Accelerated production: an opportunity to increase production capacity and efficiency.

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Strategies to increase efficiency:

- *Lower feed costs*
  - ✓ *Extend the grazing season*
  - ✓ *Use inexpensive by-product feedstuffs*
- *Decrease labor input*
  - ✓ *Pasture birth systems*
  - ✓ *Efficient feeding systems*
    - ➢ *TMR*
    - ➢ *Large bale forage feeding*
- *Increase production*
  - ✓ *Prolific genetics*
  - ✓ *Strategic nutritional management*
  - ✓ *Reduce the birth interval*

Overview:

- Introduce and compare accelerated production systems
- Basics of accelerated management
- Barriers to accelerated production success
- Approaches to insuring aseasonal breeding success

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What is accelerated lambing?

- System that decreases lambing interval to less than 12 months.
- Creates multiple birth periods.

✓ Opportunity to increase annual production per ewe

✓ Opportunity to produce lambs year round

  ➢ Build lucrative markets

✓ **Is this a system that can work for you?**

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How does accelerated production increase efficiency?

- ***Removes 4 months of maintenance feeding and reinvests a small fraction of this savings into improved nutrition***
- ***Can produce the same number of offspring per year with far fewer females***
- ***Reduces labor per offspring per year***

Accelerated lambing-historical perspective

- Extension of efforts started in the 1960's to try to increase the efficiency of production
- Efforts in the U.K., Canada and U.S.A. led to a number of systems designed to decrease lambing interval using various breed combinations
- The Polypay breed evolved out of these efforts
- Brian Magee and Doug Hogue from Cornell studied a variety of systems and fixed on the STAR system in the early 80's.

Accelerated production systems:

- **8 month system: 3 lambing periods in 2 years**

- **STAR system: 5 lambing periods in 3 years (7.2 month intervals).**

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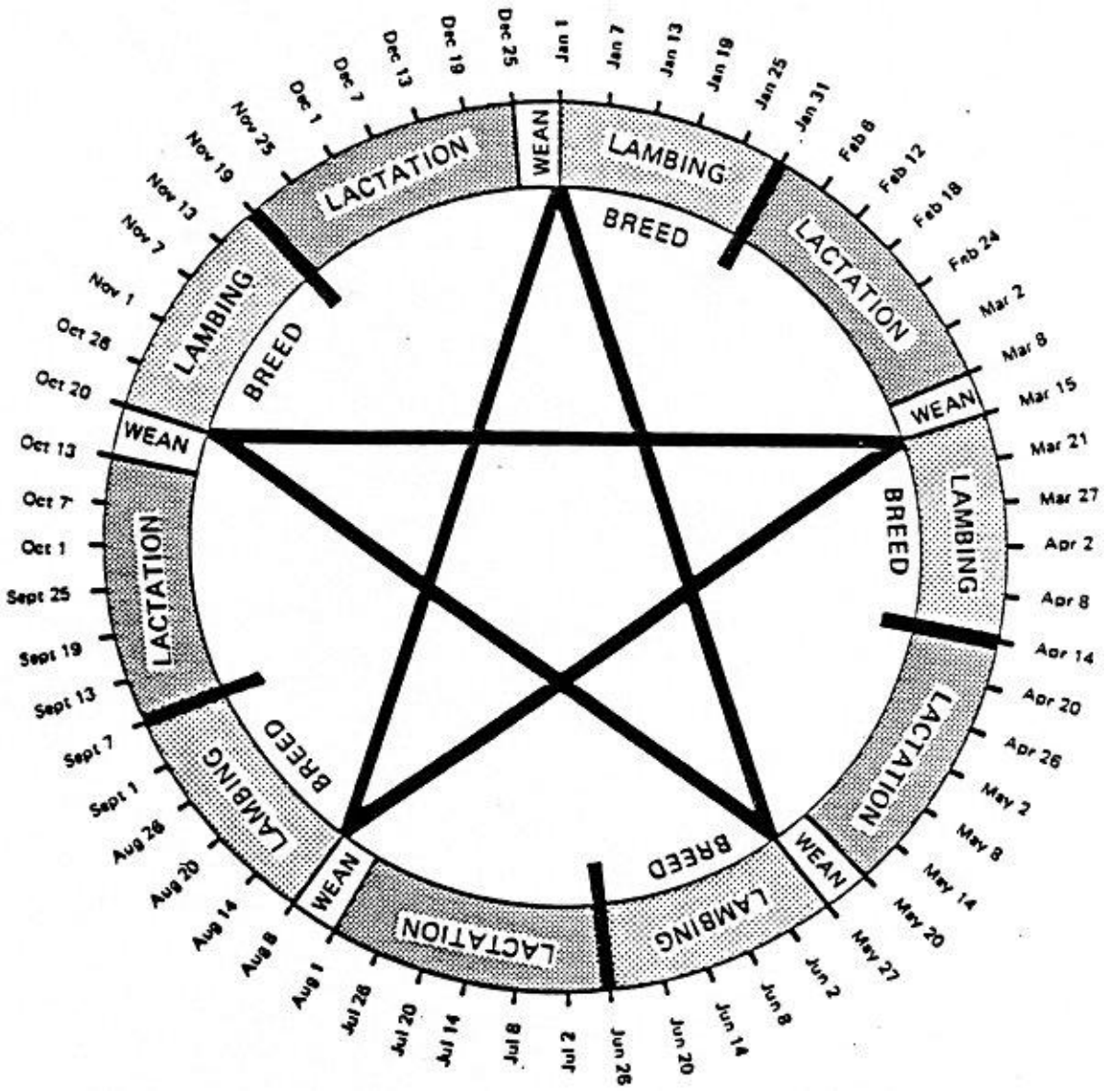
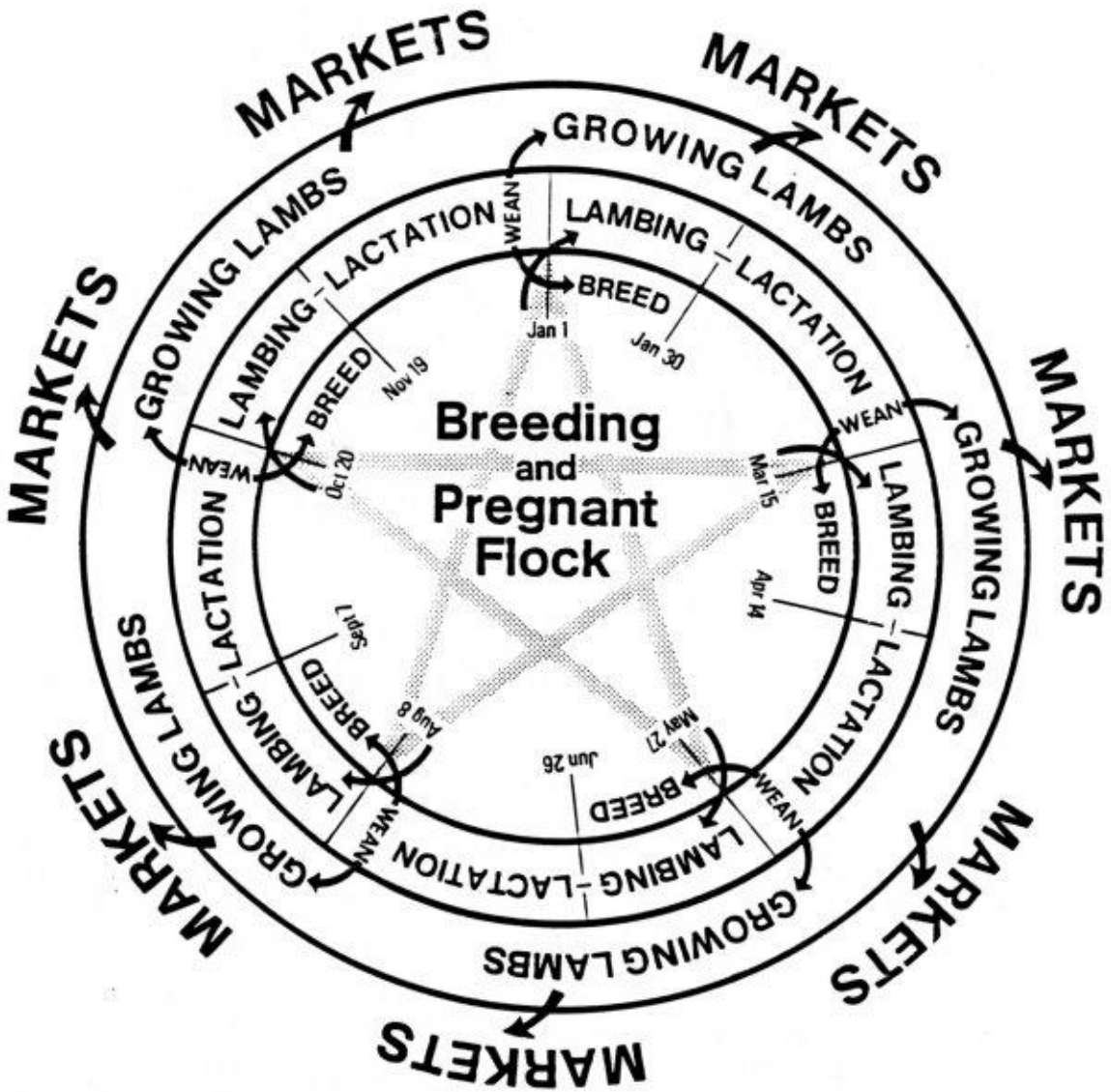
Cornell STAR® system



STAR system facts:

- Five, 73 day periods in one year
- Ewes can lamb at 7.2 mo intervals
- If ewes do not breed at first chance (7.2 mo) they can be rebred 72 days later (9.5 mo)
- 30 day lambing period
- 30 day breeding period
- 43-73 day lactation period
- Lambs are 43-73 days old at weaning

Cornell STAR® system



8 month system:

- Can alter birth periods a few weeks –creates flexibility to adjust for:
  - ✓Labor availability
  - ✓Need to hit specific market time table
  - ✓A longer lactation length
  - ✓Variation in lactation length
- If ewes do not breed (8 interval) they must wait 120 days to be rebred (12 mo interval)
- Can allow ewes a few weeks of “recovery” between lactation and breeding
- Can lengthen breeding periods >30 days

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Summary of Accelerated Systems:

	STAR	8 month
Birth interval	7.2 mo	7-9 mo
Lactation length	42-72 d	42-100d
Breeding period	<30 d	< 51 d
Lambing periods/year	5	3
Breeding periods/year	5	3
Max. # of births/ewe/yr	1.67	1.5

- **Either system can be further manipulated by photoperiod and/or hormone therapy**

Optimizing accelerated production:

- Lighting protocols
- Hormone therapies
- Ram effect
- Genetics
- Nutrition
- Male libido/fertility

2008 Production from 300 ewes on an 8 month interval system:

- 1.42 lambing/yr (94% conception regardless of season)
- 1.91 lambs weaned/ewe/lambing
- 2.70 lambs weaned/ewe/yr

- 810 lambs from 300 ewes!

Accelerated production: Theory vs. Reality

- Few formal comparisons of systems or deviations of systems.

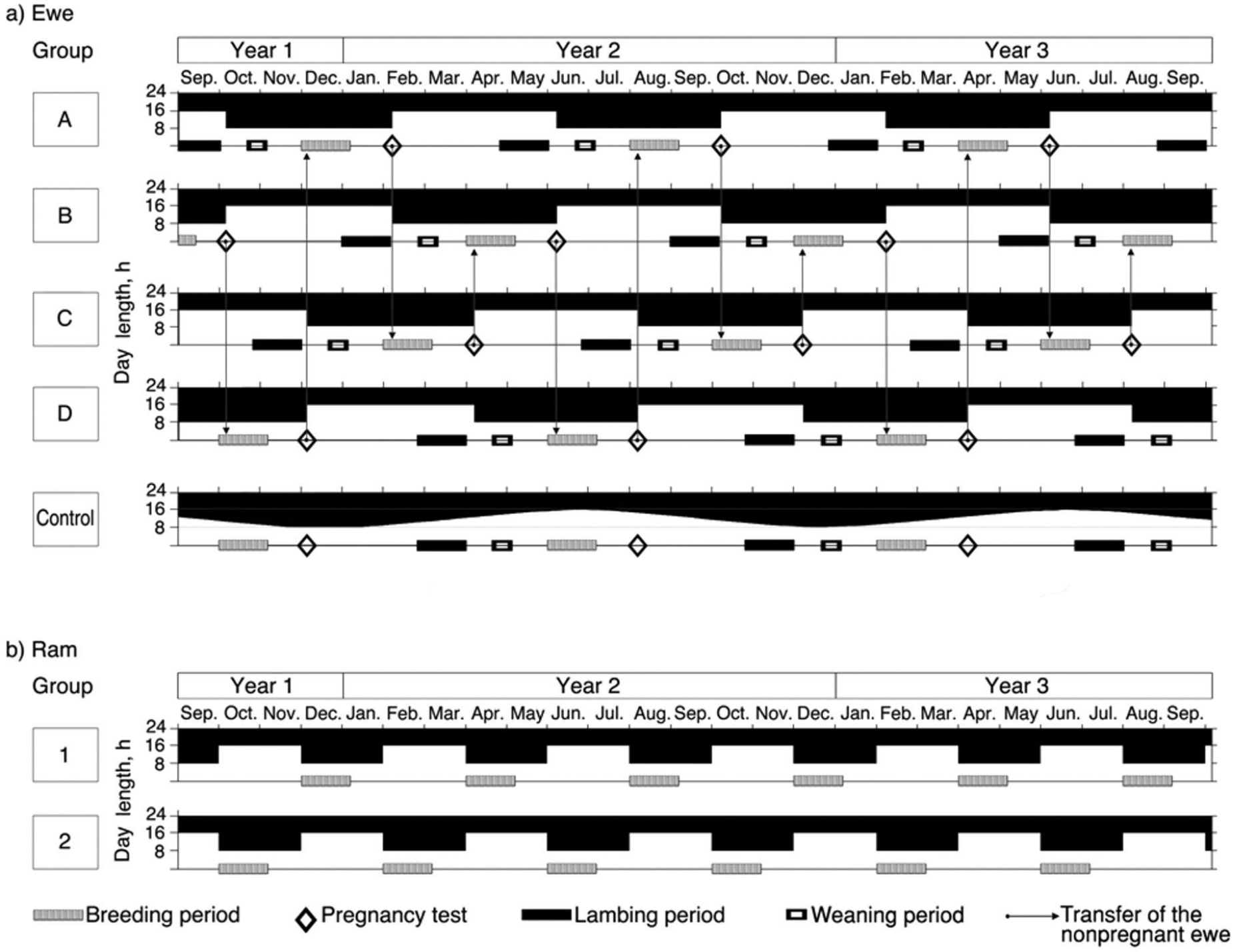
CEPOQ studies (Cameron et al. 2010):

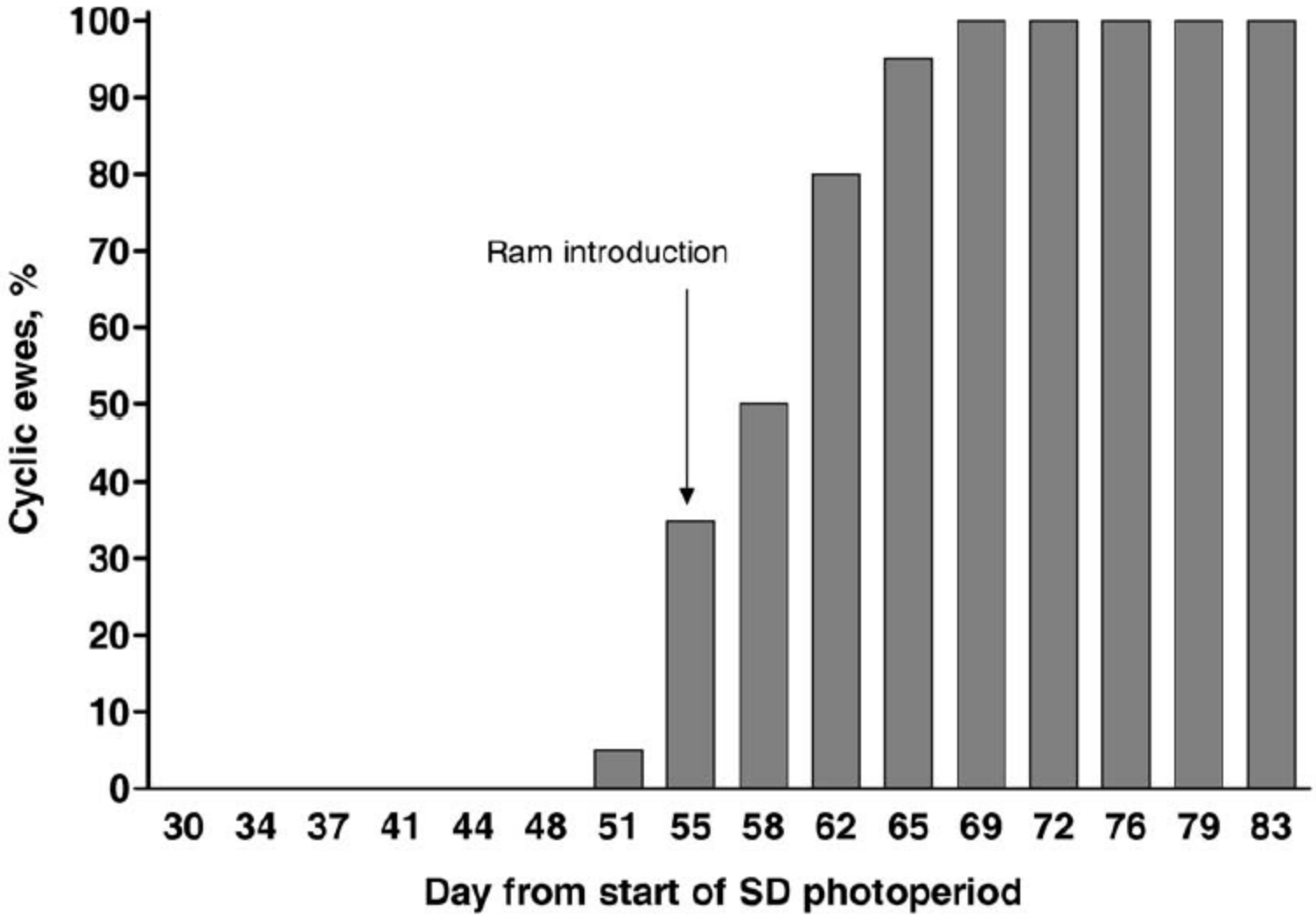
	Lambings/ewe/yr (1.5 max.)	Lambing rate
Lighting control	1.37	2.81
Progesterone therapy	1.26	2.27

CEPOQ-photoperiod control

- Nearly continuous production (4 groups)
- Alternating 4 month light intervals (16L/8D; 8D/16L)
- Overlapping 8 month system
- Optimizes ovulation rate and conception
- Limited grazing, mostly confinement
- Maximum production (3.78 lambs per/ewe/year!!)

Cameron et al. 2010; Journal of Animal Science 88: 3280-3290


a) Ewe
Group
Year 1
Year 2
Year 3
Sep. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep.
A
B
C
D
Control
Day length, h
24
16
8
b) Ram
Group
1
2
Breeding period
Pregnancy test
Lambing period
Weaning period
Transfer of the nonpregnant ewe



Cameron et al. 2010, Journal of Animal Science 88: 3280-90

Extended day protocol:

- 60 days of 24 hrs light followed by 60 days of ambient lighting condition - turn in rams.
- 100 lux (10 FC) at ewe eye level (3.5 FC minimum)
- How I do it:
  - ✓ Bring ewes in from winter pasture on Jan 5.
  - ✓ Set lights to come on at dusk and off at dawn starting Jan 5.
  - ✓ Ewes lamb Jan 25 - Feb 20
  - ✓ Turn lights off on March 5, natural light thereafter
  - ✓ Put in rams May 5.

Extended day: under evaluation…

Field application in 2008 with 300 ewe flock:

- No change of spring conception rate in aseasonal ewes (Finn x Dorset x Ile de France, n=140-182).
  - ✓ 92% natural light (3 yr average [2005-7], n=132-186)
  - ✓ 94% extended day (2008, n=182)
- Huge change in spring conception rate in seasonal ewes (purebred and ¾ suffolk ewes,).
  - ✓ 0% natural light (2 yr average [2006-7], n=13-17)
  - ✓ 92% extended day (2008, n=16)


Photo courtesy of Kyle Farms, Avon, NY

Extended day: under evaluation…

Field application in 2011 with 2000 ewe flock:

- Vastly improved spring conception rate in large flock of aseasonal ewes (Dorset x Finn x Ile de France)
  - ✓65% natural light, historic high (2007, n=455)
  - ✓82% extended day, (2011, n=1210)
    - ➢Other “improvements” in 2010 included a new TMR formulation (alfalfa haylage and corn silage base)

Extended day:

- Cost of $1.60/ewe/year for electricity use
- Bulbs cost $0.25/ewe/year
- Barn was lighted during winter lambing which created a stable environment for ewes and nice atmosphere for the shepherd

- ***Will it overcome the negative effect of sub-par nutrition on spring conception?***

Hormonal therapeutics to insure successful out of season breeding:

- Progesterone CIDRs
  - ✓ FDA approved for use in sheep
  - ✓ 40-85% conception in spring

- Melengestrol acetate (MGA) plus gonadotropin
  - ✓ Not approved for sheep
  - ✓ Ceiling of ≈70% conception in spring as reported in commercial production in Canada

Ram “male” effect:

- Induces estrus in females “on the edge” of anestrus; synchronizes females that are naturally cycling
- 1 vasectomized male: 50 females
- Isolate females from males 30 days prior to exposure
- Introduce vasectomized males and remove 14 days later, females will exhibit estrus in two modes either 17-18 or 22-23 days following initial male exposure.

- ***Does it work on females that are deep in anestrus?***

- ***What does it cost?***

Accelerated Systems: Are they complex and hard to manage?

- There are just two groups to manage:
  - ✓ Lactating
  - ✓ Pregnant / those getting bred

- Pregnant ewes can be identified via palpation in late pregnancy. Non-preg/early preg females are combined with females about to go through weaning to breed for the next cycle.
- Sorting for pregnancy earlier with ultrasound (day 40-70) allows for more precise management

Resources required for accelerated production

- Birth facility capable of housing 2/3 of flock
- Must provide a higher plane of nutrition over the year than annual birth as females are in a more productive state a greater proportion of the time
- Chronic disease issues are more apparent in accelerated lambing (OPP, Johnes) as any ceiling imposed on production is more apparent in highly productive animals.

Do accelerated flocks need to lamb indoors and be fed quality stored feed year round?

- Ewes can lamb on pasture during favorable weather (May-early Oct.)
- Grazing conditions that allow high intake of quality forage can meet needs of gestation/lactation of accelerated ewes
- Ewes can be maintained outdoors and eat stockpiled forage in winter
- Must ensure that ewe flock does not slide backwards in body condition post weaning

Sheep breeds that exhibit aseasonal fertility

Horned Dorset
*Polled Dorset**
Rambouillet
Merino
Romanov
Finn
Many hair breeds of West African decent

- *Aseasonal fertility is inversely related to the latitude unless selection pressure was exerted (i.e. Finn, Romanov, Dorset).*

Cross breeding enhances aseasonal fertility:

Heterosis and complimentarity

Examples of crosses used in accelerated lambing:

- *Romanov x Dorset*
- *Finn X Dorset*
- *Finn x Dorset x Ile de France x Romanov*
- *Finn x Dorset x Rambouillet*

Composites:

- *Rideau Arcott*
- *Polypay*

Selection for aseasonality?

- Gene markers for aseasonality?
  - ✓Melatonin 1A receptor isoforms
- EPDs: estimation difficult as ewes are not given *consistent* opportunity to re-breed.
- Proof of aseasonality difficult and slow without EPDs

Primary Barrier for Accelerated Systems

- *Aseasonal fertility (ewes pregnant/ewe exposed) varied from 18-92% between surveyed farms in New York in 2004.*
- *Producers reported large variations in aseasonal fertility from year to year within their flocks.*
- *A change in aseasonal fertility from 92% to 18% translates into a profit loss of 36% per ewe/year in a 3 lambings per year system.*

Why does aseasonal fertility vary so much within and between farms?

- *Genetics*

- *Environment*

Field Study to identify factors that influence aseasonal fertility

Two flocks chosen that share the same genetic background- Finn x Dorset with a trace of Romanov and Rambouillet.

Fertility average over 3 years

	April-June Mating	Sept.-Dec. Mating
High Fertility Flock	84%	92%
Low Fertility Flock	25%	87%

Supported by SARE (Sustainable Agriculture Research and Education)

Ewe fertility and lambing percentage

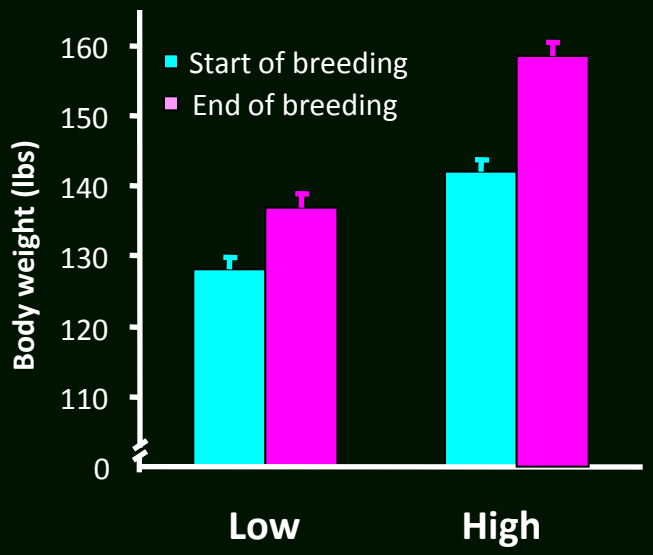
	Low Fertility	*High Fertility*
Fertility[1]:	32%	92%
Lambing Percentage[2]:	133%	206%

[1] Fertility expressed as ewe lambed/ewe exposed x 100%

[2] Lambing Percentage expressed as lambs born/ewe lambed x 100%

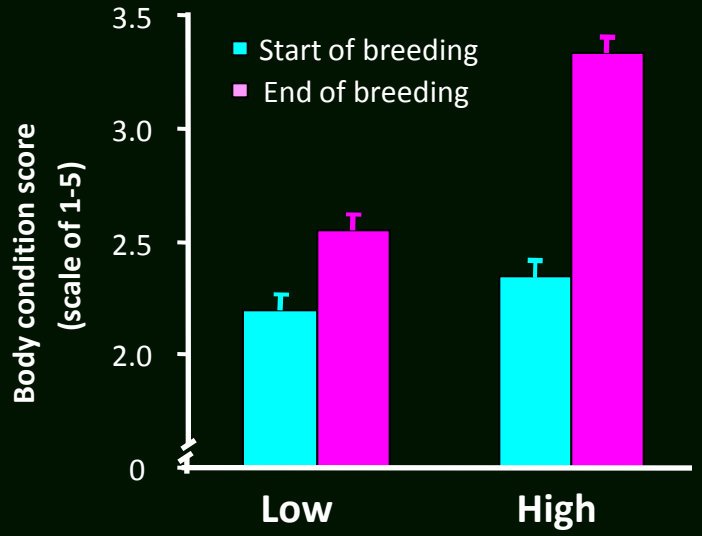
Nutritional status of ewes at the start and end of the breeding season

Body weight



P<0.001 Flock
P<0.001 Time
P<0.001 Flock x time

Body condition score



P<0.001 Flock
P<0.01 Time
P<0.001 Flock x time

Management strategies to optimize female aseasonal fertility

- Choose genetics with a documented history of aseasonal fertility.
- Provide a plane of nutrition that minimizes body condition loss during lactation.
- Provide a plane of nutrition during the breeding season that replenishes condition loss during lactation.
- Manage ewes to maintain condition through early pregnancy to minimize embryonic loss.

Comparison of energy requirements between annual and accelerated systems at 200% crop (expressed relative to maintenance, 1.0):

Period:	12 mo	8 mo
2wk pre-breeding	1.4	*1.4*
day 0-40 PC	1.2	1.2
day 40-115 PC	1.1	1.1
day 115-term	2.0	2.0
day 0-40 lactation	2.2	2.2
day 40-60 lactation	1.9	***2.2***

Male fertility:

- Male fertility and libido have a huge impact on the success of out of season breeding programs.

- ***How can you ensure that males are not limiting conception?***

Ensuring male fertility:

- Feed males 1.4X maintenance for 3 weeks pre-breeding

- Perform breeding soundness exam
  - ✓ Documents fertility but are all fertile males active breeders (have high libido)?

- Light priming: works well on all genotypes
  - ✓ 120 day protocol: 30 d (16h L/ 8h); 30 d (8h D/ 16 L), 30 d (16h L/ 8h); 30 d (8h D/ 16 L) then introduce rams/bucks.
  - ✓ Ensures high libido even in seasonal breeding rams/bucks

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Accelerated: reduced birth interval with multiple birth periods

- **Pros**

✓Create new markets and build existing markets

✓ Improve cash flow

✓ Increased production efficiency

✓ Target seasonal markets with highest prices

✓ Reduce building space requirements

✓ Distribute labor requirement more evenly over the year

✓Shorter generation interval- speeds genetic progress

✓Reduce parasite infection problems

- **Cons**

✓ Higher level of nutritional management needed

✓ High health status required to optimize efficiency

✓ Requires a winter lambing period

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Simulation: 12 mo. vs. 8 mo. in a prolific 300 ewe flock

	12 mo.	8 mo.
Total lambs	600	810
Lambs sold	540	746
Feed cost/ewe/yr	$65	$86
Feed cost/lamb/yr	$40	$40
Total feed cost	$45,300	$58,200
Value/lamb	$180	$200
Total lamb receipts	$97,200	$149,200
Labor (min/ewe/yr)	70	132
Lamb receipts-$feed	$53,700	$91,000

Consequences of poor out-of-season breeding success:

		Conception Rates			Number of ewes lambing (300 Ewe Flock)							
		Breeding Season			Year 1			Year 2			Total	Relative to
Program	Conception	Jan	May	Sept	Jan	May	Sept	Jan	May	Sept	2 years	Annual
Accelerated	Excellent	0.93	0.92	0.90	140	148	137	151	137	147	859	1.54
Accelerated	Average	0.93	0.90	0.67	140	144	104	182	106	130	806	1.44
Accelerated	Poor	0.93	0.90	0.35	140	144	54	228	64	82	714	1.28
Accelerated	Poor adjusted	0.93	0.90	0.35	140	144	54	150	135	58	681	1.22
Annual	Excellent			0.93			279		279		558	1.00

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Year round supply and product $

- High end markets are looking for consistent, year-round availability and consistent quality

- Can develop and expand local/regional markets
  - ✓High end retail
  - ✓Restaurants
  - ✓Research animals