



INDUCTION OF ESTRUS IN SHEEP IN & OUT OF SEASON




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This presentation is designed to aid in understanding of sheep breeding management


- Normal reproductive function
- Induction / synchronization of estrus
- Causes of infertility
- Accelerated breeding programs




Reproductive Characteristics

SHEEP	
Puberty	Ram: 6 months Ewe: 5 – 7 mo & 50% of mature bw & season
Age @ 1 st breeding	6 – 8 mo or 60-70% of mature bw
Pregnancy Progesterone	Secreted by the ovary (corpus luteum) but mostly placenta after day 75
Gestation length	144-151 days
Cervical Anatomy	Complex 7 rings & offset
Chromosomes	54 N – different from goats which are 60 N

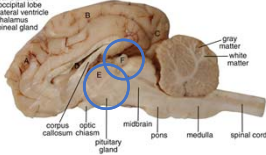
A bit of anatomy first



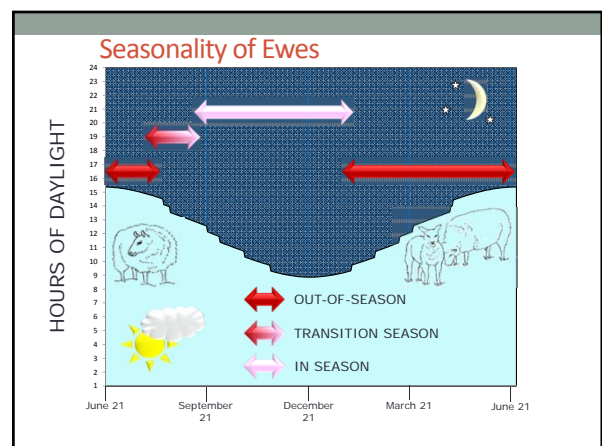
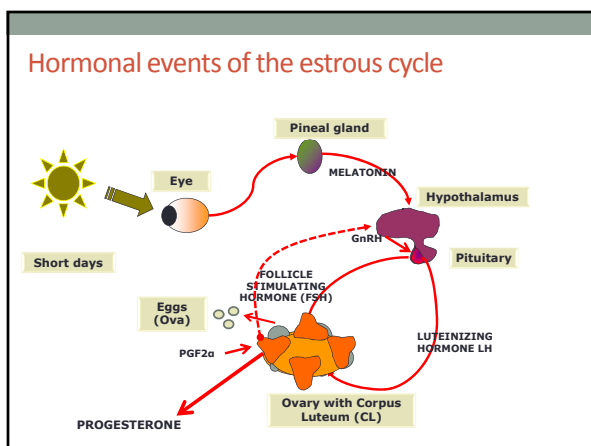
A. frontal lobe
B. parietal lobe
C. occipital lobe
D. lateral ventricle
E. thalamus
F. pineal gland



Uterus

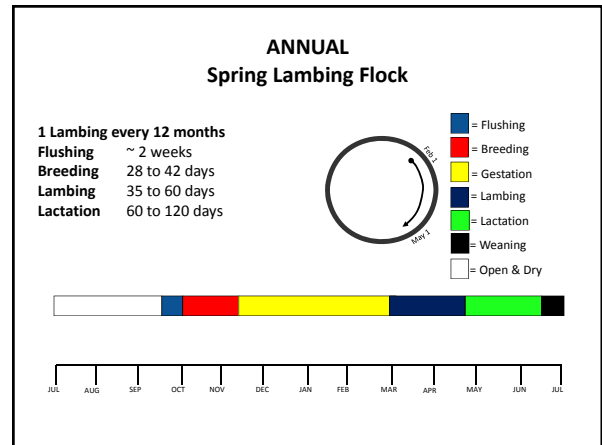
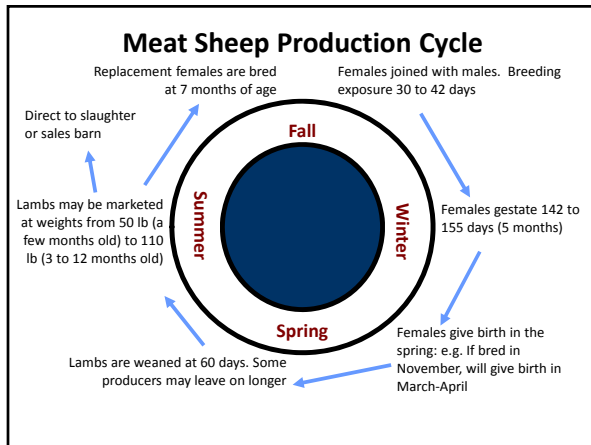


gray matter
white matter
corpus callosum
optic chiasm
pituitary gland
midbrain
pons
medulla
spinal cord



Estrous Cycle Characteristics of Sheep

SHEEP	
Length estrous cycle	17 days (14-19)
Duration of estrus	30 hrs (15-45)
Optimal breeding time after onset of estrus	Towards end of estrus, e.g 18-24 hrs
Ovulation rate	Breed dependent – multiple common
Behavioural estrus	Anorexia; vulvar swelling; small amounts of mucus; follow ram; more subtle than goats



- ### Why manipulate the estrous cycle?
- Benefits of Synchronization of Estrus
 - Concentration of breeding and lambing
 - Lambing management
 - Neonatal management
 - Uniform market animals
 - More efficient use of labour & facilities
 - Pregnancy diagnosis
 - Health management procedures

- ### Why manipulate the estrous cycle...
- Benefits of induction of estrus during the transition or anovulatory season
 - Milk supply
 - Off-season higher priced markets
 - Accelerated lambing programs

Hormones used to induce / synchronize estrus



Hormones - Prostaglandin

- Dinoprost
 - Lutalyse, Zoetis Animal Health
 - 10 mg i.m. (2 ml)
- Cloprostenol
 - Estrumate, Merck Animal Health
 - 125 µg i.m. or 75 µg i.m. / 45 kg bw



Not licensed for use in sheep or goats – VetPr only

Hormones - Progesterone

- Natural progesterone impregnated in medical silicone elastomer over a nylon core
 - CIDR 330 (Zoetis Animal Health)
 - 0.35 g progesterone
 - Licensed for use in sheep but not in goats



CIDR 330 Label (Zoetis Animal Health)

- 0.35 grams progesterone
- Induction of ewes during seasonal anestrus.
- Insert for 5 days
- Ewe to ram ratio of 18:1 for multi-sire situations
- 12:1 for ram lambs and up to 18:1 for yearling rams.
- No recommendation for use during ovulatory season
- I will provide you with more useful instructions

Hormones - Progesterone

- Melengestrol acetate
 - 220 mg/kg of premix
 - MGA 100 Premix (Zoetis Animal Health)
 - Approved for beef heifers only
 - Not approved for small ruminants
 - Must only be used with a veterinary prescription and VCPR
 - Withdrawal meat – 48 hours



Induction of estrus outside of the ovulatory period

- During the out of season period – no progesterone secreted
- Supplemental progesterone given during this time will not reliably induce ovulation
- Equine chorionic gonadotropin (eCG) is required for follicle maturation and ovulation
 - FSH and LH activity
 - AKA pregnant mare serum gonadotropin (PMSG)
- Dose is important to assure proper level of fertility and prolificacy

Hormones - ECG

- Approved for sheep, not goats
- Folligon (Merck Animal Health)
 - 5000 IU in 25 mL
 - 500 IU = 2.5 mL
- Novormon 5000 (Partnar Animal Health)
 - 5000 IU in 25 mL
 - 500 IU = 2.5 mL
- Pregnecol 6000 (Vetoquinol)
 - 6000 IU in 20 mL
 - 500 IU = 1.67 mL



Programs to Induce / Synchronize Estrus



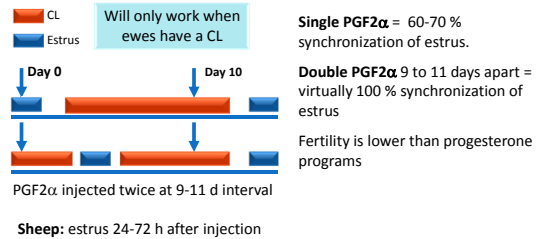
Use appropriate ratio of rams to ewes to achieve optimal fertility

Breeding Situation	Ram : Ewe Ratio
Mature – breeding paddock	1:40 to 1:80
Yearling – breeding paddock	1:20 to 1:25
Mature – rough terrain	1:20 to 1:30
Mature – transition synchronization*	1:20 to 1:25
Mature – synchronized in season	1:10 to 1:15
Mature – synchronized out-of-season	1:5 to 1:7

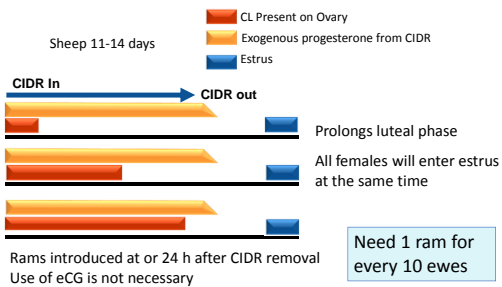
* When using ram effect

Ram lambs are less fertile than mature rams
Rams are less fertile out of season

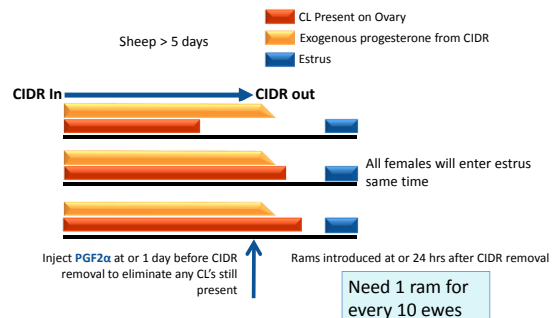
Prostaglandin Program - In Season Only

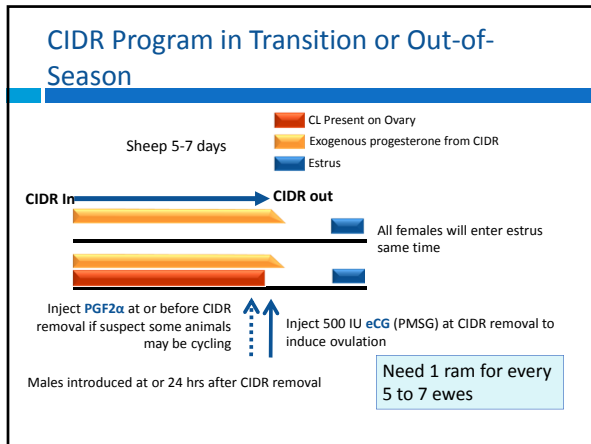


CIDR Program In-Season

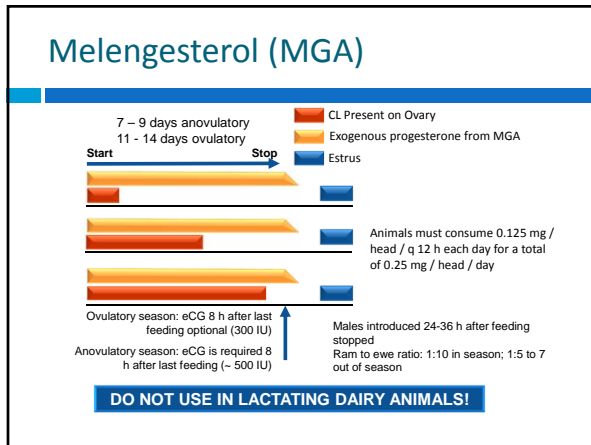


CIDR Program In-Season



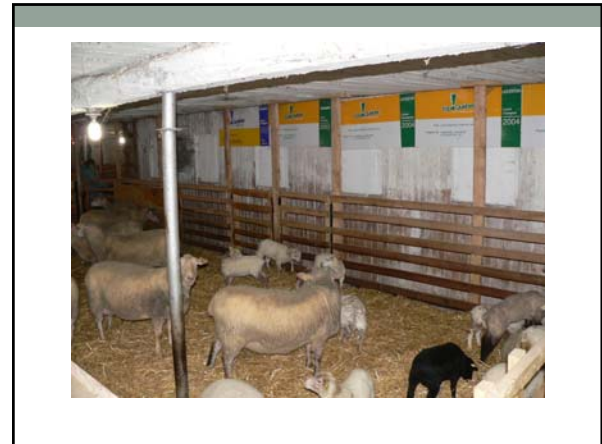
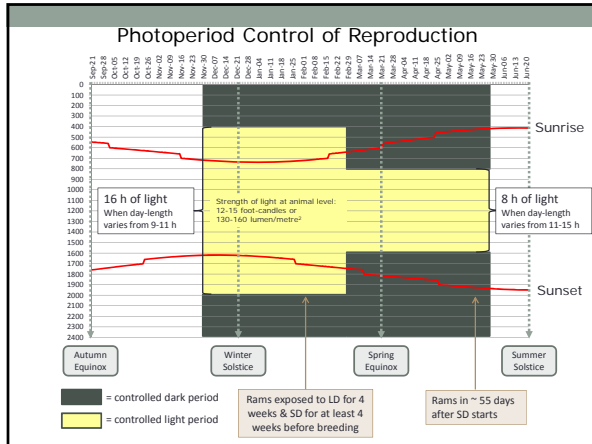


- ### CIDR Program
- Evidence to suggest that rams should not be near ewes until 24 hours after CIDR removal
 - Lower # of ovulations but earlier onset of estrus
 - Use of PGF2α at or before CIDR removal during ovulatory season may tighten and improve estrus.
 - Time to estrus generally 24 h
 - Don't put males in earlier – exhaust selves breeding too early



- ### MGA Programs
- May see lower fertility and prolificacy than with CIDRs (PEI) but other studies show similar results
 - Important to mix and feed so consumption is even (fewer fluctuations in P4 levels)
 - Link to increased risk of 3-methylindole induced pulmonary edema
 - Poor response during hot, humid weather
 - If no response, have hold-back sample analyzed but also consider other reasons for ram / ewe failure

- ### Hormone-free solutions to manipulating estrus
- Suitable for lactating dairy sheep
 - Lower technology required
 - Lower cost?
 - Lower risk to operator, environment
 - Manipulating length of daylight
 - “Male” effect
 - Dormitory effect



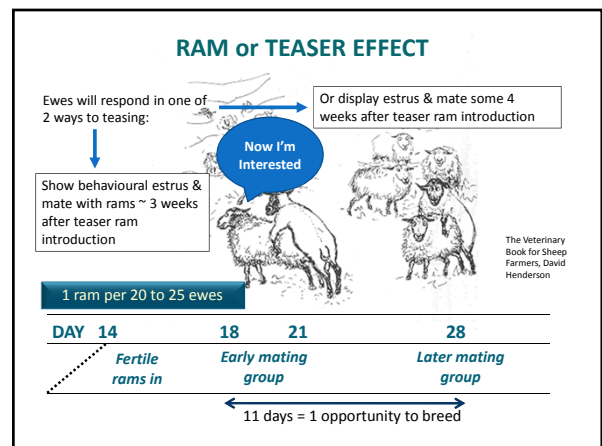
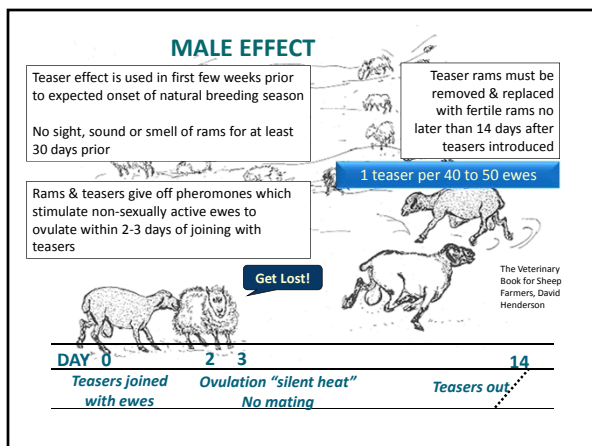
Ram Effect – Transition

- Use teasers or fertile males
- New to male at this time
 - Ovulate in ~ 3 days but estrus is silent
 - CL forms but regresses prematurely
 - Next cycle is behavioral and of normal length
- Introduction of ram / teaser
 - Must be new to ewe at least 30 days
 - Noise and activity most important
 - Introduce abruptly
 - 48 h to work

Vasectomized ram

Ram Effect

- Best during transition season
 - Very good synchronization without hormones
- Poor during ovulatory season when already cycling
- Variable during anovulatory season
 - Breed dependent
 - Other conditions



Dormitory Effect

- When ewes start to cycle
- ~ 25% of anestrus group will start to cycle too
- Rest may respond within a few weeks
- CIDR insertion to only a proportion of flock if synchronization not that crucial?



Factors affecting success

- Very seasonal breeds less fertile out of season
- Ram:ewe ratio is critical
- CIDR loss
 - higher in ewe lambs
- Nutrition
 - Body condition score
 - Flushing pre-breeding

Factors affecting success

- Timing of Male Introduction
 - If introduced too early, males will breed females not in estrus
 - If too late – may miss estrus (e.g. 48 h after CIDRs pulled)



What is success?

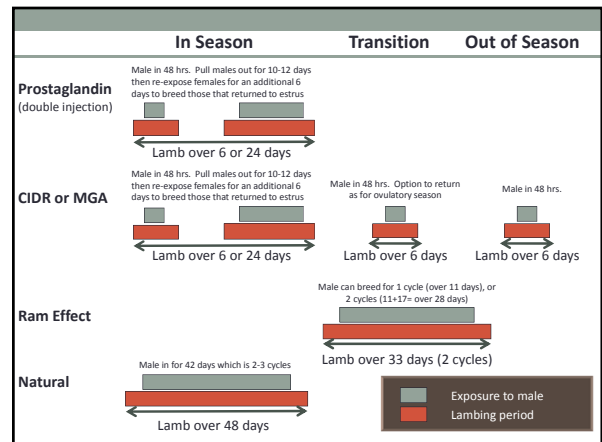
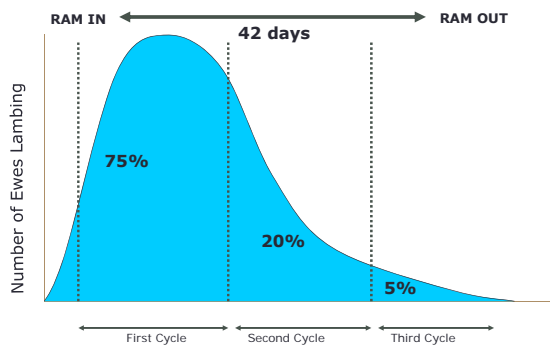
UNSYNCHRONIZED IN SEASON

Pregnancy rate to first cycle	70 – 80%
Pregnancy rate over breeding period	95 – 100%

SYNCHRONIZED

Pregnancy rate in season	60 – 70%
Pregnancy rate during anovulatory season	40 - 70%

Distribution of Lambing – Unsynchronized In Season



Don't forget to have adequate ram power!

Make sure the rams are fertile before you spend money on hormones



What about mismating?

- E.g. The owner of a small flock of sheep comes to the barn in the morning and finds that the ram lambs intended to be sold that week to market have broken into the ewe pen
- He sees some breeding activity between mothers and sons— what can be done?



Induction of Abortion from Mismating

- The progesterone that maintains pregnancy in a sheep comes from the CL only for the first month or so from pregnancy
 - PGF2 α will easily kick the pregnancy out
- After 45-50 days progesterone is excreted only by the placenta
 - PGF2 α will not work so
- Wait 11 days from the event to make sure active corpus luteum
- Sheep
 - < 45-50 d gestation PGF2 α will work well
 - > 50 d gestation, PGF2 α + dexamethasone once/day for 2 to 3 days with poor success – only use on advice of veterinarian
- This can be a big problem for feedlot ewe lambs with teenage pregnancies!

Induction of Lambing

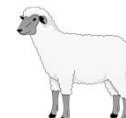
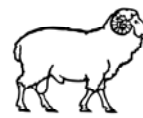
- When length of exposure to the ram is known and short
 - E.g. ram exposure 48 hours or less
 - AI breeding
 - Extremely accurate ultrasound aging
- Induce lambing after 142 days of gestation
 - Can be adjusted by breed if length of gestation is longer but don't go shorter – lambs can't tolerate more than a few days of being premature
 - Some will wait until first lamb is dropped then inject the rest
- Concentrate lambing for labour, facilities
- Dexamethasone intramuscular (16-20 mg)
 - Will lamb 24 h to 72 h later – average 36 h
 - Can mostly lamb on a weekend!
 - PGF2 α will not work as pregnancy not CL dependent




Why do sheep fail to meet reproductive goals?

Failure to Meet Reproductive Targets



- | | |
|---|---|
| <ul style="list-style-type: none"> • Ram Failure <ul style="list-style-type: none"> • Failure to mate the female • Failure to get the female pregnant | <ul style="list-style-type: none"> • Ewe Failure <ul style="list-style-type: none"> • Failure to be mated • Failure to conceive or maintain pregnancy • Poor prolificacy |
|---|---|




RAM: Failure to Mate



- Crayon failure
 - Mounts not being recorded properly
 - Harness doesn't fit
 - Too cold for crayon





RAM: Failure to Mate





- Low libido
 - Disease
 - Low body condition score
 - Will lose at least 1 BCS during breeding
 - Exhaustion
 - Photoperiodic effect
 - Seasonality of breed
 - Hot weather


RAM: Failure to Mate




- Reluctant to mount / breed
 - Pain or physical blockage from infectious balanoposthitis (pizzle rot from high protein diets)
 - Pain from orf infection on prepuce
 - Congenital deformity or traumatic injury to penis
 - Lameness


RAM: Failure to Mate





- Insufficient number of rams to ewes
- Varies with situation – consider
 - Topography (breeding pasture versus wild terrain)
 - Age and experience of the male
 - Time of the year (ovulatory, transition, anovulatory)
 - Synchronization of the females



Ram: Failure to Mate



- Unsuitable to environment
 - Breed type hardiness
 - Hill or range
 - Versus paddock breeding
 - Conformational fault
 - Feet & legs
 - Can't do the necessary traveling to find females in heat

RAM: Failure to Mate

- Inter-male aggression
- Males may fight with each other rather than breed





RAM: Failure to Mate



- Preference for specific females
 - Rams can fall in love with one ewe
 - Or dislike some ewes
 - Need to rotate rams in synchronized programs



RAM: Failure to Achieve Pregnancy



- May present as
 - Return to estrus
 - Low pregnancy rate
 - Spread out lambing period
 - Late start to lambing
 - Spread out lambing period
- May also present as poor prolificacy

RAM: Failure to Achieve Pregnancy



- Seasonal sub-fertility
 - Late spring / early summer worst
 - For short season breeds, rams are affected too
 - Fertility & prolificacy ↓
 - Testes are soft, smaller



RAM: Failure to Achieve Pregnancy



- Orchitis
 - Inflammation of the testis
- Epididymitis
 - Inflammation of the epididymis
- Can be ascending infection from mounting rams
- *Brucella ovis*



RAM: Failure to Achieve Pregnancy



- Excessive heat to the testes
 - Fever due to illness, local inflammation
 - Chorioptic mange of the scrotum
- Excessive cold to the testes
 - Frost bite
- Inflammation caused by injury
 - Scrotal haematoma
- Need to heal 60 days to restore semen quality



RAM: Failure to Achieve Pregnancy



- Testicular circumference too small
 - Generally > 32 cm in season
- Poor sperm characteristics



RAM: Failure to Achieve Pregnancy



- Failure of the synchronization program due to poor ram management
 - Too few males for the number of females in that particular program
 - Rams are subfertile / inexperienced
 - Putting the males in with the females right after the CIDR is removed
 - Keeping males in with females while the CIDRs are in

EWE: Failure to be Mated



- Pregnancy
 - Accidental exposure
 - E.g. not separating out ram lambs early enough
 - Accelerated lambing systems when may keep early bred ewes with open ewes
- Lactation



EWE: Failure to be Mated



- Out of season
 - Nulliparous (never been bred) have a shorter season than older ewes
 - Breed variation – know your flock



EWE: Failure to be Mated



- Failure of the synchronization program
- CIDR management
 - Loss from individuals
 - Left in too long
 - Didn't leave in long enough
- Melengestrol (MGA) management
 - Incorrect frequency of feeding
 - Feeding management
- Anovulatory / transition season
 - Didn't use eCG or insufficient dose
 - Too much light during "dark phase" of day

EWE: Failure to be Mated



- Hormone disruptors
 - Mycotoxins such as zearalenone
 - Some plants produce estrogenic-like substances
- Body condition score
 - Very thin
 - Very fat
 - Dental disease
 - Parasites, other infectious disease



EWE: Failure to be Mated



- Issues with nulliparous ewe-lambs
 - Not well grown due to inadequate nutrition or disease
 - Slow maturing breed
 - Shy because inexperienced
 - Less fertile out-of-season
 - Unable to compete with adult females if bred together

EWE: Failure to be Mated



- Undocked long tails of ewes?
 - Impedes physical breeding
- Freemartin / intersex
 - ~ 5% of ewe lambs born co-twin to a male
 - Deformed reproductive tract & infertile



EWE: Failure to Conceive or Maintain Pregnancy



- May present as repeat marking by the ram if there is more than one opportunity to breed
 - May be greater than one cycle between breedings
- Reasons as previously outlined +
- Failure of the synchronization program
 - Rams put in too early
 - Will breed before females are actually in estrus
 - Poor hygiene when inserting CIDR's
 - Vaginitis

EWE: Failure to Conceive or Maintain Pregnancy



- Early Embryonic Death
 - < 60 days gestation
 - Genetic defects
 - Abortion diseases
 - High urea nitrogen from feed
 - Stress



Common Causes of Abortion in Sheep

Infectious

- *Chlamydophila abortus*
- *Campylobacter* spp
 - *C. jejuni*
 - *C. fetus fetus*
- *Toxoplasma gondii*
- Border Disease virus
- *Coxiella burnetii*

Non-Infectious

- Iodine deficiency
- Stress
- Trauma



EWE: Poor Prolificacy



- In the face of adequate number of rams
 - Any of above +
- Genetics
 - Breed can't meet producer goals
- Nutritional deficiency in flushing period
- Severe nutritional deficiency after breeding
- Over conditioned ewe lambs have lower ovulation rate
 - Poor fertility in ewe lambs raised in a feedlot

EWE: Poor Prolificacy



- Lower prolificacy at beginning and end of ovulatory season
- Lower prolificacy out of season
- Primiparous and older females are less prolific
- Inadequate # and fertility of males

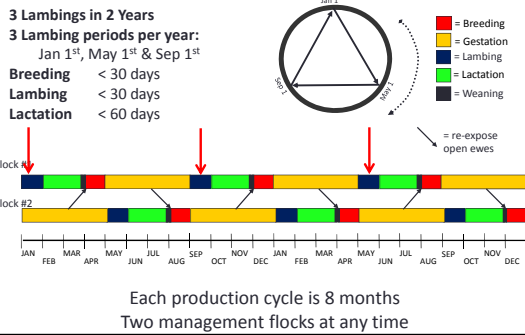
Accelerated Breeding Programs



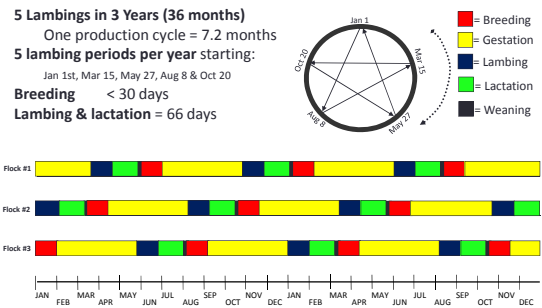
Accelerated Lambing Programs

- 3 Lamb Crops in 2 Years
 - Breed every 8 months.
 - Lambs weaned at 50 days
 - Breed in-season, out-of-season and transitional season.
 - Allows for marketing of meat animals year round.
- Cornell Star
 - Breed every 7.2 months
 - 5 lamb crops in 3 years
 - Minimal breeding / lambing period and early weaning

“Three in Two” Accelerated Lambing System



CORNELL STAR Accelerated Lambing System



Conclusions

- To optimize productivity from a sheep flock, it is important to understand normal reproduction and how to manipulate it.



Questions?

