Factors Affecting Fertility in ewes - some points to consider

October CEPOQ Webinar

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Outline of the presentation

- The New Zealand situation (brief)
- Breeding ewe lambs (at 8 months)
- Managing mature ewes to maximise performance
 - with a focus on body condition score (because if to achieve these targets feeding must be sorted)
- Ewe wastage
- Breeding out of season some options







Current areas of research by our group

- Diverse pasture mixes to maximise performance
- Nitrate leaching under sheep grazing
- Ewe lamb breeding short and long term effects
- Transitioning from a wool breed to a self sheading breed
- Ewe wastage (ensuring ewes stay productive for longer)
- Bio-economic modelling
- Impacts of increased temperature
- Triplet ewe management







Sheep farming in New Zealand

- In New Zealand sheep and beef cattle managed together
- It is an all-outdoor farming systems (protein not limiting)
- There is little to <u>no use</u> of grain-based supplements but, there may be crops grown for grazing in the paddock (i.e. brassicas or herbs) and silage and hay could be utilised
- Ewes of all ages lamb once a year only
- Currently approximately 30% of ewe lambs (8 months at breeding) go to the ram
- Natural breeding only, ewes culled after 6 years
- Lambing occurs in spring (August through to October)







Current sheep farm income (%)

Farm type	Income %						
	1989/1990 2016/201		/2017	2019/2020			
	Wool	Sheep	Wool	Sheep	Wool	Sheep	
S.I High Country	71	15	28	40	24	47	
S.I. Hill Country	50	29	13	58	8	63	
N.I. Hard Hill Country	42	23	6	58	5	57	
N.I. Hill Country	34	23	5	45	3	46	
N.I. Intensive Finishing	28	24	3	33	2	32	
S.I Finishing Breeding	40	36	6	58	3	54	
S.I. Intensive Finishing	39	45	7	72	4	74	
S.I. Mixed Finishing	14	15	1	8	0.5	10	

The income from wool as a percentage of total farm income has dropped while the income derived from lamb (sheep sales) has increased Note -the reminder of income is tradition from cattle/deer of grain cropping







beet

Sheep and Cattle Numbers New Zealand





0800 BEEFLAMB (0800 233 352) | WWW.BEEFLAMBNZ.COM | BY FARMERS. FOR FARMERS



Productivity Total sheep and lamb production

Source: Beef + Lamb New Zealand Economic Service

Livestock productivity

	Unit	1990-91	2019-20p	Change
Lambing Performance	lambs/100 ewe	102	129	+27%
Lamb Weight	kg/head	13.9	19.0	+37%
Lamb Production	kg/ewe	9.8	21.5	+120%
Wool Production	kg/head	5.3	5.1	-4%
Steer Weight	kg/head	297	312	+5%
Milk Production	kgMS/cow	259 ¹	385	+49%









The performance of our flock is on the rise

- Performance in our farms is increasing nationally
 - mature ewe lambing %
 - number of lambs born to hoggets (12 months at lambing)
 - lamb growth
 - carcass weights
 - kg of lamb weaned per ewe









Managing ewe lambs (hoggets)

(8 months at breeding)









PODCast – B&LNZ

https://beeflambnz.podbean.com/ e/hogget-lambing-%e2%80%93unlocking-the-potential-professorpaul-kenyon-massey-university/

http://www.beeflambnz.com/Documents/Farm/Hogget%20perfor mance%20-%20unlocking%20the%20potential.pdf







Efficiency gains from breeding ewe lambs

- the production of a lamb within the first year of life
- more lambs produced on farm within a given year
- more efficient use of herbage in spring
- an increase in lifetime performance
- an early selection/screening tool
- more progeny born on farm therefore potentially more selection pressure
- potential reduction in the generation interval if progeny born to ewe lambs are selected as replacements
- increased farm returns \$







Ewe lamb breeding performance based on % of their subsequent mature weight



• achieving 65% plus of mature live weight is a better guide for suitability for breeding







Effect of body condition at breeding



Massey Agriculture

ANIMAL SCIENCE MASSEY UNIVERSITY





Target setting and monitoring

Set monthly live weight targets

- monitor live weight (or at least a subset)
- compare target to actual
- the earlier you know you have a problem the easier it will be to fix
- offer them quality feed at high allowances
- Ensure you have appropriate health plans in place
 - vaccinations
 - parasite control
 - monitoring mineral status etc...







Teasers (vasectomised males)

- Exposer of ewe lambs to teasers for 17 days directly prior to planned start of breeding
 - can increase the numbers pregnant and those pregnant early in the breeding period
 - ideal ratio 1:75 but still effective at greater ratios (1:200)
- Teasers should <u>not be</u> used as a short term fix for poor live weights (i.e. yes you get them pregnant but you will create problems down the track)







Ram choice for breeding with ewe lambs

- Ewe lambs are structurally smaller than mature ewes at lambing
 - therefore more susceptible to dystocia/difficult births
- Ideally you would choose a ram of a 'smaller' frame size or of the same breed
 - do not use the larger framed terminal sire types
 - genetics has more of an affect on birth weight/size than nutrition
 - sires with birthweight information?







Management during breeding

- Ewe lambs are shy breeders so ram to ewe lamb ratio is important during the breeding period
 - ideal range 1:50 to 1:75
 - ram teams better than single sire mating
- Avoid the use of ram lambs during the breeding period
 - unless ratios are low (less than 1 : 50)
 - mature rams can be reused after having being with the mature ewes successfully
- You can reuse rams after they have been with the mature ewes







Traditional management of our mature ewe flock in early pregnancy

With mature ewes we hold them at maintenance for at least the first two thirds of pregnancy

 we can do this because she has reached her mature weight



We cannot do this with a ewe lamb as she needs to continue to grow herself as well as gain in total weight/size for the pregnancy itself







Comparison of total live weight profile in pregnant(orange) and non pregnant ewe lambs(grey)











- To maximise the weight of the ewe lamb <u>and</u> her offspring at weaning she needs to be gaining 130 - 150 g/d in total live weight <u>throughout</u> pregnancy
- To achieve this she needs to be offered
 - Good quality herbage with pre-grazing masses in the range of 1400 – 1800 kg DM/ha and post grazing masses above 1000 - 1200 kg DM/ha
 - this may require a reduction in other classes of stock or an increase in alternative feed sources





Forever discovering

Reducing risk of reproductive lost



Live weight of ewe lamb three to four weeks prior to lambing

The effect of liveweight and body condition score on the ability of ewe lambs to successfully rear their offspring

K.J. Griffiths^{a,*}, A.L. Ridler^a, C. Heuer^b, R.A. Corner-Thomas^a, P.R. Kenyon^a

Te Kunenga ki Pūrehuroa



Small Ruminant Research 145 (2016) 130-135

Setting targets for lambing paddocks

- Lambing paddocks
 - grass based pasture covers above 1200 kg DM/ha (NZ)
 - not only do you want maximum milk production the ewe lamb needs to continue to grow also
 - advantages from separating multiple- and single-bearing ewe lambs







Management in lactation

- Consider weaning early (i.e. at 80 days rather than more than 100) to allow young mother more time to recover live weight before rebreeding
 - this can benefit the young dam and *if done* correctly will not impact on weaned lamb growth
- Light ewe lambs (young dam) at weaning results in lighter two-tooths (18 months at rebreeding) and poor performance then
 - increased ewe loss rates (greater wastage)
 - no increase in lifetime performance







Bio economic models can determine the most profitable system in a <u>constrained</u> feed scenario

- To be as profitable as not breeding ewe lambs with M.A ewe lambing of 135%, you need to achieve at least 26% in ewe lambs
- To be as profitable at M.A lambing of 135% and ewe lambs at 104% you could just aim for 150% in M.A ewes
- To be as profitable as the average scenario of 135% in M.A. ewes and 60% in ewe lambs you could just aim for 142% in M.A ewes



Farrell et al 2020 Farrell et al 2021







Are there long term impacts of breeding ewe lambs?

- Any decrease in two-year-old live weight is not permanent as long as live weight penalty not greater than ≈ 3kg (or ≈ 0.5 a BCS)
- Ewe lamb breeding does not reduce ewe longevity <u>if</u> managed properly in their <u>first</u> year of life
 - i.e. they meet live weight targets and are fed appropriately
 - if of poor live weight and BCS going into 18 month breeding they will be less likely to be in flock future years (i.e. they display greater wastage)







Long term impacts

- Ewe lamb breeding has the potential to increase lifetime performance (approx. 0.8 to 1.6 extra lambs per lifetime)
- The size of the potential increase in lifetime performance from ewe lamb breeding depends upon
 - the level of performance she achieves as a ewe lamb
 - her live weight as a two-year-old (17/18 months at breeding) and the effect this might have on her two-year-old performance (and longevity)
- We are just finishing a project looking at impacts of keeping replacements from ewe lambs







Mature ewes







The importance of BCS as a buffer and as a tool to identify where the extra feed should be targeted

- For every additional gain in condition the response in animal performance is smaller and it costs more feed to get that gain
- There is a point (≈ body condition score 3 to 3.5) at which a further gain in condition will not increase production levels
- Body condition scoring should be a regular used tool on farm
 - weaning, pre-breeding, scanning, set









Using BCS to make informed decisions



Tom Fraser







The extra ME required to gain 0.5 BCS

Metabolisable energy required (MJ) above maintenance requirement to increase body condition score (BCS).

BSC Target	Beginning BSC						
	1.5	2	2.5	3	3.5	4	
2	9						_
2.5	80	71					1 BCS ≈ 6 – 7kg
3	229	220	149				0
3.5	471	462	391	242			
4	822	813	742	593	351		
4.5	1297	1288	1217	1069	826	475	

Live weight and body composition associated with an increase in body condition score of mature ewes and the relationship to dietary energy requirements

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Small Ruminant Research 143 (2016) 8-14







Why its inefficient to feed as one mob



It costs a lot of feed to gain BCS in those ewes of BCS 3.0 or above







Target feeding of those that not at the optimum BCS – to minimise the use of feed









Optimising feeding levels of mature ewes

- Decisions should be based on
 - amount of feed available now and predicted in the future (and cost)
 - physiological stage of the ewe and number of offspring
 - ewe body condition score (BCS)
- Use targeted feeding to focus on those that will give you the greatest return per Kg of DM eaten









Management at weaning

- BCS all ewes
- Split mob into two groups
 - the size of each mob should be based on current and predicted feed availability
- Ewes of higher BCS placed on maintenance only, to clean up herbage for other classes of stock
- Ewes of poorer condition feed to gain condition
 - truck and trailer approach in a rotation grazing scenario
 - if ewes gain 100 g/d it will take 60 70 days to gain one BCS







There are many factors affecting ovulating rate and therefore number of lambs weaned

- Nutrition
- BCS
- Breeding
- Genetics
- Phyto-oestrogens
- Mycotoxins
- Health status (disease)
- Stress
- Exogenous hormones
- Others....







Nutrition and ovulation rate

- The 'static' affect
 - In general..
 - the heavier the ewe the higher the ovulation rate
 - also same relationship with body condition
 - data suggest plateau at BCS 3.0 or 3.5
 - Although it is apparent..
 - when you look at studies there is the law of diminishing returns occurring









Management pre-breeding

- True flushing is ewes requires a <u>HUGE</u> amount of feed on a flock basis
- The response to flushing (dynamic effect on reproductive performance) in ewes of good BCS is minimal
 - therefore, by raising the BCS of the poor condition ewes from weaning the need for flushing is likely minimal
 - if farmers wish to flush only flush the poor condition ewes - this also makes these ewes more resilient in late pregnancy/early lactation









Kenyon and Webby 2007







Mid pregnancy

Ewes need to be pregnancy scanned during this period

- obtain information on number of fetuses <u>and</u> early vs late
- body condition ewes at pregnancy scanning
- sell non pregnant ewes



Animal Production Science, 2016, 56, 669-678 http://dx.doi.org/10.1071/AN15202

Economic value of pregnancy scanning and optimum nutritional management of dry, single- and twin-bearing Merino ewes

J. M. Young^A, R. Behrendt^B, M. Curnow^C, C. M. Oldham^C and A. N. Thompson^{D,E,F}







Ewe priority feeding groups in late pregnancy based on PD and BCS information

- Hierarchy of demand
 - poor condition multiples, lambing first cycle
 - reminder of first cycle multiples
 - second cycle multiples
 - single bearing ewes first cycle
 - late single bearing ewes (and potentially some multiples)
- Single bearing ewes are more able to buffer
- Later lambing ewes feed demand will increase in their late pregnancy when pasture covers are starting to lift
- Farmers will differ on how many mobs they feel confirmable to mange in winter







Ideal ewe BCS profile over a production year



Singleton — Twin

Kenyon and Cranston 2017







Ewe wastage







Longevity

- Longevity = the ability of a ewe to survive and be productive until culled for age (in NZ target is to cull for age after 6 years of age)
- Wastage = ewes that do not meet the above
 - prematurely culled
 - die on-farm
 - it does not include those culled (cast) for age







Impacts of ewes not lasting (increased wastage)

•Replacements number greater with higher wastage

- Cost of higher rates of replacements
 - Lower flock reproductive performance and milk production
 - younger ewe flock on average
 - Extra feed going into more replacements for little return
- A recent analysis showed that total Cash Operating Surplus (COS) for the sheep enterprise of an average N.I. Hill country farm was reduced by NZ\$ 1,069 per year per 1% increase in ewe wastage







The effect of ewe wastage in New Zealand sheep and beef farms on flock productivity and farm profitability

L.J. Farrell*, P.R. Tozer, P.R. Kenyon, T. Ramilan, L.M. Cranston

Ewe losses

- Period of greatest loss is between pregnancy diagnosis (mid pregnancy) to weaning
 - loss rates can be very high over this period (especially in highly fecund flocks)
 - focus period of intervention and monitoring
- Ewe losses in this period <u>also</u> contribute to lamb losses
- This is the period of greatest metabolic demand







Risk Factors – preliminary data example

- BCS risk factor for wastage (within year)
 - Two-tooth culling rate 57% lower per unit increase in BCS
 - Two-tooth death/missing rate 24% lower per unit increase in BCS
 - Sixth-tooth culling rate 44% lower per unit increase in BCS
 - Sixth-tooth death/missing rate 54% lower per unit increase in BCS
- Nutritional management important but is reflected in BCS







Out of season breeding

Some management options







Manipulating the breeding season (NZ)

Reasons to alter breeding season in sheep in NZ?

- avoid summer dry
- early-season lambs can get premiums
- spread out NZ lamb production
- heavier lambs ready for slaughter at a given date
- ewes can lamb 3 times in 2 years
- Only a handful of NZ 12,000 plus flocks are lambing more than once a year
- Early season lambing in some areas is undertaken to avoid the summer dry or for milk production flocks for human consumption to spread out supply







Illustration of breeding and lambing schedules of an ewe in "STAR" system



Bred 1 January, lambed 27 May (year 1) Bred 8 August, lambed 1 January (year 2) Bred 15 March, lambed 8 August (year 2) Bred 20 October, lambed 15 March (year 3) Bred 27 May, lambed 20 October (year 3)

http://sheep.cornell.edu/management/repro duction/star-management/







Physiological basis of the breeding season

The precise method by which the hypothalamic sensitivity to oestrogen changes is not fully known

- Two principal factors responsible
 - 1. Photoperiod change detected by the optic nerve and signal sent to the hypothalamus
 - 2. Signals from optic nerve stimulate pineal gland to produce melatonin







Factors affecting the breeding season

Season Latitude/Altitude Temperature Breed / origin Genetics Social Nutrition Stress Age







Minor effects

- Nutrition
 - very poor nutrition can decrease body weights (i.e., poor BCS) that inhibit oestrus activity and therefore delay onset of breeding season
 - high levels of nutrition (flushing) may increase lambing % but will not advance the onset of the breeding season
- Stress
 - stress can delay onset of breeding season
- Age
 - younger animals tend to be slightly later







Breed options

- Where breed/species originated
 - those breeds that originated from closer to the equator are less seasonal e.g., Merino and merino-crosses show longer breeding seasons
 - other less seasonal sheep breeds include Dorset, Rambouillet, Finn sheep, Romanov, Karakul, and some hair type sheep
 - the most seasonal breeds are the British long-wool and meat breeds
 - e.g., Romney, Suffolk







Select within breed

- Slow and/or limited progress
- Selection typically the female
 - i.e. disapplying activity or conceiving early/outside the season)
- Selection can be via the male
 - i.e. –testes size, responsiveness of LH secretion to testosterone(?)







Male effect

- 'Male' effect traditionally used to advance the season by just a few cycles to allow early breeding
 - this technique is only effective just prior to the spontaneous onset of breeding (i.e. the male effective is unlikely to work deep in the anoestrous period), ≈ 3 to 4 weeks prior to normal start
 - the sudden introduction of the ram and his pheromones can induce cyclic activity
- There is 'some' evidence to suggest cycling ewes can induce other ewes to cycle (social facilitation)









Smith et al 1997







Using the ram effect to move the start of breeding season earlier and thus time of natural peak in OR



Max OR in May but that would coincide with October born lambs which are relatively late in the lambing season if the aim is to have lambs slaughtered by early December to obtain peak prices

By advancing the season the peak OR is now April which would result in lambs being on average a month older (rather than waiting till May to breed to max OR) by early December and therefore more likely to reach the target slaughter weight







Male effect - Ram/buck effect

Options

- entire males
 - less seasonal breeds of rams are more effective
- generally considered less effective but used include
 - vasectomised males
 - bucks can work with ewes
 - hormone treatment wethers/ewes
- females need to be isolated from males prior to use for this technique to be most effective
- males work better if they have been with ewes before hand (i.e. continually being used)







Techniques to induce breeding season: Hormonal/Exogenous

- Most methods of manipulating breeding season (well outside of the normal breeding season) rely on the administration of exogenous hormones
 - designed to bypass the negative feedback effect of oestrogen on hypothalamic and pituitary function by treating females with gonadotropins







Progesterone alone

Progesterone (P₄) alone (~14 days)

- generally, most effective when used just prior to the season beginning
- works because females have already started to secrete FSH and LH at increased levels
- P₄ sensitizes brain to oestrogen
 - P₄ allows for the first ovulation to be accompanied with an overt oestrus (heat)
- if the female is not successfully bred she will likely continue to cycle







P_4 and equine Chorionic Gonadotropin (eCG) 1-2 days before P_4 withdrawal

- Effective well before natural breeding season starts
 - most popular method
 - regimens differ in timings
- P₄ sensitizes brain to oestrogen
- eCG has activity similar to FSH and LH
- Not all ewe will come into oestrus (heat)
 - it may be less intense in those that do
- If not successfully bred, they may revert to anoestrous (noncycling) if it is still well before the start of the normal breeding season
- Length of treatment and dose rates vary depending on the situation







Melatonin treatment

- Seems to work best less seasonal breed i.e. Merinos or Merino-crosses
- Implant is placed under skin of ear to mimic that released in short days, about 1 month prior to joining with the ram
- More effective if used in ewes that are nearing the start of the normal breeding season
- Does it affect the male?
 - Yes
 - Sperm production, scrotal circumference greater during short days







Conclusion

Thankyou for your time

I am happy to answer any questions and provide more detail if needed





