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AN INVESTIGATION INTO THE RAM EFFECT ON SYNCHRONISING OESTRUS AND IMPROVING CONCEPTION AND PREGNANCY RATES OF A HILL FLOCK DURING THE BREEDING SEASON

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Abstract

Sheep breeding can be manipulated by several methods and is hugely dependant on the use of hormones to modify the physiological events involved in reproduction. This study aims to investigate the use of the "ram effect" by teasing the ewes for different timescales to synchronise breeding, induce oestrus, to improve conception and pregnancy rates during the breeding season. During the 17 day pre-breeding synchronisation period 126 ewes were assigned to three treatments and a control. Treatment group one was exposed to a vasectomised ram for 17 days (n=30). Treatment group two were exposed to an entire ram for two days (n=30). Treatment group three were exposed to an entire ram for four days (n=31). The control were not exposed to either a vasectomised or an entire ram (n=35). This study found a significant difference (P=0.002) in conception rates in ewes exposed to an entire ram for four days in that they conceived less than expected in the first half of cycle one compared to the other treatments and control. It was also found that ewes had conceived significantly more than expected when exposed to an entire ram for four days for the second half of cycle one compared to the other treatments and control (P=0.043). In conclusion in this study it was found that the ram effect is not effective at inducing oestrus during the breeding season. The synchronicity of the ewes was achieved; however other factors may have influenced this study including flushing, photoperiod, and the female effect.

Key words: *sheep, oestrus, reproduction, vasectomised, conception, conceive, synchronised.*

INTRODUCTION

Reproduction in sheep can be controlled by several methods, including administering hormonal changes to modify the physiological events that effect the reproductive cycle (Abecia et al., 2012). The ram effect is a natural phenomenon to induce oestrus synchronisation, improve conception and pregnancy rates (Delgadillo et al., 2009). The use of vasectomised rams (teaser ram) is not a new concept to synchronise ewes to induce oestrus in seasonally anovulatory ewes and is widely used in the sheep industry (Hawken et al., 2007). The use of a teaser ram is inexpensive, the typical cost for the operation to vasectomise a ram is £30-40 and can last for many breeding seasons, one teaser can be very efficient with the ability to cover over 100 ewes at a time (Eblex, 2014). Previous studies suggest the teaser is a reliable and non-pharmaceutical method to induce oestrus when compared to intravaginal sponges which artificially alter the hormone balance of the ewe (Hawken et al., (2008) and Rosa & Bryant (2002). The management of sheep breeding and synchronisation is however complex and is dependent upon many factors (Evans et al., 2004). This study will investigate natural methods of oestrus synchronisation using the "ram effect". This study will also evaluate the influences of ram effect including the hormonal balance associated with sheep reproduction and other factors that can also enhance the synchronisation of oestrus, and improve conception and pregnancy rates.

METHODOLOGY

1. Location

This study was conducted at Thwaite Head Farm, Garsdale, Sedbergh, Cumbria. England. LA10 5PB (latitude 54^{o} N longitude -2^{o} S) at an altitude of 200-657 meters above sea level, during the ewe's pre-breeding season of November 2013 following the methodology of Kenyon et al. (2008).

2. Treatments and 17 day pre-breeding synchronisation

On day one of the experiment 126 Swaledale primiparus and nulliparous ewes between the ages of 18 and 30 months were randomly assigned to three treatment groups and a control for the 17 day pre-breeding synchronisation period. The ewes were treated with a combined flukicide, anthelmintic and sheep scab treatment (Closamectin), as well as a mineral drench (Farmers Choice) and an insecticide (Crovect) to control biting lice.

The entire rams were fertility tested to check the sperm for strength, motility and abnormalities. This was carried out at by Paragon Vets in Penrith, Cumbria who specialise in advanced breeding. The semen was collected by training the ram to jump a teaser ewe, an artificial vagina was used to capture the semen (Paragon Vets, 2013). The teaser ram and the entire rams were raddled yellow on their briskets with a small paddle daily during the pre-breeding synchronisation period to indicate if ewe's were mated by the presence of a yellow raddle mark on the ewe's rumps.

Ewes in treatment group one were exposed to one vasectomised (teaser) ram for 17 days, on day one of the pre-breeding synchronisation period (teased 17 days, *n*=30). Treatment group two ewes were exposed to one entire ram for two days on day one of the pre-breeding synchronisation period (two day teased, *n*=30) shown in plate three. Treatment group three ewes were exposed to one entire ram for four days on day one of the pre-breeding synchronisation period (four day teased *n*=31). The control group were not exposed to either an entire ram or teaser ram (*n* = 35) during the pre-breeding synchronisation period (see table 1 for summary).

Table 1. Data collection protocol

Day 1 Pre breeding period	Day 3 (48hrs teased)	Day 5 (96hrs teased)	Day 18 Began breeding day 1	Day 26 (8 days)	Day 35 (18days cycle 1)	Day 52 (35 days cycle 2)
Treatment 1began 17 days of teasing. Treatment groups 2 and 3began the period of teasing.	Treatment 2 ram was removed	Treatment 4 ram was removed	Treatment 1 teaser ram was removed and rump marks recorded. All ewes were put to the entire rams for breeding. Rams had red raddle applied	All rump marks were recorded and The raddle colour was changed to blue.	All new rump marks recorded including ewes returned to service. Raddle colour was changed to green.	All new rump marks recorded including ewes returned to service. Rams were removed.

3. Flushing and pre-breeding synchronisation

During the 17 day pre-breeding synchronisation period each treatment group were managed separately under comparable grass sward in different pastures consisting of common bent, matt grass, sheep's fescue, along with soft and heath rush. The pastures had around 10 cm of grass growth, which is optimum sward height for flushing ewes without the use of compound feed (Eblex, 2013). An average of 20 kg of dry matter per hectare per day of grass growth is available to the ewes and is effective for pre-breeding flushing (*Ibid*). The pastures had been free of sheep for six weeks before the study commenced to ensure a clean pasture for newly drenched ewes to be free from parasites. The pastures were of similar size between 10 and 15 hectares at the same altitude of around 450 metres above sea level. The control group were taken on to a pasture 0.5 km away from the treatment, a sufficient distance so as not to be influenced in any way by the rams in any of the treatments such as pheromones excreted from the rams.

4. Breeding period

On the morning of day 18 all the ewes were merged and split evenly between two entire pedigree Swaledale rams and were introduced for breeding. The duration of the breeding period was for two oestrus cycles 34 days (days 18-52) as described in table one**.** The rams were marked on their brisket with a red raddle for the first half of cycle one for the identification of ewes mated as demonstrated in plate five. The raddle colour was changed at each data collection day (day 26 to blue and 35 to green) as outlined in table one. The number of ewes which displayed raddle marks were counted on each data collection day as described in table one. The raddle was applied daily to the rams to ensure the rump mark were visible on the ewe when they had been mated.

The ewes were recorded as being mated in the first half of cycle one (days 18-26), second half of cycle one (days 26-35) or in cycle two (days 35-52). In addition to this the ewes were then also recorded if mated during both the first and second cycles indicating these ewes had

returned to service, and not mated due to no raddle marks on the rump.

5. Post breeding period

The ewes were allocated into scanning groups cycle one and cycle two according to the colour of the rump marks. The ewes that displayed raddle marks were pregnancy scanned by a skilled technician who has been scanning ewes for over 25 years he used an Ovi-Scan ultrasound sheep scanner (as shown in plate six) to determine how many foetus's the individual ewe's were pregnant with, this was carried out on day 94, 35 days after ram removal. Each ewe was identified as either non-pregnant, single, twin or triplet.

6. Statistical methods

The computer program used to investigate the data was Mini Tab 16. A chi square statistical analysis was used to examine any significant differences within the data collected for each treatments and the control. Excel 2010 was used to generate graphs and input the raw data.

RESULTS

1. Pre-breeding period

Treatment one ewes teased for 17 days had fourteen (46.6%) out of 30 ewes which displayed raddle marks in the pre-breeding period. In contrast no ewes treated by the entire ram for two and four day treatments in the pre-breeding period were mounted by the rams as indicated by the lack of rump marks.

2. Conception rates

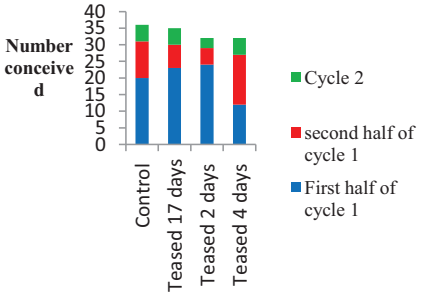

Figure 1. Proportion of the conception rates for the treatments over the different breeding periods

Figure one clearly outlines teased four day treatment has a higher proportion of ewe's mated in the second half of cycle one, compared to all the other treatments and the control. In contrast the other treatments and control have more ewes mated in the first half of cycle one.

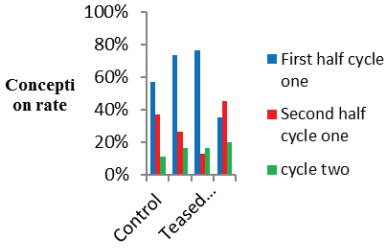

Figure 2. the percentage of ewe conceived for the treatments over the different breeding periods

Figure two summaries the conception percentages for the first half of cycle one are higher for teased 17 days treatment and teased two day treatment this is almost 20% higher than the control and 35% higher than the teased four day treatment. Figure two outlines a higher conception percentage in teased four day treatment for the second half of cycle one, when compared to the other treatments and the control.

Table 2. Effect of ram contact treatments on conception rates

Treatment		First half of cycle one	Second half of cycle one	Whole of cycle one	Cycle two	Cycle one and two
Teased 17 days *n*=30	O	23	7	28	2	5
	E	18.81	9.05	27.38	2.62	4.29
	χ^2	0.934	0.463	0.01	0.146	0.119
Teased two days *n*=30	O	24	5	29	1	3
	E	18.81	9.05	27.38	2.62	4.29
	χ^2	1.4322	1.81	0.096	1.001	0.073
Teased four days *n*=31	O	12	15	27	4	5
	E	19.44	9.35	28.29	2.71	4.43
	χ^2	2.854	3.415	0.059	0.168	0.073
Control no ram contact *n*=35	O	20	11	31	4	5
	E	21.94	10.56	31.94	3.06	5
	χ^2	0.172	0.019	0.027	0.291	0

Key O = observed number
E= expected
χ^2 = chi square value
The red indicates a significant difference (P=<0.05) in the data.

There was no significant differences in conception rates between the teased 17 days treatment and teased two days treatment compared to the control, however there is a significant difference between teased four days treatment (*P*=0.002, degrees of freedom (*DF)* =3) and all other treatments in the first half of cycle one. Indicating there were fewer ewes mated in the first half of cycle one than expected due to the lack of raddle marks on the rumps of the ewes in teased four days treatment. Table two highlighted in red indicates the significant difference in the expected conception rates in teased four days treatment. There was no significant difference in the treatment groups for the whole of cycle one (*P*=0.480 *DF*=3) when including the first half of cycle one and ewes returned to service data shown in table two.

The second half cycle one found a significant difference between teased four days treatment and the other treatments and control (*P*=0.043 *DF*=3). Table two highlighted in red indicates a significant difference in conception rates in the second half of cycle one with more than expected conceiving from the presences of raddle marks.

There were no significant differences between the treatments or the control (*P*=0.871 *DF*=3) in cycle two including ewes returned to service as shown in table two. Indicating all treatments and control observed a similar number of raddle marks, with similar numbers of ewes returning to service. No significant differences were found between the treatments and control (*P*=0.480 *DF*=3) excluding ewes returned to service shown in table two indicating the observed and expected values were similar.

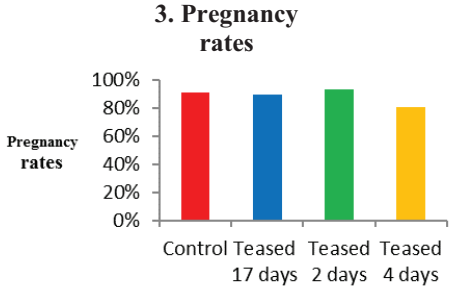

Figure 3. Proportion of pregnancy rates for the treatments over the whole breeding period (34 days)

Pregnancy rates for each group are expressed visually in figure three, outlining the range of 80-93% for the pregnancy rates across the treatments and control this indicates the similarities across the treatments.

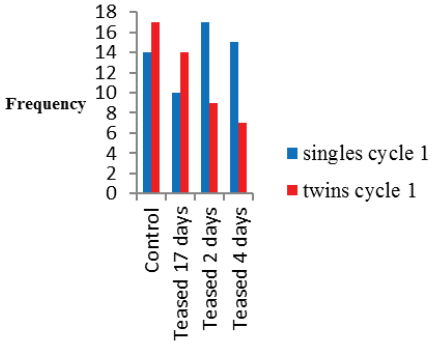

Figure 4. Frequency of ewe pregnant with twins and single with in the treatment groups in the first 17 days of breeding

The frequency of twins and single in cycle one are visually expresses in figure four indicting there are more twins in the control and in the 17 days teased treatment than in entire ram treatment groups (teased two and four days).

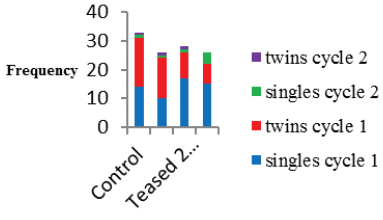

Figure 5. Proportion of ewes pregnant with twins and singles for each treatment in cycle one and two

The proportion of ewes pregnant with twins and single across the different breeding periods are visually outlined in figure five. There were no ewes pregnant with twins in the four day teased treatment in the second cycle. There were a higher proportion of ewes pregnant with singles in the teased four day treatment when compared to the other treatments and the control.

There is no significant difference between the treatments (*P*=0.268 *DF*=3) for both cycles as outlined in table three. There were fewer twins in teased two days treatment and teased four days treatment compared to teased 17 days treatment and the control, however this was not significant. Pregnancy rates for cycle one found no significant difference between the

treatments (P=0.143 DF=3) as shown in table three. The pregnancy rates for cycle two were unable to generate a P value because of the lack of data for cycle two as most ewes we pregnant in cycle one as indicated in table three and expressed visually in figure five.

Table 3. Pregnancy rates for the treatments over the different breeding periods

Treatment group			Cycle one	Cycle two	Whole breeding period (cycle one and two)
Teased 17 days n=30	Twin	O	14	1	14
		E	11.19	0.71	11.43
		χ^2	0.705	0.114	0.578
	Single	O	10	1	13
		E	13.33	1.66	15.71
		χ^2	0.833	0.266	0.469
Teased 2 days n=30	Twin	O	9	1	10
		E	11.19	0.71	11.43
		χ^2	0.428	0.114	0.179
	Single	O	17	1	18
		E	13.33	1.66	15.71
		χ^2	1.008	0.266	0.332
Teased n=31	Twin	O	7	0	7
		E	11.56	0.73	11.81
		χ^2	1.801	0.738	1.960
	Single	O	15	4	19
		E	13.78	1.72	16.25
		χ^2	0.108	3.012	0.469
Control n=35	Twin	O	17	1	17
		E	13.06	0.83	13.33
		χ^2	1.191	0.033	1.0083
	Single	O	14	1	116
		E	15.56	1.94	18.33
		χ^2	0.155	0.458	0.297

DISCUSSIONS

1. The null hypothesis

This study tested the null hypothesis that there is no effect on synchronising oestrus and increasing conception and pregnancy rates by using the different variations of the "ram effect" on a hill flock during the breeding season. The null hypothesis was accepted as using a teaser ram and short term exposure to entire rams did not show any significant differences for inducing oestrus or increasing conception and pregnancy rates during the breeding period.

The results indicated the majority of ewes were mated in oestrus cycle one, however other factors could have also influenced the ewes to synchronise oestrus. The study by Kenyon et al., (2008) found the use of teasing and short term exposure was effective to induce oestrus this was also the case in several other studies (Celi et al., (2013); Delgadillo et al., (2009); Evans et al., (2004); Hawken et al., (2007); Hawken et al., (2008); Maatoug-Ouzini et al., (2013).

2. Oestrus synchronisation benefits

The agriculturalist can benefit from synchronising ewes by controlling and shortening the lambing period, which allows for the subsequent management of weaning and slaughter or sale of lambs (Abecia et al., 2012). Synchronisation can also allow more efficient use of labour, the efficient use of facilities such as lambing sheds and the ability to forward plan feeding, including pasture management and medicine use (Martin et al. 2004). The synchronisation of the flock in this study was apparent; however there was not a particular treatment in this study that significantly accounted for this.

3. The male effect on oestrus synchronisation

The introduction of rams to seasonally anovulatory ewes has been recognised to stimulate reproductive activity in ewes for over a century (Delgadillo et al., 2009). The "ram effect" is more effective when used to induce oestrus in anovulary ewes which are not cycling (Ibid).

The ram is proven in several studies to increase the secretion of luteinising hormone (LH) within 20 minutes, this explains why 46% of the ewes in the 17 days teased treatment were mounted as the teaser ram induced oestrus

during the pre-breeding synchronisation period (Kenyon et al., 2008; Hawken et al., 2007; Evans et al., 2004). The presence of LH and follicle stimulating hormone (FSH) are vital for ovulation to occur and subsequently oestrus and conception (Hawken et al., 2007). In this study the influence of the ram effect has been recognised to have worked in the first half of cycle one due to more ewes mated. The study conducted by Kenyon et al. (2008), confirmed the teaser ram to be the most effective to induce oestrus. There was no significant difference in this study across the treatments and contradicts the findings of Kenyon et al,. (2008). The ewes in this study have mainly conceived in the cycle one, none of the treatments however have significantly increased the conception rates, this is evident from the control having similar results in this study.

The presence of the ram or teaser has had an influence on the synchronisation of the ewes in this study; however other factors have also played a part. In a study conducted by Hawken et al. (2007) suggested the ram effect is not as effective to induce oestrus synchronisation during the breeding season when ewes are cycling. This may have been the case in this study as the ewes in treatment one were cycling, this was evident with 46.6% of the ewes displaying raddle marks in the pre breeding synchronisation period. In the study conducted by Kenyon et al, (2008) this was not the case, finding only 5% of the teased treatment had displayed mating activity, as the study had been conducted in the pre breeding season. The study by Kenyon et al, (2008) found the use of teaser rams to have been effective to induce oestrus synchronisation, however short term teasing with entire rams also has a significant influence on conception rates.

Hawken et al, (2007) found that cycling ewes will be influenced by the presences of rams by the increase of LH levels compared to before rams were introduced. Rosa & Bryant (2002) reported the presence of a ram will induce ovulation within five days of introduction with 60% of ewes ovulating at the beginning of the breeding period and 28% during the middle of the breeding period. This study has found an advancement of the breeding period seeing the majority of ewes mated in cycle one, therefore the pre-breeding synchronisation treatments may have been ineffective when comparing to the control. The ram effect has had synchronising effect in this hill flock, due to the high number of ewes mated in cycle one across all treatments and control indicating other factors have influenced the outcome of this study.

4. Short term exposure to entire rams

In the Kenyon et al., (2008) study the use of short term exposure to entire males were found to be effective to increase conception rates and compact the lambing period; however this was not as effective as the use of a vasectomised ram this was also found in the study by Bedos et al., (2014). The use of short term exposure of an entire ram can be an alternative to the vasectomised teaser ram to induce oestrus and synchrony of a flock during the breeding period (Hawken et al., 2008). The use of an entire male which will be used for breeding is a more cost effective way to synchronise a flock as he will be producing valuable progeny as a result of breeding him after the pre-breeding synchronisation period (Ibid). The vasectomised ram has the added expense of feeding all year round, and the surgical treatment to vasectomise him, yet he will be unable to produce offspring (Kenyon et al., 2008).

In this study, the short term exposure treatments was not as clear and contradicted the findings by Kenyon et al., (2008). The use of the four day teased treatment had a significant difference compared to the other treatments and was not as effective as two day teased treatment, however other factors may have influenced this study. The two day teased treatment did not show any significant differences to inducing oestrus when compared to the 17 day teased treatment. This indicates that a relatively short period is just as effective as a longer period such as 17 days when synchronising during the breeding period. Given that the rams can increase LH in as little as twenty minutes and potentially induce ovulation approximately 72 hours later, short term exposure of an entire male is another method of synchronising breeding (Hawken and Beard, 2009).

5. Pheromones

The use of the ram effect is reliant on the pheromones excreted by the ram and is present in the wool, bare skin next to the eyes, nostrils and flanks (Rosa and Bryant 2002). The ram can stimulate oestrus activity in anoestrus ewes through olfactory receptors in the ewe (Ibid). The pheromones are elevated when the rams come into contact with ewes, which increase the release of testosterone and LH, increasing the production of pheromones (Ibid). The influence of the pheromones along with sounds and contact with the ram is enough to trigger oestrus in anoestrus ewes (Ibid). In this study the use of the same entire rams in the pre-breeding synchronisation period were also used in the breeding period indicating that these rams were at their peak for breeding. The study by Rosa and Bryant., (2002) remarked that the continual contact of rams during breeding will increase cycling activity. This was also confirmed in a study by (Martin et al. 2004). All the ewes were mated in this study demonstrating the rams were able to influence cyclic behaviour themselves over the entire breeding period.

6. Age of the ram

The age of the ram is likely to influence how well he can perform over the breeding period. This was agreed by (Ungerfeld et al., 2008) where the use of adult (experienced) rams were compared to yearling rams, a significant difference of 78.5% (adult) compared to 61% (yearling) of ewes showing oestrus, concluding that adult ram were more effective to synchronise oestrus and increase conception and pregnancy rates. In this study the entire rams and the teaser were four and a half years old and had three previous breeding periods indicating that they had experience to perform sexually.

7. Female to female effect

The continuous presence of cyclic ewes in a flock can induce and synchronise oestrus, this phenomenon is brought about by social stimulations known as the “female effect” (Rosa and Bryant 2002). The high presence of cyclic ewes of up 50% can influence the anoestrus flock mates to induce oestrus which was found in the study by Rosa and Bryant (2002). There is no reason why this effect cannot influence ewes during the breeding season to induce oestrus. Zarco et al., (1995) confirmed this in there study explaining the higher proportion of cyclic ewes in a flock can induce oestrus of the flock mates by up to 40% this is similar to the findings by Rosa and Bryant., (2002).

The female influence in this study could explain why the control results were similar to the treatment groups, if ewes in the treatment groups were cycling then the control could have been spontaneously cycling too. The pre breeding results for treatment one found 46% of the ewes with raddle marks indicating that they were cycling due to the presence of the teaser ram. The study conducted by Zarco et al., (1995) suggested that there is a direct stimulation of the hypothalamus pituitary gland brought about by oestrus ewes are similar to the pheromones produced by the ram. The indication of the female pheromone is apparent from the rams ability to identify the difference between an oestrus ewe and non-oestrus ewe from the vaginal secretions (Ibid).

This female to female effect is more apparent in cattle from the interactions of the herd to the oestrus cow the vaginal secretions from oestrus cows can enhance the synchronisation of herd (Ibid). This study found no significant differences between the control and the treatments, this indicates that a phenomenon such as the “female effect” could have influenced the results and could be an effective natural way to induce oestrus outside the breeding season.

8. Melatonin levels and short day length

The transition from the anoestrus period to the breeding period is slow and developed by the day length (Rosa and Bryant 2003). The melatonin which is released from the pineal gland when the days begin to shorten (known as the photoperiod) has a major influence on the levels of LH and FSH secretions which are vital as already mentioned to trigger oestrus and ovulation (Malpaux et al., 1996). Melatonin can be used to enhance oestrus by

using a melatonin implants which is placed in the ear of the ewe (Ibid). A study carried out by Celi et al. (2013) found that the use of melatonin implants and the male effect were beneficial to induce oestrus and the fecundity of Payoya goats and the study suggested this would also be beneficial to the sheep industry.

The Swaledale breed of sheep as used in this study are particularly inclined to increase melatonin levels when the photoperiod shortens this is due to the natural way in which they survive in high latitudes which are greater than 40 percent (Chemineau et al., (1992) and Abecia et al., (2012). The natural shortening day length in this study determined the melatonin excretion levels may have increased as the breeding period went on from early November to early December and would influence the ewes to begin oestrus. This is another explanation for the control group having similar results to its teased counterparts, which would stimulate LH and FSH, when the control ewes began breeding the ram would trigger the LH and explain why the control began to oestrus at a similar time to the treatments.

In the study by Rosa and Bryant., (2002) described that the "female effect" is particularly effective following a long anoestrus period and in ewes which are naturally seasonal breeders. This was experienced by the control group and the treatments in this study. This was not considered in the study carried out by Kenyon et al., (2008) and may have been a contributing factor in their study. Melatonin is a natural occurring phenomenon that can aid the synchronisation of oestrus with the influence of the ram effect, and may have been a contributing factor in this study.

9. Female previous experience of rams

A ewes previous experience of ram contact will influence how fast oestrus induction occurs (Chanvallon et al., 2010). The nulliparous ewes in the study conducted by Chanvallon et al., (2010) found to have a slower response to the ram effect than the parous ewes. The results for this study found a significant difference in the four days teased treatment, by observing fewer ewes mated than expected in the first half of cycle one and more than expected mated in the second half of cycle one. The reasons for this was concluded to be because of a higher proportion of nulliparous ewes with 20 out of the 31 ewes in four days teased treatment compared to the other treatments as outlined in figure six. This was over looked when randomly assigning the ewes to treatments. The results in this study concurred with Chanvallon et al., (2010) and are an explanation for the significant difference in the results for this study. Kenyon et al., (2008) was using ewe lambs (nulliparous) in their study and therefore this would not have influenced the data collected as it did in this study.

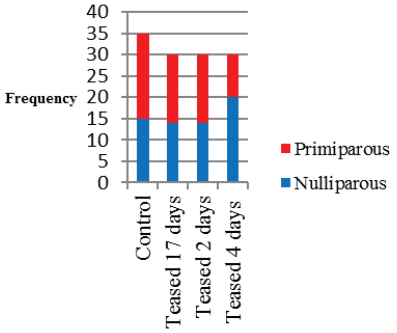

Figure 6. Proportion of nulliparous and primiparous ewe in each treatment

10. Nutrition and flushing

Nutrition has an important part to play in the fertility of the ewe, offering a high plane of nutrition 6 weeks prior to breeding and is commonly known as flushing (Robinson et al., 2006). This technique can increase the ovarian follicular growth, improve the function of the corpus luteum pre breeding and aid with embryo survival post breeding (Ibid). In this study the ewes were introduced to a higher plane of nutrition for the pre-breeding synchronisation period (17 days), however the pregnancy results of this study may have been different if the flushing period was extended to six weeks prior to breeding.

The results for the control was similar to the treatment groups, the control group were moved to a pasture further away and where the grass was possibly of better nutritional value compared to the treatments. The pasture had slightly more grass growth on a larger area with more DM per head per hectare as a result the

ewes were of slightly better body condition score (compared to the treatments) as a result of a better plane of nutrition when the breeding period began. Robinson et al., (2006) concurred this when ewes taken from poor grass on to lush new grass growth can influence the oestrus induction of ewes as well as increasing fecundity, this is also found in the study conducted by Molleat et al. (1995).

CONCLUSIONS

The breeding of seasonally anoestrus ewes is an area of further research that will be useful to farmers to apply to their flocks. The timing of when to introduce the ram effect is dependent on many factors; this study found the use of teasers is not as effective during the breeding season in November to December this finding was true of a previous study by Delgadillo et al. (2009). The use of the ram effect does have a role to induce oestrus increase conception rate and in turn synchronise ewes during the breeding period as found in this study. Teasing is relatively inexpensive with the cost of the vasectomy being £30 and the teaser can last over five breeding seasons. This is compared to a pharmaceutical synchronisation method at a cost of around five pounds per ewe (Paragon vets, 2013).

The entire ram treatment used in this study can also play a role with the two day teased treatment being more effective than the four day teased treatment, this is more cost effective that the vasectomised ram as he does not need a vasectomy and as he is used for breeding and can produce progeny. The ram effect is a natural method to compact breeding and in turn lambing to take advantage of better market price for finished lamb, management of feed and medicines and better use of labour. However this study outlined other factors that will influence how breeding progresses as this was apparent when looking at the control and the similarities to the treatments.

Natural methods to advance the breeding season are often used by farmers as common practice, but may not be using teasers, instead rely on feeding and short day length to enhance breeding and fertility; however the use of the ram effect can be used to more effectively synchronise ewes pre-breeding (August to September). This study found the use of a teaser ram is less effective during the breeding period this is concurred by Hawken et al., (2007). The effective use of teasers whether it is a short exposure from an entire ram or longer periods with the use of a vasectomised ram can be used alongside sufficient flushing, and melatonin from shortening days.

The collaboration of few of the factors discussed in this study could be the best way to synchronise ewes during the breeding period and appears to be convincing. This could be particularly effective when used on higher hill farms in the northern hemisphere when lambing is much later usually in late April beginning of May taking advantage of shorter photoperiods. Teaser rams could be run with anoestrus ewes in July/August for a period of a month before breeding to enhance oestrus of lowland flocks and begin cycling much earlier, Hawken and Beard (2009) concurred with this in their study.

This study could have been improved if the method of inputting the data collection protocol utilised electronic identification (EID). All the ewes in the study were tagged with EID and could have accurately counted mating activity over the different breeding periods and could easily record if an individual ewe returned to service. The pregnancy scanning results for each treatment groups and lambing records could be easily recorded without the risk of human error, this could be a consideration if the study was repeated.

The method in this study could be improved if the nulliparous and primiparous ewes were studied separately as this may have influenced the ram effect due to the experience of the primiparous ewes as mentioned in the discussion. This was not possible in this study due to the lack of comparable pastures at Thwaite Head. The quantity of ewes would not have been a large enough sample size to generate enough data to compare differences between nulliparous and primiparous ewes. This could be something to consider if the study was repeated.

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