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Induced cryptochidism no solution to the rut

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ABSTRACT

Two experiments were made to determine if induced cryptorchidism (short-scrotum) would modify behaviour and reduce liveweight loss during the rut without affecting subsequent velvet production. In the first experiment, groups (n = 10) of entire and induced cryptorchid mixed-age stags were used in a behaviour study in consecutive years. In mid-January, stags in the cryptorchid group were sedated with xylazine, and their scrotum shortened as much as possible (two thirds of the length) by the application of two standard lamb castration rings. Behavioural observations made during the rut showed significant ($P < 0.05$) reductions in the incidence of roaring, chasing and pacing in the cryptorchid group. In a larger scale experiment on six commercial properties, the live weight and condition score change over the rut, and subsequent velvet production was compared on 100 entire and a similar number of cryptorchid stags. Average liveweight loss during the rut (Feb-June) was 17 kg with no significant difference between entire and cryptorchid stags. There was no difference in mean live weight of the two groups the following Sept/Oct and the average velvet weight was 2.48 and 2.41 kg for the entire and cryptorchid stags respectively ($P>0.05$). Although induced cryptorchidism influenced stag behaviour during the rut, this was not reflected in reduced live weight or condition score loss during this period.

Keywords: stags; cryptorchidism; rut; behaviour; live weight.

INTRODUCTION

The rut in velveting stags is a threat to the welfare of the animals, their environment and their handlers. During the rut, stags kept in bachelor groups as in velveting herds, display agonistic behaviours that include physical confrontation. As a result of such fights injury including broken limbs occurs (Kilgour & Dalton, 1983). The incidence of death or euthanasia in stags as a result of the rut is not well documented but is known to occur In the intensive farm environment there is also an increase in fence pacing as stags seek to enlarge their personal space. Wallowing and dust bathing are also behaviours associated with the rut. As a result, the potential for soil erosion and deterioration in water quality exists (Rodda *et al*., 2001). There is also an increased risk to farmers who move or handle stags during the rut. Cases of human death as a result of attack by stags during the rut are well documented.

The most common response among farmers of velveting stags during the rut is to provide them with as large an area as possible and leave them undisturbed (Moore *et al*., 1985). An effect of this strategy is that less pasture area can be 'saved' over autumn for use in winter and, thus, winter supplementary feed requirements for velveting stags is high (Drew, 1983).

Modification of the behaviour of stags during the rut would simplify the management of this class of stock over the autumn period and reduce the impact of this branch of deer farming on the environment. Castration has been used in other species as a means of modifying behaviour but is not a viable option in velveting stags because the antler growth and casting cycle ceases following castration (Barrell *et al*., 1985).

Induced cryptorchidism has been used mainly in sheep to reduce some of the management problems associated with entire ram lambs (Probert & Davies, 1986; Kirton *et al*., 1995). Induced cryptorchidism has been shown to reduce testicular size and disrupt the brain-pituitary-testes axis (Lunstra & Schanbacher, 1988) to the extent that the cryptorchid testis is not normal (Schanbacher, 1981). In most reports with domestic species, these changes in testicular function have not been reflected in detectable changes in mating behaviour (Bass *et al*., 1976; Schanbacher, 1976) but there is some evidence (Hudson *et al*., 1967; Tierney & Hallford, 1985) that induced cryptorchid lambs show less intense courtship and mating behaviour than entire rams. It is possible, in a species such as deer which show very dramatic changes in behaviour during the rut, that induced cryptorchidism might modifying the behaviour of stags in the rut without detrimentally affecting subsequent velvet production. This paper reports on the effect of induced cryptorchidism on the behaviour, liveweight change and subsequent velvet production of red deer stags.

METHODS

Two experiments were made to determine if induced cryptorchidism (short scrotum) would modify behaviour and reduce liveweight loss of adult stags during the rut without affecting subsequent velvet production. In the first experiment, 20 mixed-age stags on the Lincoln University deer farm were allocated by age and live weight to two groups (n = 10) of entire and induced cryptorchids which were used for a behaviour study. In mid-January and at approximately monthly intervals until early June, all stags were sedated with xylazine (0.75 mg/kg live weight). The diameter (±5 mm) of their testes was recorded and a 10 ml jugular blood sample was taken and plasma stored frozen for subsequent analysis of testosterone concentration (Shi & Barrell, 1982). On the first occasion, stags in the cryptorchid group had their scrotum shortened as much as possible (two thirds of the length) by the application of two standard lamb castration rings so that the testes were pressed against the abdominal wall. The effects of xylazine were reversed where necessary with yohimbine (0.05 mg/kg).

The two groups of stags were grazed in adjacent paddocks (1.1 ha) and the groups were alternated at monthly intervals. Behaviour was monitored from a hide outside the paddocks for periods of 1 hour, twice per week from 4–5 pm from 23 March to 15 May. The incidence of stags, fence pacing, displaying (pawing ground) and wallowing (in waterhole), vocal roaring and initiating a chase, mount or fight with another stag was recorded. Scan sampling at 15-minute intervals identified the proportion of stags grazing, lying, idling (standing) or active (walking, pacing, etc).

In a larger scale experiment (Experiment 2) on six commercial properties (Canterbury Stag Research Group[1]), the live weight and condition score change over the rut, and subsequent velvet production were compared on 100 entire and a similar number of cryptorchid stags. Within each property, stags (n =20 to 48) that ranged in mean age and live weight from 2.5 ±0.50 to 8.6 ±0.49 years and 140 ±17.9 to 196 ±19.5 kg respectively, were allocated to treatment groups on the basis of their previous year's velvet weight, live weight and age. The procedure for induction of cryptorchidism was as described above and was performed between 14 January and 13 February 1998. The live weight and condition score (Audigé *et al*., 1998) of all stags was recorded at this time, after the rut (10 June–2 July) and in spring (Sept). Casting date (to within a week), velveting date, velvet weight and grade were recorded. Entire and cryptorchid stags were run together under each farm's normal farming practice.

The mean incidence of each behaviour over a 14-day period (5 periods in total) was used to compare the behaviour of the two treatment groups. Testes diameter and plasma testosterone concentration of individual stags were compared by analysis of variance at each of the 4-sampling dates. For experiment 2, within-farm mean treatment values of all variables were used in analyses of variance to test for treatment and farm effects.

The experimental protocol was approved by the Lincoln University Animal Ethics Committee.

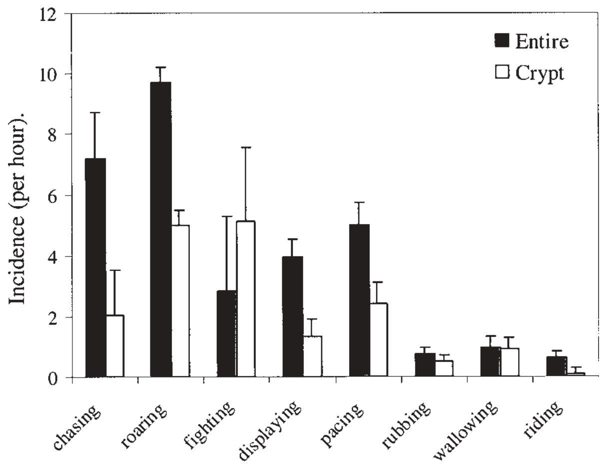
RESULTS

Behavioural observations made during the rut in experiment 1 (Figure 1) showed significant (P< 0.05) reduction in the incidence of roaring (-50%), chasing (-75%) and pacing (-50%) in the cryptorchid group compared with the entire stags. There was a slight increase in the incidence of fighting among cryptorchid stags.

A significantly (P<0.05) lower proportion (0.06) of cryptorchid stags were active over the observation periods than entire stags (0.15) and this was reflected in a higher proportion of cryptorchid stags observed lying (0.42 vs. 0.31 of entire stags). There was no difference between treatment groups in the proportion of stags observed grazing (0.40) or idling (0.13).

In experiment 1, there was a suggestion that cryptorchid stags lost less total live weight over the rut (-17 kg compared with –20 kg for entire stags) but given the small number of animals involved and the wide range

FIGURE 1: The incidence of a range of behaviours in entire and cryptorchid (Crypt) stags



(Note: values for roaring per 10 min)

in live weight this difference was not statistically significant. Testes diameter of cryptorchid stags was significantly (P<0.05) less than that of entire stags from late March until measurements ceased in early Jun (Table 1). There was no significant difference between entire and cryptorchid groups of stags in their mean plasma testosterone concentration.

TABLE 1: Mean testes diameter (mm) and plasma testosterone concentration (ng/ml) of entire and cryptorchid stags

Variable	group	date				
		22 Jan	**27 Feb**	**28 Mar**	**1 May**	**5 Jun**
Testes diameter (mm)	entire	45.5	44.5	50.0a	45.5a	43.0a
	cryptorchid	47.5	44.0	45.6b	41.5b	39.0b
	sem	1.7	1.5	1.1	1.4	1.7
Testosterone concentration (ng/ml)	entire	0.89	5.54	24.3	9.04	0.87
	cryptorchid	0.81	5.88	17.8	6.71	3.72
	sem	0.20	0.96	5.5	1.97	0.61

Within columns, means followed by a different letter are significantly (P<0.05)

In experiment 2, there was no significant difference between cryptorchid and entire stags for any of the traits measured (Table 2). Mean liveweight loss over the rut was the equivalent of 10.7% pre-rut live weight and on this basis, one condition score value equated to 27 kg live weight. There was relatively little change in mean live weight from post-rut to spring. The time of harvest, weight and grade of velvet were unaffected by cryptorchidism.

Liveweight loss over the rut of individual stags was positively related to their pre-rut live weight (Figure 2). Every kg of additional pre-rut live weight was associated with an extra 0.70 kg live weight loss over the rut. An effect of this association was that the SD of the live weight of all stags fell from 24.9 kg (pre-rut) to 15.2 kg (post-rut). When the effect of age of stag on velvet production was accounted for, there was no significant association of weight change over the rut with subsequent velvet

[1] Members of the Canterbury Stag Research Group: Heatherlea Deer Park, High Peak Station, Landcorp Farming, Cheddar Valley, Lincoln University, Mount Somers Station, Quartz Hill Station

TABLE 2: Mean live weight, condition score and velvet production of entire and induced cryptorchid stags on 6 Canterbury deer farms

Sequence of observations	Treatment group			
	Entire	Cryptorchid	LSD $_{(0.001)}$	n
Age (years)	5.44	5.42	0.07	200
1997 velvet antler weight (kg)	2.28	2.27	0.02	200
Live weight (Jan/Feb) (kg)	174	172	3.3	200
Condition score	4.50	4.43	0.17	200
Treatments imposed	**nil**	**Cryptorchidism** induced		
Post-rut liveweight (June) (kg)	150	151	1.7	198
Condition score	3.60	3.68	0.15	198
Live weight -casting/velveting (kg)	150	150	1.9	143
Casting date	10 Sept	8 Sept	5.9	75
Velveteing date	9 Nov	6 Nov	3.7	102
Velvet weight (kg)	2.55	2.48	0.31	179
Velvet grade[1]	3.02	3.11	0.35	143

[1]where SA grade = 1, A=2, B=3, C=4 and D=5

production (equation 1)

Velvet weight (kg) = 1.83 (±0.092) + 0.096 (±0.022) x age (years) – 0.006 (±0.003) x kg weight change over the rut (R^2 = 0.31) (equation 1)

DISCUSSION

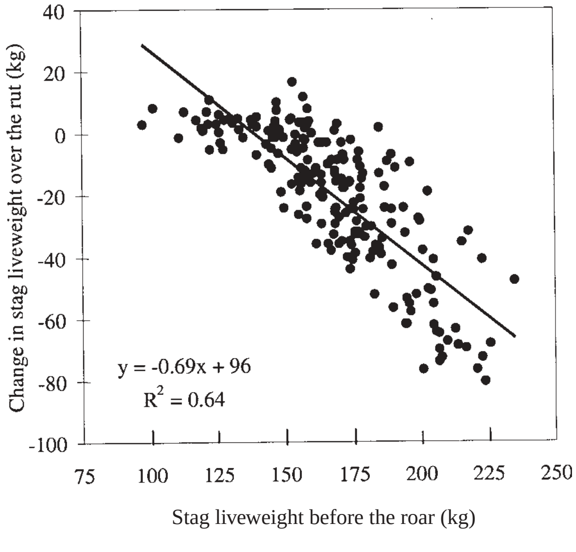
Induced cryptorchidism modified the behaviour of mixed-aged stags compared to entire stags in the first experiment. Groups of cryptorchid stags showed a lower incidence of many of the behaviours associated with the rut and were less active than entire stags, so on this basis induced cryptorchidism could be considered as a positive management option. This change in behaviour of stags associated with induced cryptorchidism is in contrast to most reports on cryptorchidism in domestic species (for example: Bass *et al*., 1976; Schanbacher, 1976; Kirton *et al*., 1995) although a few authors report a reduction in the intensity of mating behaviour (Hudson *et al., 1969;* Tierney & Hallford, 1985). It was not feasible in the large-scale on-farm trial to monitor behaviour formally. The only consistent comment was that any fractious stags at the post-rut weighing were almost exclusively in the group of entire stags

A reduction in testes size due to induced cryptorchidism is a universal finding. In most cases the decrease (more than 50%) is greater than measured in this study. Rubber rings were place as high as possible on the scrotum but this restriction, and the short time period between this intervention and the subsequent rut, may have limited the reduction in testes size. Although no formal measurements were made at later dates, casual observation of cryptorchid stags in later seasons suggested some compensatory growth of the scrotum so that it became less easy to distinguish phenotypically between entire and cryptorchid stags.

A significant reduction in plasma testosterone concentration is not a necessary result of induced cryptorchidism (Probert & Davies, 1986; Lunstra & Schanbacher, 1988) but LH and FSH levels are higher than in entires and often approach those of castrates. The response of the testes of induced cryptorchid animals to exogenous gonadotrophins is impaired, there is a large reduction in the total number of Leydig cells and a reduction in LH and FSH receptor sites (Lunstra and Schanbacher, 1988). Clearly the brain-pituitary-testes axis is disturbed by induced cryptorchidism and this may be sufficient to affect behaviour in a species such as deer that have very pronounced sexual behaviour.

In the larger scale on-farm trial, there was no effect of cryptorchidism on live weight or condition score change over the rut or on subsequent liveweight change or velvet production. So, although induced cryptorchidism may influence behaviour, the reduction in the incidence of behaviours associated with the rut and a reduced level of activity is not enough to reduce live weight or condition score loss over the rut. Although the observations of foraging behaviour were not extensive, there was no difference in the proportion of entire or cryptorchid stags observed grazing. It is not safe to use faecal marker technology to measure feed intake during the rut, but given these results it would seem unlikely that the energy intake of cryptorchid stags could have been markedly different

FIGURE 2: The relationship between the live weight of stags before the rut and the liveweight loss over the rut



to that of entire stags.

The possibility that cryptorchidism at an early stage of sexual development (weaning) might give different results has not been investigated. Potential candidates as replacements in velveting herds are normally assessed on their 2-yr.-old velvet production (January) and those not required contributing to venison production. The behaviour of yearling stags over the rut is not seen as a major issue, therefore, there is little need to incorporate behaviour control until stags are selected for the velvet herd.

Heavier red deer stags in this study lost more live weight over the rut. A similar observation has been made in wapiti (Hudson *et al*, 1985). The fact that there was no relationship between liveweight loss over the rut and subsequent velvet production suggests that, if liveweight loss over the rut is repeatable and heritable, it may be possible to select for stags that lose little weight over the rut. Such stags might be less compromised (higher body-fat levels) and have lower energy requirements over winter.

On the basis of this work, although the rutting behaviour of red stags may be altered by cryptorchidism, without ameliorative effects on live weight and inappetence, induced cryptorchidism is unlikely to be viewed as a solution to problems associated with the rut in velveting stags. However, possibilities may exist to select for stags whose behaviour and live weight are less affected by the rut.

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