating mobs – it appears that the social interaction resulting from changing mating mobs may have a negative effect on conception rates;
- Minimise mixing with adults;
- Minimise disturbance during mating;
- Environmental factors as for adult hinds above, may be important for yearlings.

Conception *per se*

The main method of improving conception *per se* is simply to leave the stags in with the hinds for longer. This, however, has the negative impact of spreading the calving pattern, delaying the conclusion of calving, and therefore decreasing weaning weights. This is considered to be undesirable in most commercial farming situations. This factor should be included with all of the factors above for early conception.

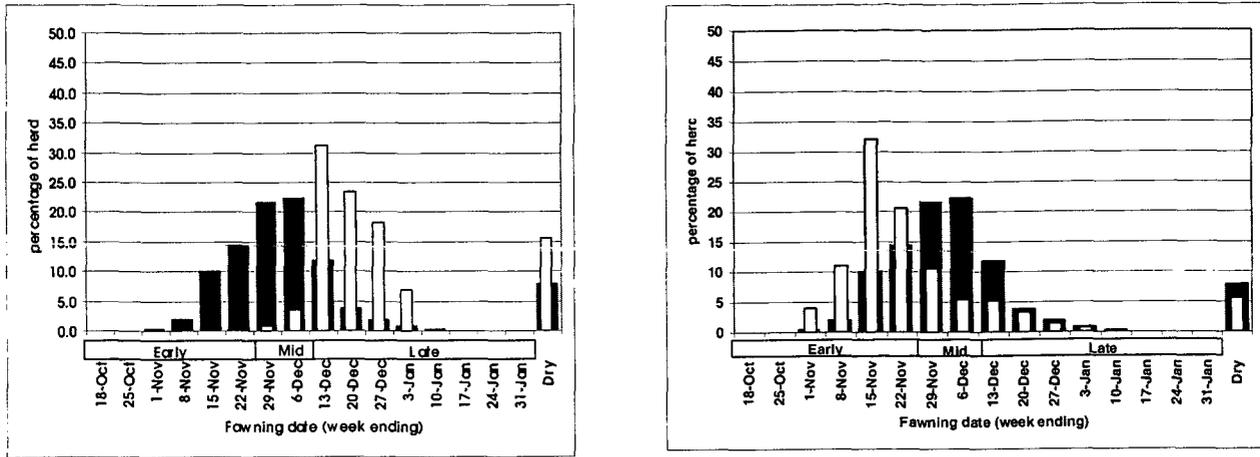
Cost benefit analysis

Reproductive success is a major determinant of profitability of breeding herds. The reproductive pattern of two herds within the Deermaster project (Beatson *et al.* 1999) are used for comparison. Data from these herds is presented in Figure 1.

The following assumptions have been made to permit a financial comparison:

- Average breeding herd size for Deermaster farms (n=323);
- Non-pregnant deer have been retained;
- Birth weight average 9.0 kg (both sexes);
- Growth to weaning: 300 g/day;
- Survival to weaning: 92%
- Average live value: \$4/kg
- Date of valuation: March 1

Figure 1. Predicted calving dates based on pregnancy profiling from two farms for the 1997 and 1998 years, with the averages of all farms as black bars and the individual farms as open bars.



Farm 1: Late conception and low rate.

Farm 2: Early conception and high rate

The cost-benefit data is presented in Table 1.

Table 1. Performance data and financial return for herds 1 and 2 (Figure 1) based on the above assumptions.

	Herd 1	Herd 2
Preg. Rate %	84	96
No. Preg	271	310
Mean calving date		
No. weaned	Dec 20	Nov 20
Ave. wt. Mar 1 (kg)	249	285
Ave. value (\$)	30.3	39.3
Total value (\$)	121	157
	30 179	44 745
Difference		\$14 566

This analysis shows a difference of \$14 566, or a 48% increase in return for Herd 2 with the better reproductive performance.

While it is acknowledged that this comparison is based on the extremes, it demonstrates that there is significant financial advantage in improving reproductive performance. In the present scenario, 23% of the increased return is related to birth date and therefore higher rates at weaning, while the improvement in conception rate resulted in a 15% increased return. However, the majority of factors that contribute to a high conception rate also contribute to an early conception date, ie: these factors are confounding. So in reality, the rate and date components of improvement cannot be separated, with one exception. The one factor which would not confound these results is the stag joining and withdrawal dates; ie: if they were late a high conception rate could still occur but the conception date would be delayed.

Conclusion

There is now an enormous range of deer farm reproductive performance data available from a number of research and extension projects. These indicate a wide range of reproductive performances as measured by pregnancy rate and conception date (pregnancy profile).

The technology and knowledge exists to enable characterisation of individual herd reproductive status, identification of causative factors, ie: those contributing to the reproductive pattern observed, and for the selection of the appropriate programme for an individual farm based on the farmer's goals and objectives.

Achievement of high reproductive performance is financially rewarding since the majority of the factors contributing to high reproductive performance involve low capital expenditure. Indeed, most of these factors relate to management skill, or expertise, which is a combination of knowledge and experience. Thus, the only cost normally required to achieve levels of reproductive performance is that associated with seeking and achieving the level of knowledge which ensures capability of reaching high levels of performance. The relationship is therefore ultimately between management expertise and farm productivity. The Deermaster and RWDPP extension projects are a practical demonstration of these principles on commercial deer farms.

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